

Aggregation of DERs

The SolarCity logo, featuring the word "SolarCity" in a green, sans-serif font.

Power Forever

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Trenton, NJ

SolarCity, the #1 full-service Residential and Commercial solar provider in America*

The national leader in solar, SolarCity has**:

9 Years of experience

19 States currently served

75+ Facilities

340+ Batteries deployed

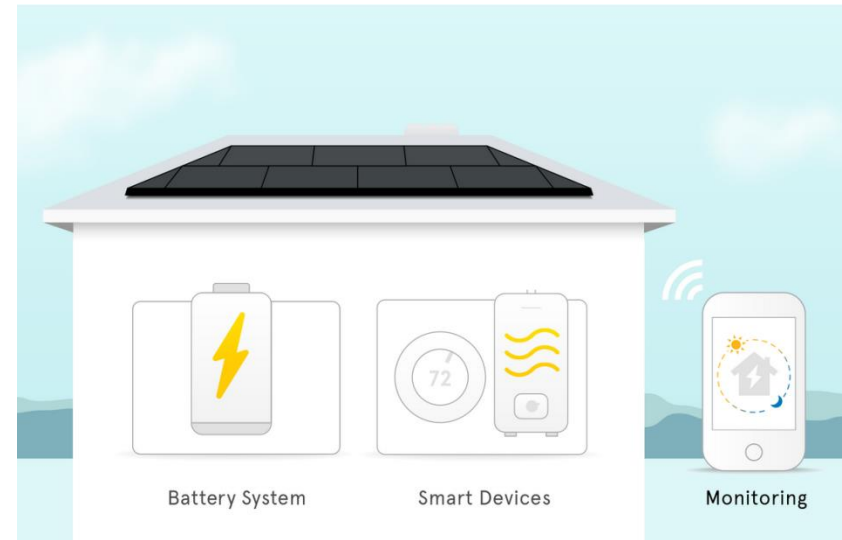
1,400+ MW installed

1,800+ Commercial projects

10,000+ Employees

300,000+ Customers

\$9 Billion+ Of solar projects financed



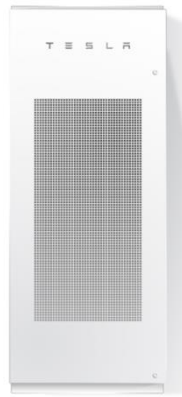
* According to the Q1 2015 GTM Research U.S. PV Leaderboard.

** "States served" data as of 8/10/15; "Facilities" data as of 6/30/15; "Employees" data as of Oct 16, 2016; "School installations" data as of 9/24/14; "MW installed" and "Customers" data as of Oct 16, 2016; "Commercial projects" data as of 4/22/15; "Solar projects financed" data as of 10/27/15.

SolarCity

Leader in storage technology.

- SolarCity has worked with Tesla for 4+ years on batteries
- Developed suite of battery products + internal software
- Fully integrated grid scale and distributed storage
- Over 340 batteries deployed by SolarCity



Powerpack

250 kW /500 kWh blocks

Fully scalable

SolarCity



Powerwall 2

13.5 kWh

Grid Services leverages existing products to unlock additional value to utilities, grid operators, and customers

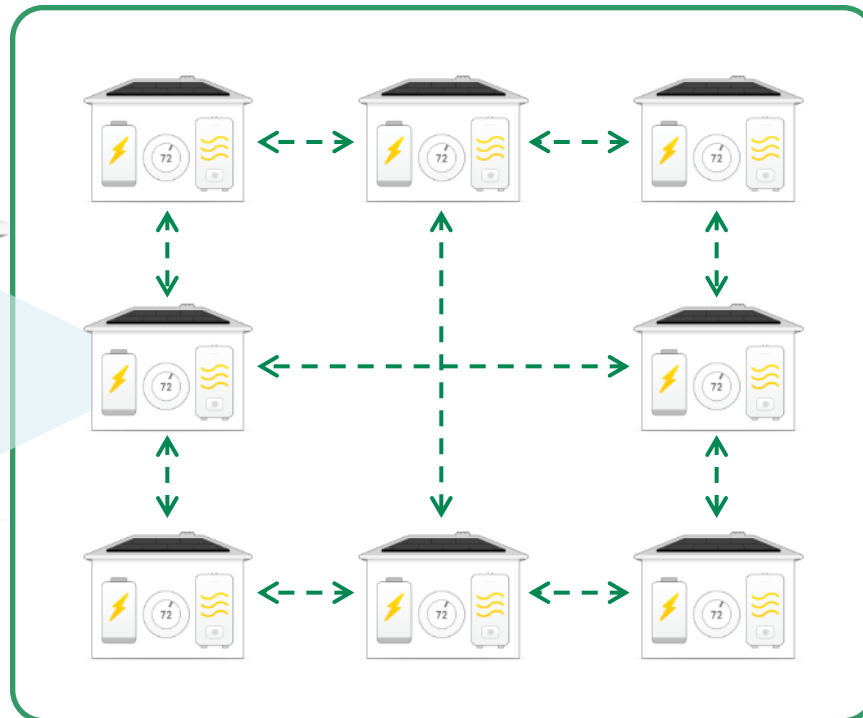


Aggregating Distributed Energy Resources to Provide Grid Services

Distributed Energy Resources (DERs)



Aggregated DER Portfolios



Grid Services

Demand Response
and Dynamic
Capacity

Voltage &
Reactive Power

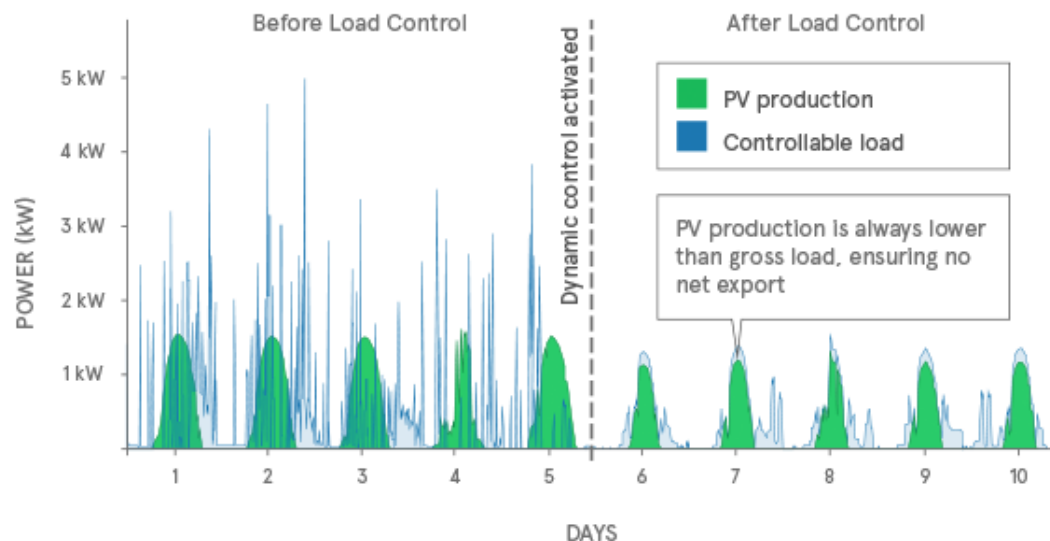
Frequency
Regulation

Contingency
Support

Flexible Capacity and Reserves

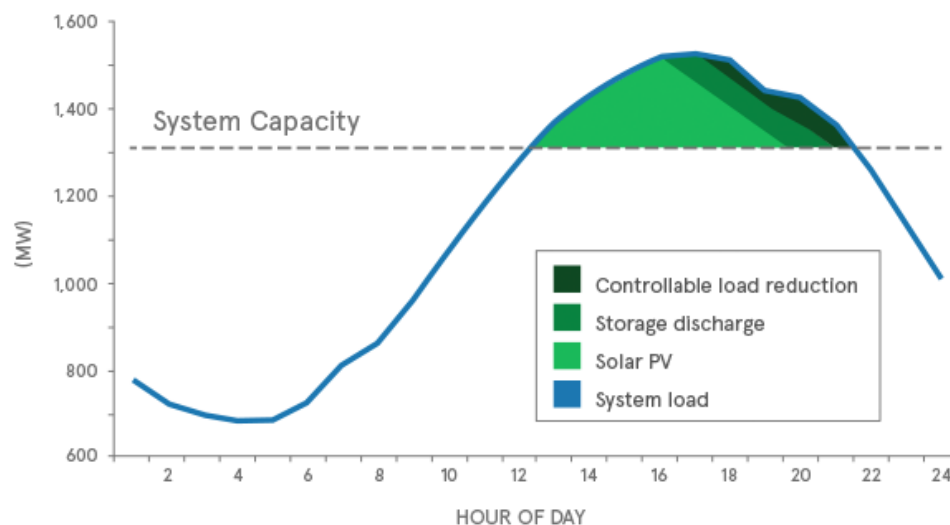
Flexible Ramping and Spinning Reserves

A dynamically controlled portfolio of DERs can provide immediately-available assets to support system and local ramping needs. Whether your need is daily system ramp support or dispatchable reserves without notice, our platform provides cost effective performance.



Dynamic Capacity and Peak Shaving

By aggregating and shaping solar PV, battery storage and controllable loads, we can reduce the demands on your power distribution and transmission infrastructure. This controllable capacity can help you avoid or defer costly grid upgrades.



Capacity Services

The combined strength of PV + storage.

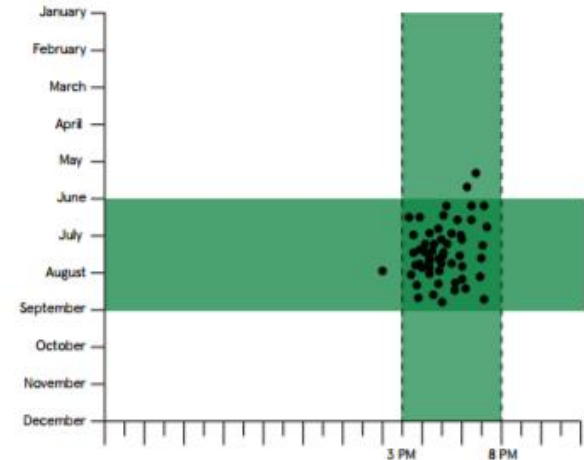
Coincident peak events and other charges assessed on utilities can have a big impact on your organization's bottom line. That's why SolarCity developed Capacity Services. It's a breakthrough PV + storage solution that provides firm and dispatchable energy when you need it most.

By combining solar energy generation and storage, we can offer a wide variety of capabilities that you can't get from PV or storage alone. With Capacity Services, you'll save on both your energy (per kWh) and capacity (per kW) charges.

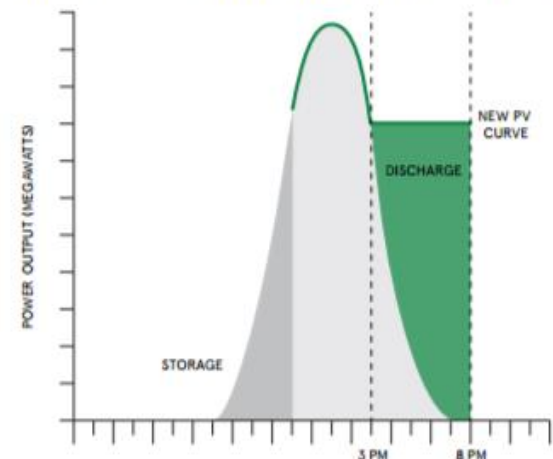
A tailored solution for your needs.

Currently under contract with multiple utilities, we're at the forefront of the PV + storage marketplace. We can configure your project to address your specific operational needs and challenges—from peak load reduction to load shifting to grid issues specific to your system.

COINCIDENT PEAK EVENTS



SHIFT LOAD WITH CAPACITY SERVICES

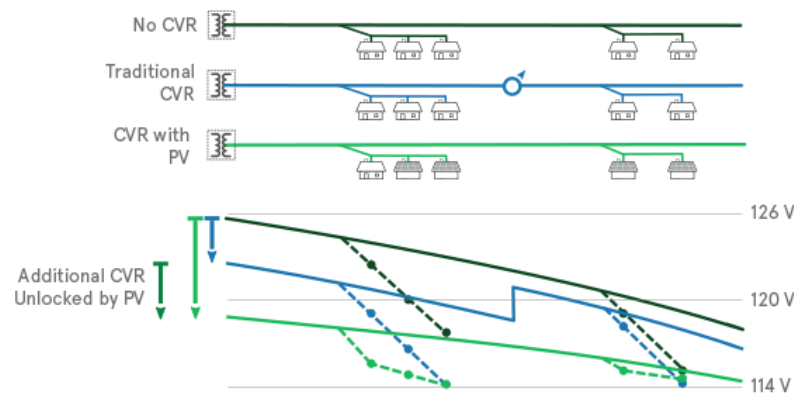


Voltage Support and Frequency Regulation

Voltage and Reactive Power Support

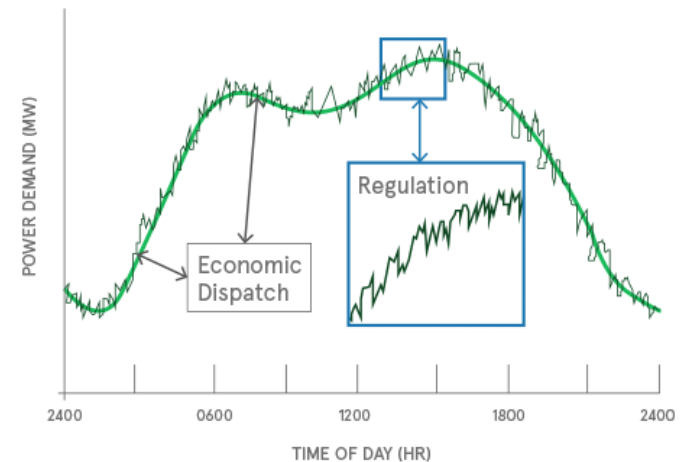
Our DER portfolios include smart inverters that provide voltage support and reactive power at both the bulk power and local levels.

These inverters can significantly improve power quality, reduce customer consumption and carbon emissions through conservation voltage reduction (CVR), offer a cost-effective alternative to voltage-regulating equipment, and reduce line losses.



Frequency Regulation

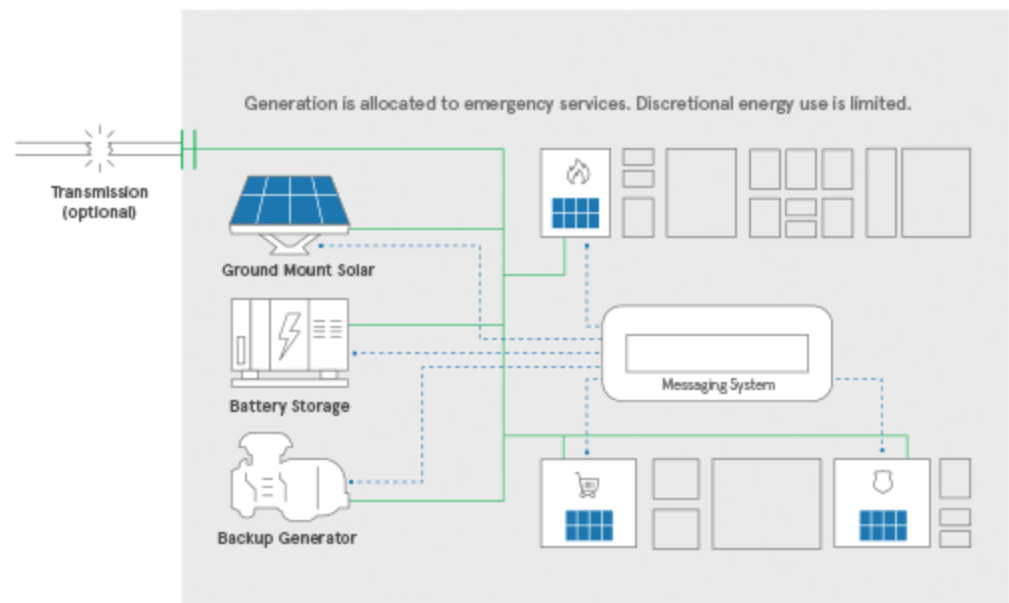
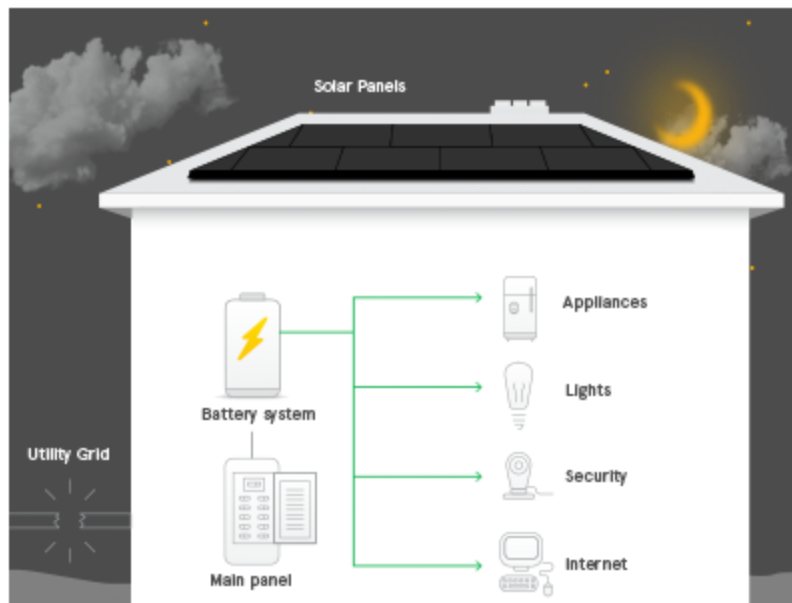
Our distributed energy resource portfolios can follow frequency regulation dispatch signals to help match system supply and demand. Round-trip communication and control occur fast enough to participate in four-second frequency regulation markets.



Backup Power and Microgrid Support

Reliability and Resiliency

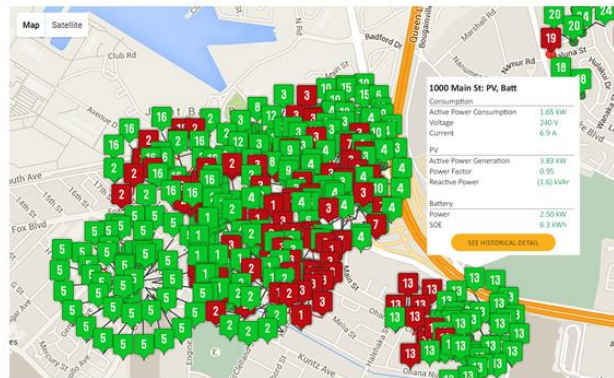
Our customer battery installations provide backup power to critical loads—improving customer reliability during routine outages. Aggregated portfolios of DERs can also provide system-level frequency response and support local microgrid operations to enhance system resiliency during major outages.



Visibility and Control

Grid Visibility and Situational Intelligence

We offer precise visibility of the grid edge on a second-by-second basis across all of our systems. As the leading residential and commercial system installer, we have the broad system penetration needed to provide valuable grid condition information that will improve situational intelligence and operations.

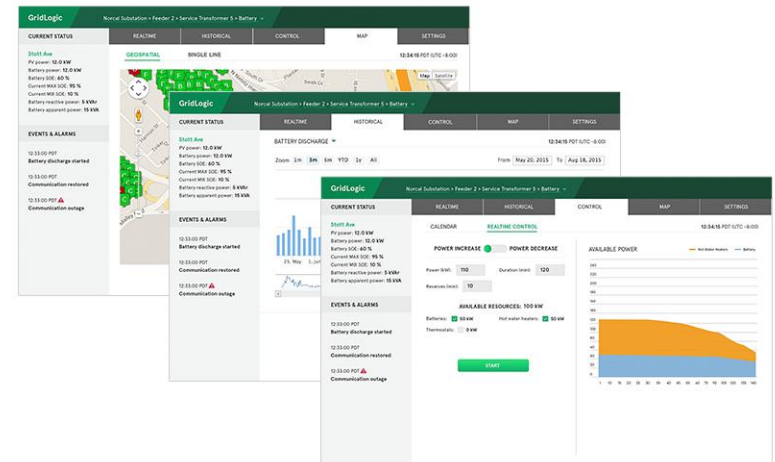


Metering and Data Backhaul

In addition to DER visibility and control, SolarCity's distributed communications infrastructure offers a cost-effective alternative for dedicated utility communications investments. Whether to backhaul grid-sensing data or increase the granularity of advanced metering data recorded and analyzed, SolarCity's embedded communications infrastructure can securely and cost-effectively backhaul your data.

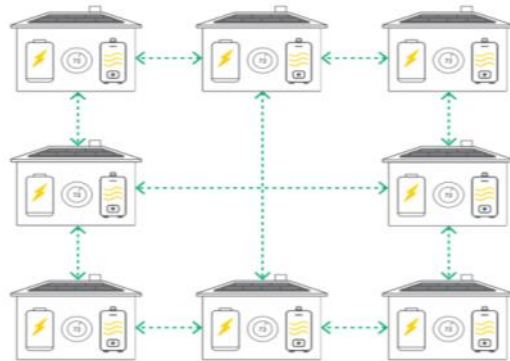
Manage DERs with our GridLogic platform.

Our software and control platform, GridLogic, comes pre-integrated with SolarCity's vast deployment of DERs, allowing you to immediately monitor and control a significant portion of DERs on your grid. The GridLogic control platform is modular and scalable—so it can adapt and expand to manage all DER assets as your energy needs evolve. You can manage the platform through the GridLogic interface or through streamlined integration into existing utility control platforms.

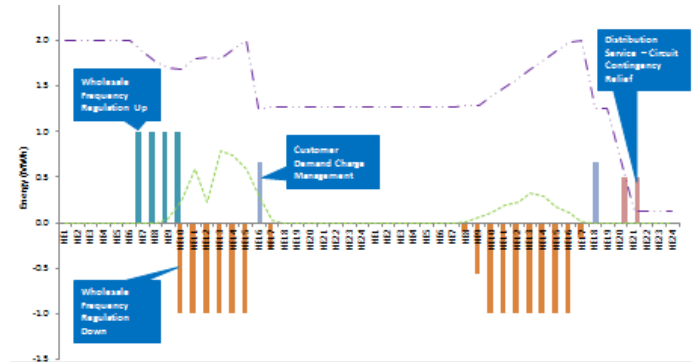


Grid Service Projects

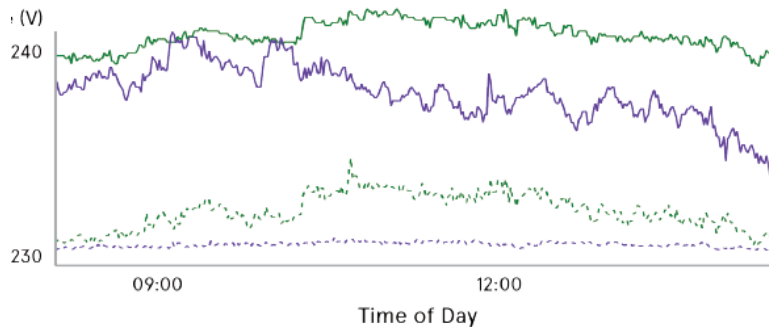
DER Aggregation for Grid Services



Wholesale Bidding Optimization for BTM Battery Portfolio



Smart Inverter Dynamic Reactive Power Support



Aggregated BTM Storage for Dynamic T&D Capacity



Community Solar + Battery Deployment

CMEEC solar + battery deployment within ISO New England



- 13 MW solar + 1.5 MW / 6 MWh battery storage
- Installation at distribution feeders across 5 sites
- Largest PV-paired storage system in Northeast
- Use Cases:
 - CMEEC peak demand reduction
 - ISO-NE coincident peak load reduction
- Other benefits include:
 - Reduction in capacity tags
 - Opportunity to integrate as a microgrid

PG&E Pilot

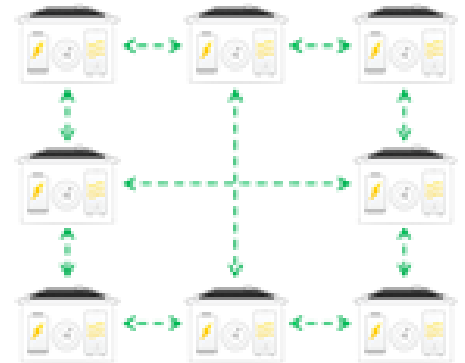
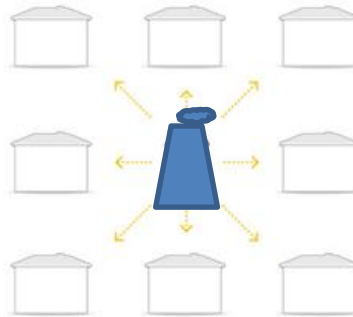
- Residential rooftop PV plus: smart inverters or behind-the-meter energy storage
- Up to 150 residential customers
- Coordinated by the utility to optimize distribution planning and operations
- September 2016 - December 2017

Southern California Edison Pilot

- Smart Energy Homes: rooftop solar PV, batteries, controllable thermostats, and smart inverters
- 50 homes
- Drive costs to customers down
- Distribution grid support
- Ancillary services to CAISO market

Barriers Exist at Many Levels

- Customers
- Utilities
- Wholesale Markets



Peak Load Drives Costs

State of Charge Report:

- The top 10% of hours accounted for 40% of annual spend.

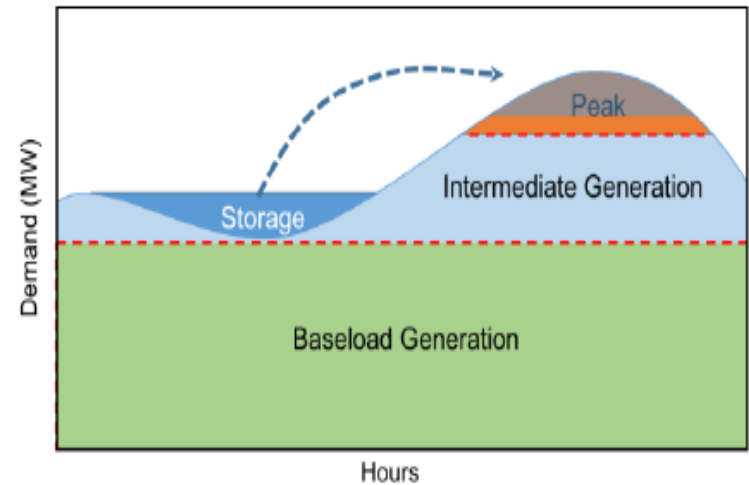


Figure 3: Energy storage can use off peak energy during times of high demand

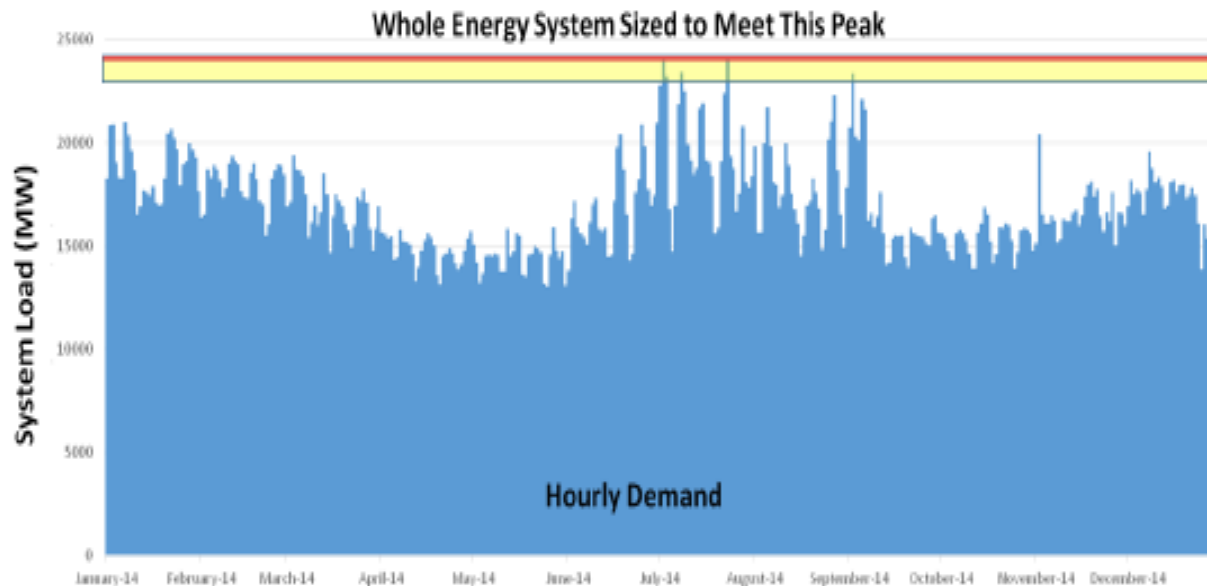


Figure 2: The whole electricity system is sized to meet peak demand

Average Prices Hide the Importance of Peak Load

Average Cost vs Long-Term Marginal Cost (MA) \$/MWh

Hours	Average	Top 10%	Top 0.5%
Generation	\$18.19	\$199.15	\$3,983.00
Transmission	\$2.63	\$28.76	\$575.25
Distribution	\$14.19	\$155.35	\$3,107.00
Total Marginal Cost	\$35.00	\$383.26	\$7,665.25

Based on 2013 AESC Study, Exhibit G-1, Summary of Electric Utilities' T&D Cost Survey and Exhibit 5 -26. CONE and Net CONE Assumptions; ISO New England 2014 Load Data.

Utilities Do Not Have Incentive to Choose DER

- Shareholders earn returns through investments
 - Choose rate-based investment
 - Choose highest value investment
- Utilities recover revenues through kWh sales
- No incentive to deploy or utilize DER

Wholesale Markets- PJM

- Net Injection
 - Behind-the-meter resources cannot inject energy onto the grid in providing wholesale services, so are limited by on-site load
 - 7 kW Solar PV + 5 kW Battery = 12 kW Resource
 - Resource \leq Real Time On-Site Load
- Energy Limited Resources
 - Market prices do not appropriately value energy limited resources that can serve high-cost peaks

Other Considerations

- Incentive should provide clear and stable price signals
- Declining block incentives have been successful in many contexts
- Clarify storage position in net metering and interconnection
- Metering requirements should be based on quality of data, not hardware

Our Vision

To create the most compelling energy company of the 21st century by delivering cleaner, cheaper power through distributed generation.



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