



# Distributed Solar+Storage Driving Grid Transformation

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# Sunrun Overview

- ❑ We have deployed **1.7 GW** of residential solar to over **242,000** customers.
- ❑ We have **installed over 5,000 Brightbox** solar+storage systems.



**Our systems perform.**  
Cumulative system production in-line with customer expectations



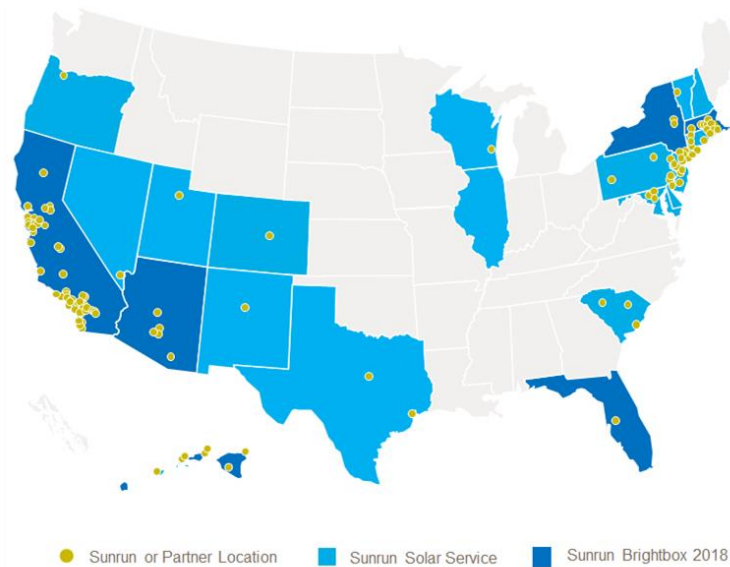
**We offer a strong customer experience.**  
A+ rating with the Better Business Bureau



**Customers pay their bills.** ~1% cumulative loss rate on billings



**Transferring service is easy.** ~99% service transfer NPV recovery rate

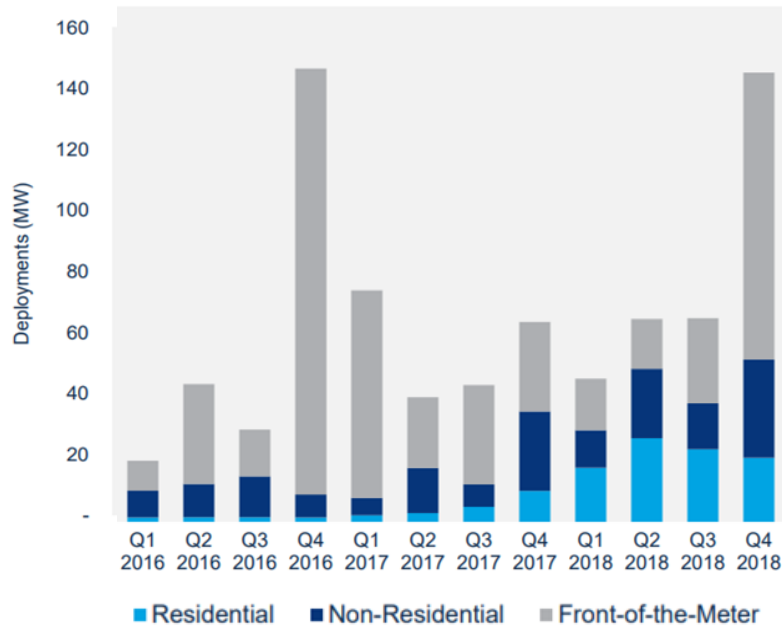


## Residential ‘Solar+Storage as a Service’ enables Sunrun to deliver ongoing customer and grid value over the long term.



- ❑ We pioneered residential “solar as a service”, beginning in 2007, and our Brightbox residential PPA now includes 25 years of “battery as a service.”
- ❑ We form long-term partnerships with our customers, guaranteeing asset performance over the life of a typical 20 or 25-year PPA.
- ❑ We work through sales and installation partners as well as our own sales + marketing and installation branches.
- ❑ Our long-term presence enables durable participation in delivering grid value
- ❑ Our ability to aggregate fleets of storage enable turnkey access to an innovative resource for distribution, transmission and system-wide value

# Residential storage is poised to become a GW-scale asset in the 2020's

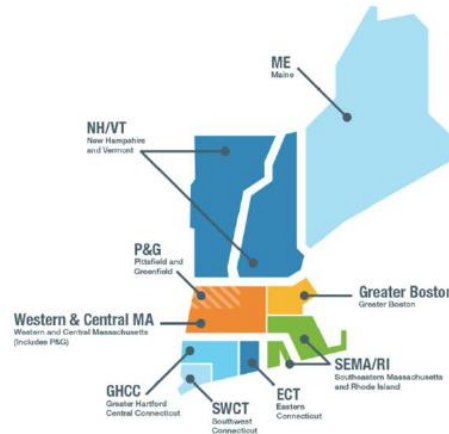


- Residential storage grew 380% Y/Y in 2018, poised for continued expansion
- ~3 million homeowners have already invested in standby generators with higher cost / disadvantages vs. energy storage
- Pairing with solar enhances value and enables distribution through resi solar
- Wood Mackenzie projects residential storage will make up 42% of storage market in 2024; 10+ GWh cumulatively deployed

# Sunrun Won 20 MW ISO-NE Bid

## ISO-NE Capacity Auction

- Forward Capacity Auction (FCA)
- Held each year
- Procures capacity for 3 years in the future to meet projects need (~30 GW)
- Separate from energy market
- Declining bid auction, lowest cost resources win
- All clearing resources paid the same clearing price



## Sunrun in FCA 13

- Qualified for > 20MW in lengthy process
- Cleared 20 MW of resources across the region at \$3.80/kw-Month
- First for residential and first for aggregated PV + Storage
- Summer 1-5pm, Winter 5-7pm
- ~5,000 homes
- Typical installation is 10 kWh / 5 KW paired with 5-10 kW solar
- Customers gain backup power, optimization of solar production (e.g. Clean Peak), and share of capacity revenue

# Key attributes of ISO-NE Passive Demand Resource Program

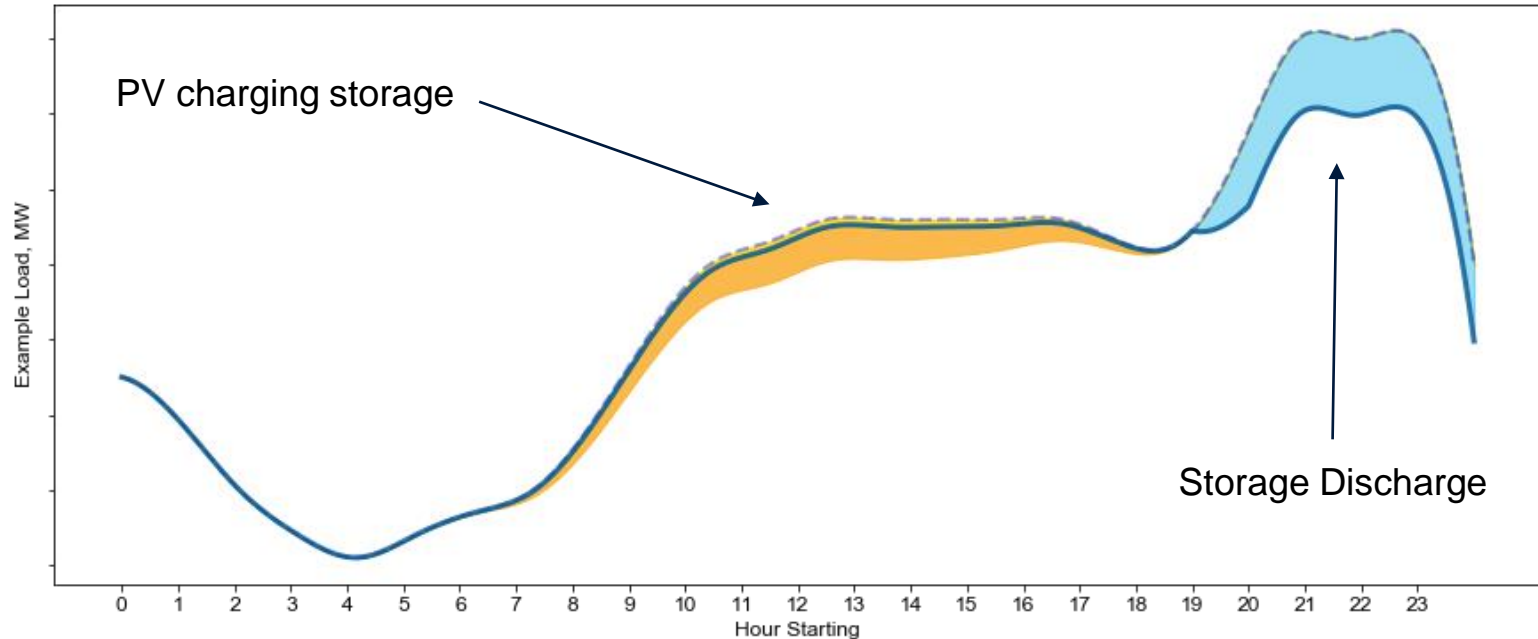


- **Provides predictable discharge** without complicated interactions with ISO
  - Rules require discharge from 1-5 PM in the summer and 5-7 PM in the winter but no dispatch from ISO
- **Direct metering at the smart inverter**
  - Also being proposed in MA BYOD programs and in Vermont by Green Mountain Power (with no utility meter!)
- **Values exports**
  - Demonstrates ability of BTM VPP to reduce aggregate load even if onsite load is zero
- **Capacity-only product**

# Permanent Flexible Load Shift

- **ISO-NE construct can be utilized as load reduction where wholesale markets with accessible programs are unavailable**
  - “Permanent Flexible Load Shift”
  - Would have reliable impact to load shapes, similar to energy efficiency from a planning perspective
- **Consistent impact to load curve**
  - Makes “unpredictable” BTM energy storage “predictable”
- **Utilize the asset, worry less about degradation**
  - Assets are meant to be used every day. Degradation can be managed.
- **Effective for resource adequacy AND system security**
  - Resource adequacy as well as transmission or distribution security needs can be addressed through reliable and consistent load reduction
  - Rules can be created to target localized load peaks
- **“Flexible” - if peaks change, so can dispatch windows**

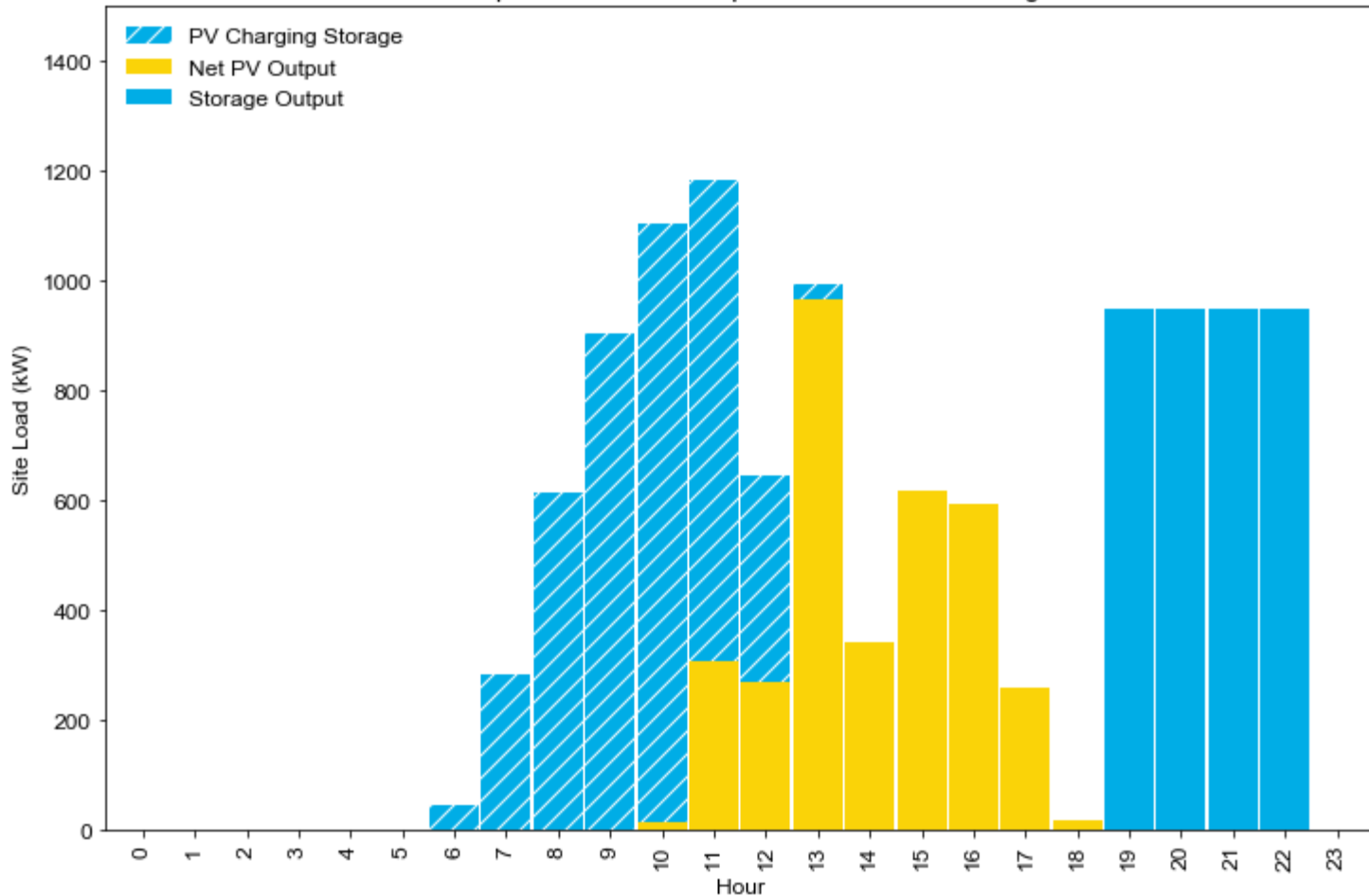
# Set discharge windows can provide predictable BTM DER load impacts



Example load curve with 3.4GW peak demand, with 200MW PV & 200MW / 600MWh storage capacity.

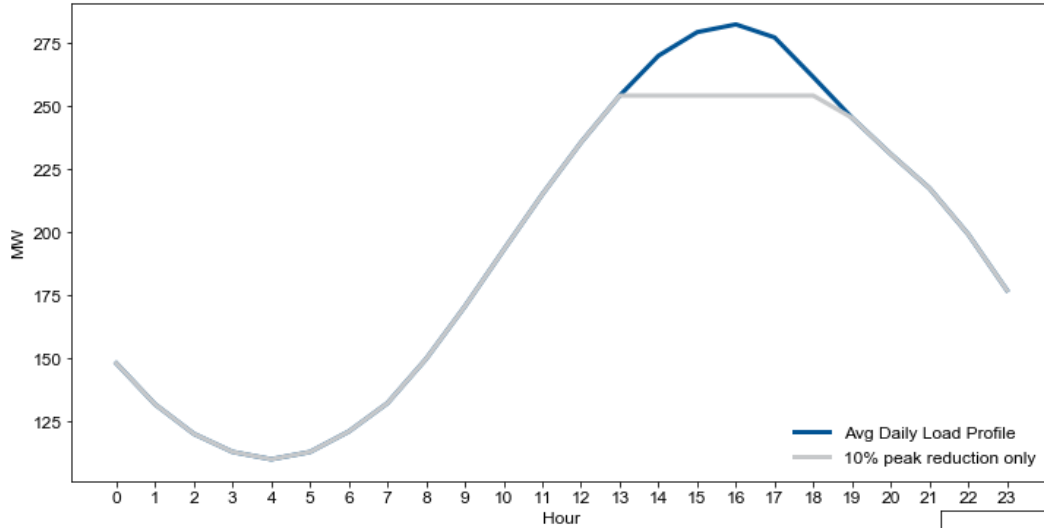


Example: Observed Campus Load with PV+Storage



PV & Storage  
output to go  
with previous  
load curve

August 2017 Avg Load Profile - Reducing Peak by 10%



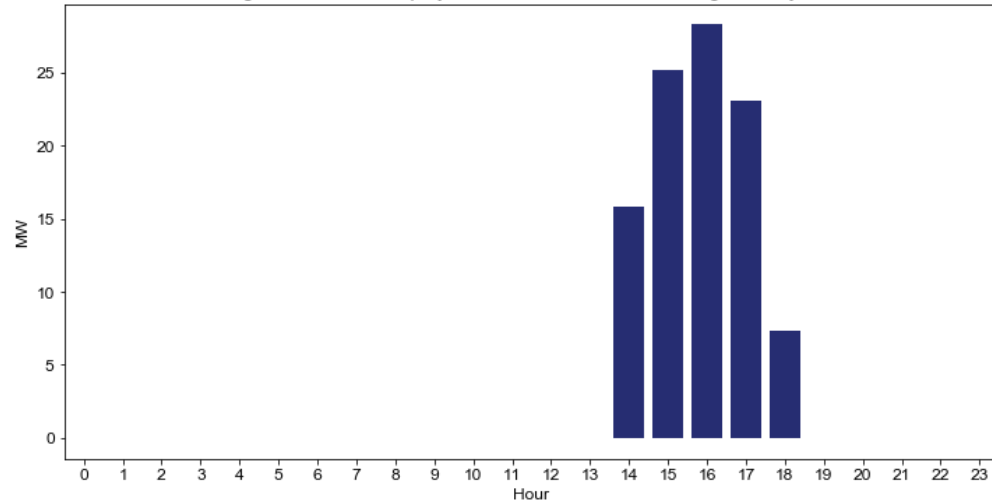
← Flattened load curve required non-uniform discharge. Storage can be shaped to provide the desired outcome ↓

Access to load data on a real-time basis will enable these types of load reduction impacts.

This in turn will enable planning around BTM in a more efficient manner.

Pricing around these forecasts would be more granular to incent the shaping seen here

August 2017 DER Deployment Profile in MW - Reducing Peak by 10%



# The evolution of VPP market participation

Illustrative technology curve indicating path to VPP value realization

