RESILIENTPOWER

A project of CleanEnergyGroup

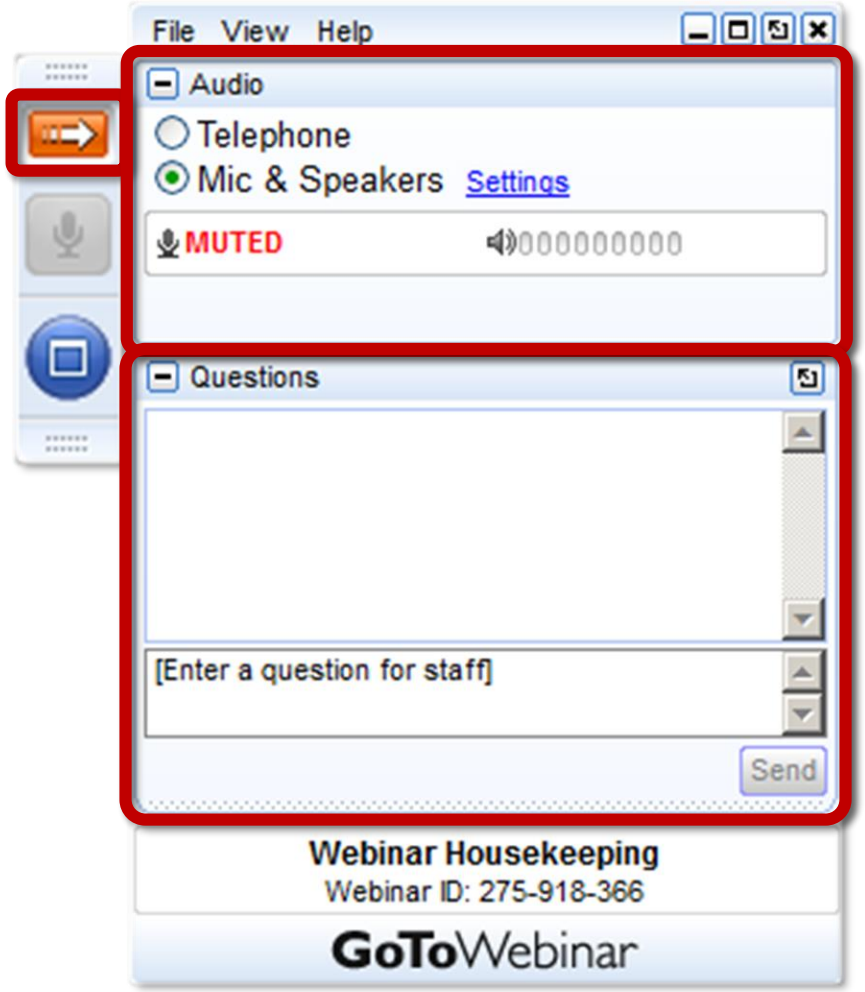
Cutting Demand Charges with Battery Storage

CleanEnergyGroup

Innovation in Finance, Technology & Policy

June 5, 2018

HOUSEKEEPING



Use the orange arrow to open and close your control panel

Join audio:

- Choose Mic & Speakers to use VoIP
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Submit questions and comments via the Questions panel

This webinar is being recorded. We will email you a webinar recording within 48 hours. Resilient Power Project webinars are archived online at: www.resilient-power.org

RESILIENT POWER

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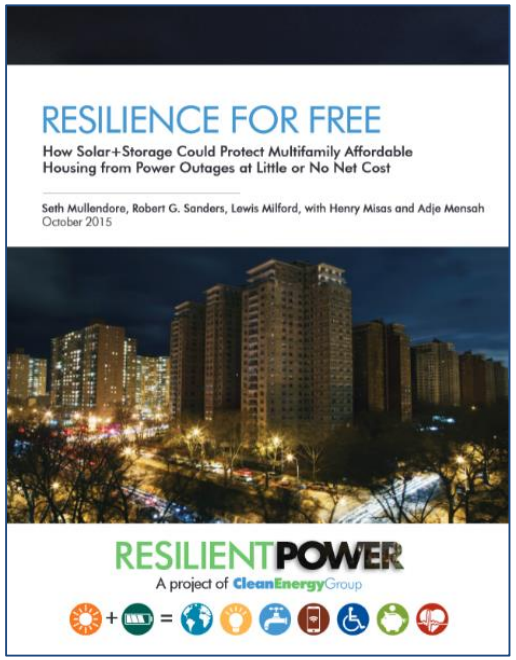


Meridian Institute
Connecting People to Solve Problems

Barr Foundation

SURDNA FOUNDATION
Fostering sustainable communities in the United States

THE JPB FOUNDATION

THE KRESGE FOUNDATION

THE NATHAN CUMMINGS FOUNDATION

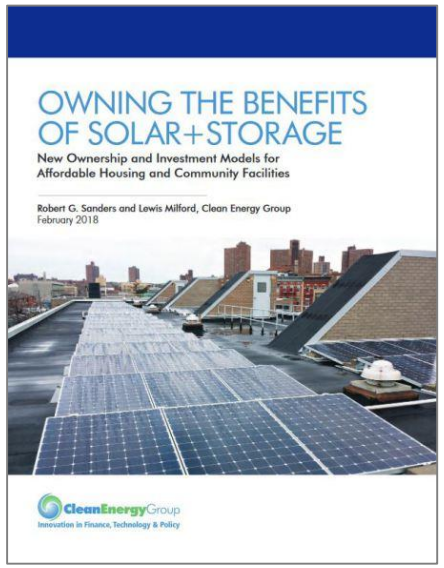
CleanEnergy States Alliance

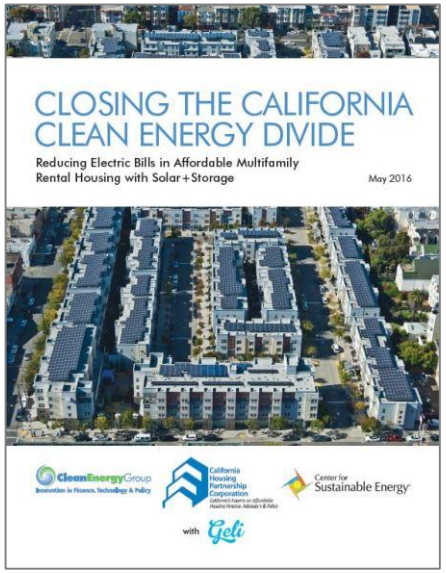
www.cleanegroup.org

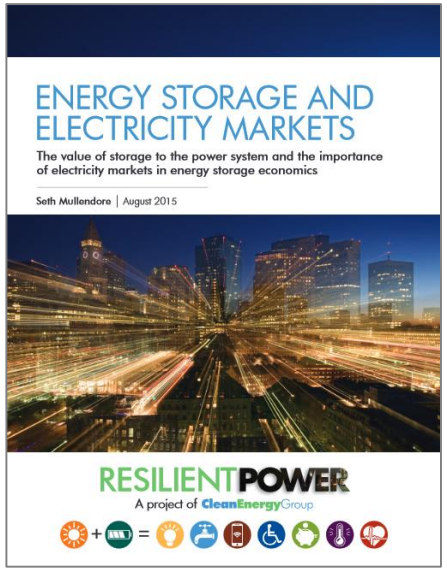
www.resilient-power.org

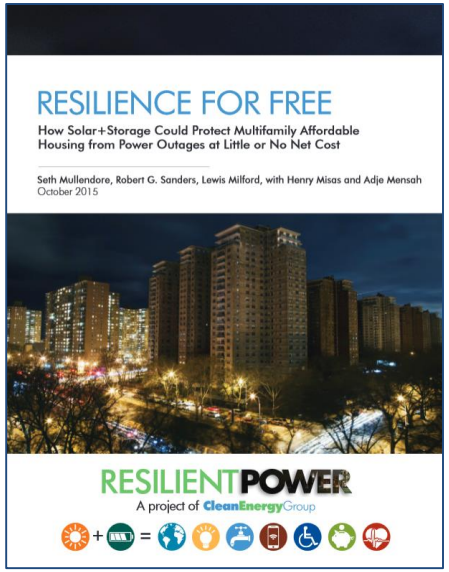
THE RESILIENT POWER PROJECT

- Increase public/private investment in clean, resilient power systems (solar+storage)
- Protect low-income and vulnerable communities, with a focus on affordable housing and critical public facilities
- Engage city, state and federal policy makers to develop supportive policies and programs









SUPPORTING 100+ PROJECTS ACROSS THE COUNTRY

Portland: Assessment of 10 LMI properties including affordable housing, foodbanks, medical centers, and shelters

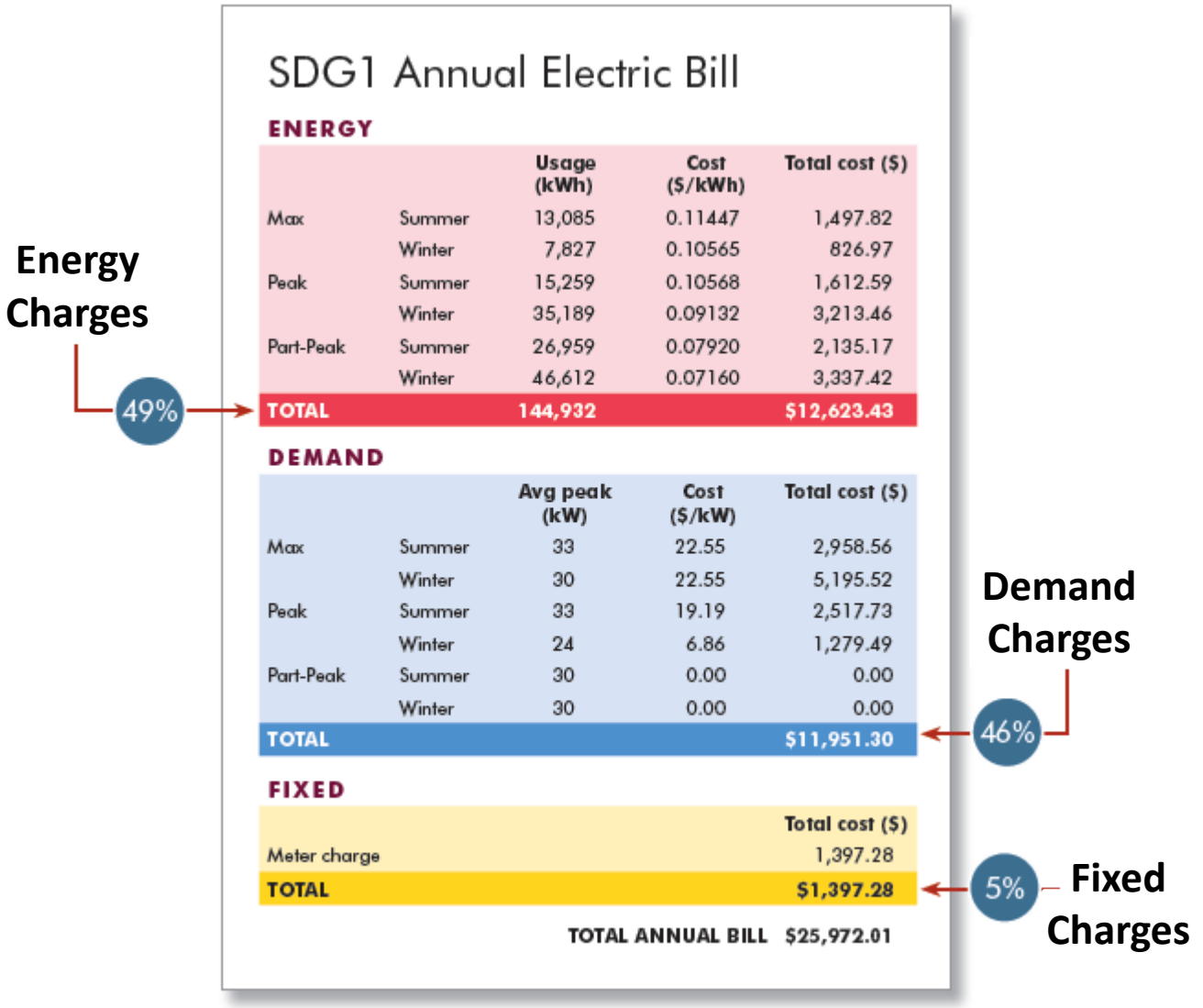
Boston Medical Center: One of the first hospitals in the country to install storage for resiliency

DC: Largest solar+storage installation at affordable housing in the country

Puerto Rico: Supporting the installation of solar+storage at more than 60 medical clinics

California: Multiple housing properties representing hundreds of units of affordable housing

WHY SHOULD I CARE ABOUT DEMAND ?

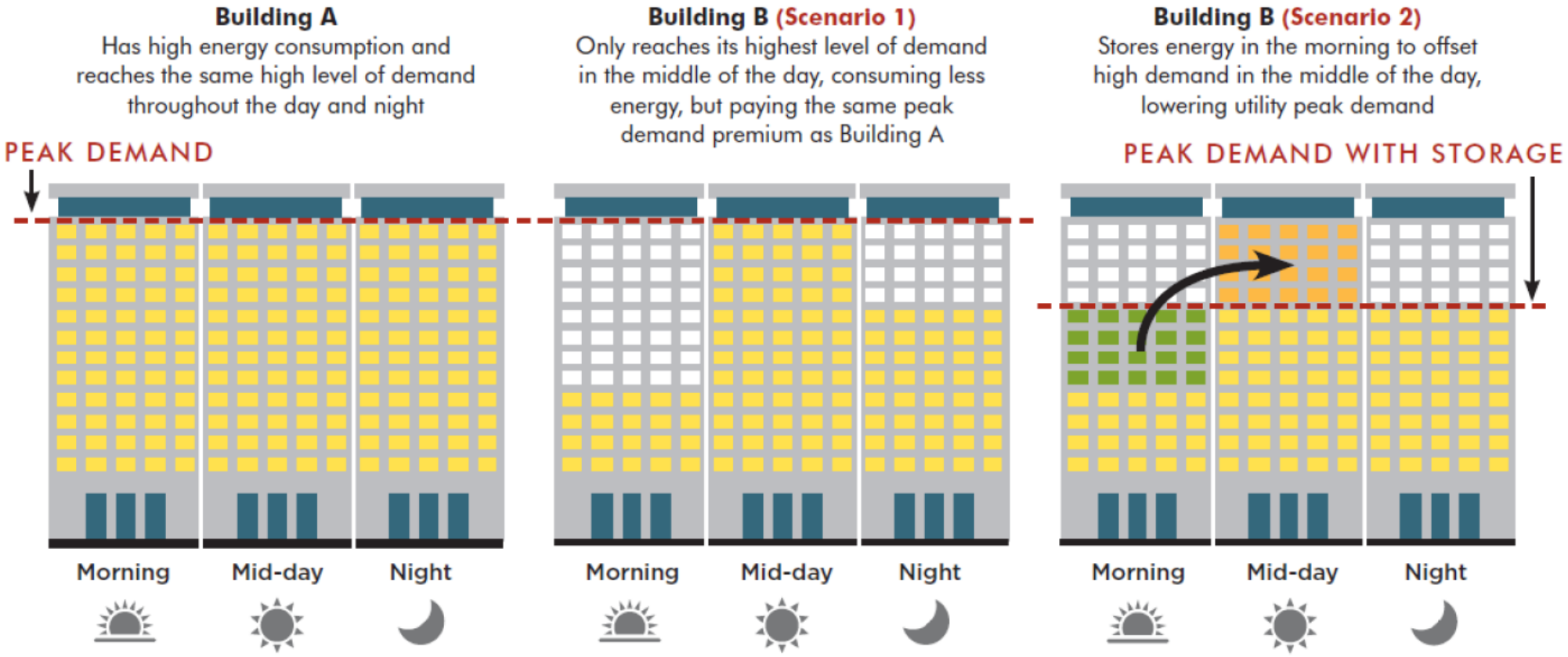


WHAT ARE DEMAND CHARGES ?

Along with fixed monthly fees, commercial customers are typically billed for electricity in two distinct ways: **consumption** (energy) charges and **demand** charges

Table 1. Types of Charges	Consumption Charge	Demand Charge
What are you paying for?	Total amount of electricity used during a billing period	Highest level of electricity used during a billing period (“peak demand”)
Customer Type	Residential and Commercial	Commercial
Unit of Measurement	Kilowatt-hours (kWh)	Kilowatts (kW)

CONSUMPTION VERSUS DEMAND



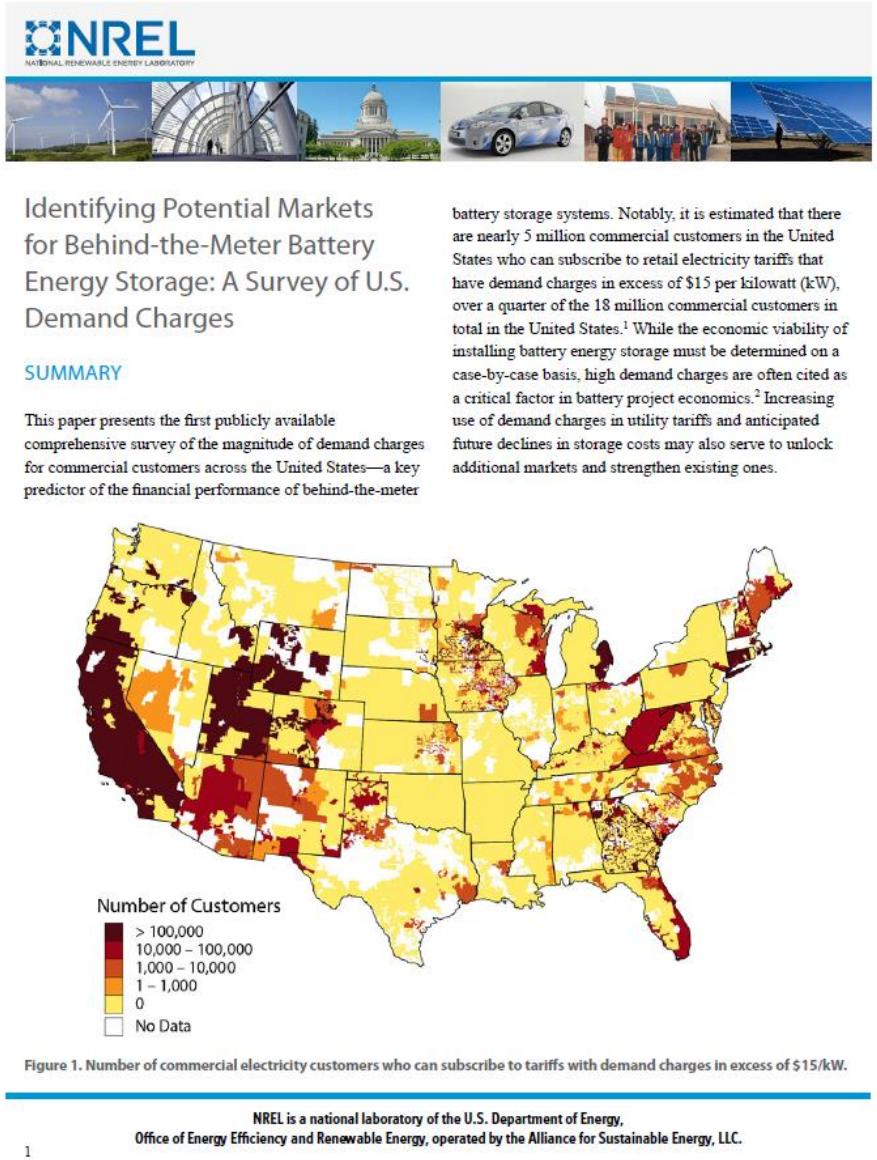
In **Scenario 1**, Building A and Building B will incur the same peak demand charges over the course of the day, even though Building A will have consumed considerably more energy during that time. In **Scenario 2**, Building B can use energy storage to reduce its mid-day grid energy consumption by meeting some of its demand with on-site stored energy. **This could reduce its overall peak demand** for the period, resulting in a lower utility bill.

Grid Energy Consumption

Stored Energy

Stored Energy Consumption

WHO PAYS DEMAND CHARGES ?



NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Identifying Potential Markets for Behind-the-Meter Battery Energy Storage: A Survey of U.S. Demand Charges

SUMMARY

This paper presents the first publicly available comprehensive survey of the magnitude of demand charges for commercial customers across the United States—a key predictor of the financial performance of behind-the-meter battery storage systems. Notably, it is estimated that there are nearly 5 million commercial customers in the United States who can subscribe to retail electricity tariffs that have demand charges in excess of $15 per kilowatt (kW), over a quarter of the 18 million commercial customers in total in the United States.[1] While the economic viability of installing battery energy storage must be determined on a case-by-case basis, high demand charges are often cited as a critical factor in battery project economics.[2] Increasing use of demand charges in utility tariffs and anticipated future declines in storage costs may also serve to unlock additional markets and strengthen existing ones.

Number of Customers
> 100,000
10,000 – 100,000
1,000 – 10,000
1 – 1,000
0
No Data

Figure 1. Number of commercial electricity customers who can subscribe to tariffs with demand charges in excess of $15/kW.

NREL is a national laboratory of the U.S. Department of Energy,
Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

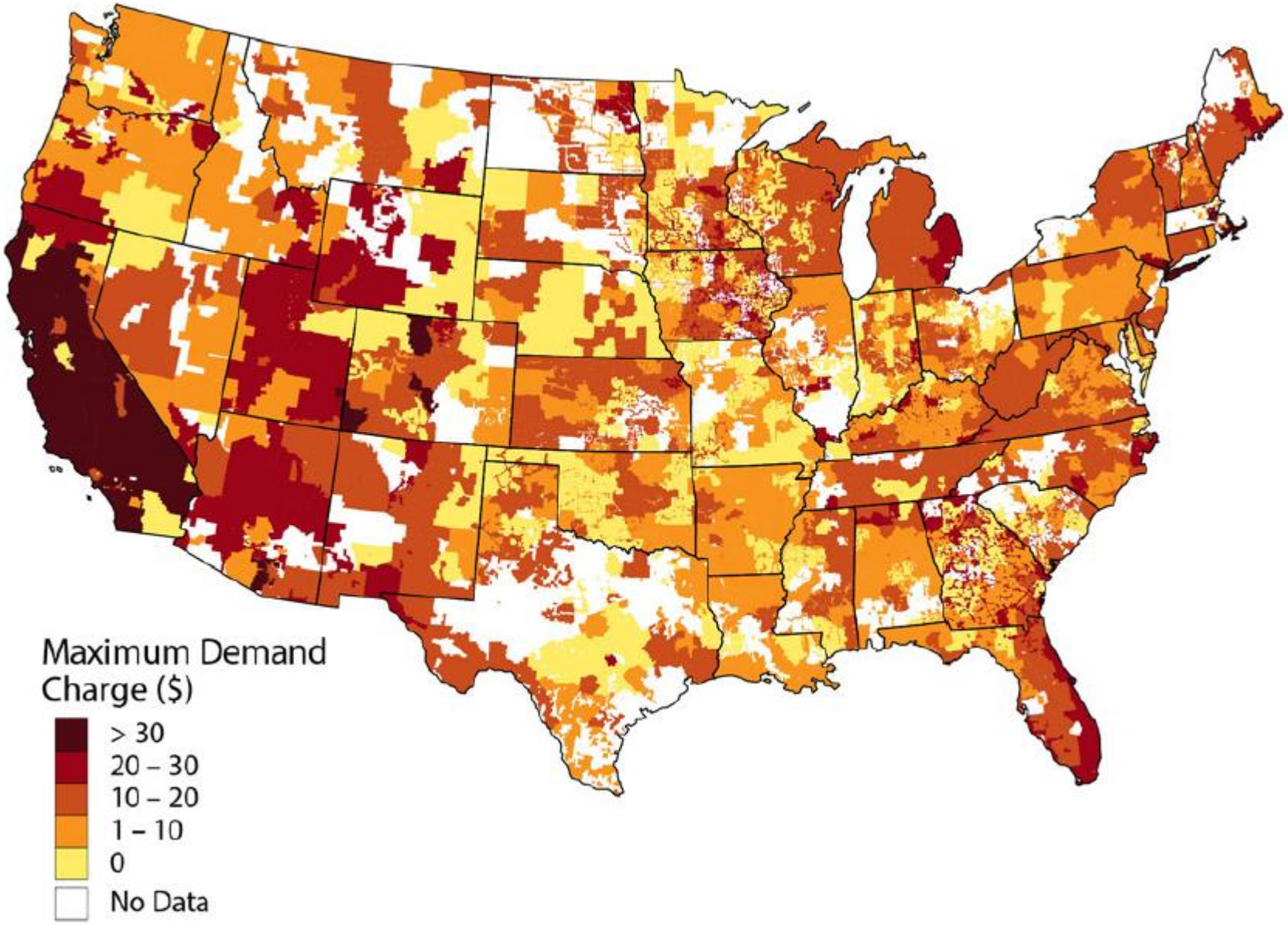
1

Most medium to large commercial customers in every state are subject to demand charges

Includes private and nonprofit businesses, community facilities, public buildings, and multifamily housing properties

Nearly 5 million commercial customers (over 25% of U.S.) may face demand charges high enough for battery storage to make economic sense

WHO PAYS DEMAND CHARGES ?



Demand Charges Across All Utilities Operating in the State

	Maximum charge across all utilities	Average of all utility maximum charges	Median of all utility maximum charges
New York	$51.25	$9.30	$4.30
California	$47.08	$11.45	$10.60
Colorado	$46.43	$21.68	$16.65
Massachusetts	$41.25	$19.14	$15.50
Arizona	$35.45	$18.82	$18.50
Nebraska	$30.00	$14.82	$15.70
Illinois	$30.00	$16.58	$16.63
Georgia	$28.70	$5.83	$3.60
North Carolina	$25.65	$15.61	$15.63
Vermont	$25.39	$17.43	$16.05

Cutting Demand Charges with Battery Storage
Webinar Speakers

Steve Kelley
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Seth Mullendore
Vice President & Project Director
Clean Energy Group
seth@cleanegroup.org
(Moderator)

ENGIE Storage

Intelligent Energy Storage

Steve Kelley, SVP of Sales

The grid is under stress from…

1. Variable Supply
2. Transmission Constraints
3. Variable Demand

There are three ways to solve these problems…

1. Build More Power Plants
2. Build More Transmission Lines
3. Deploy Distributed Energy Resources

"[Energy storage] will strengthen our innovation economy and provide the Commonwealth with a roadmap for reducing our most expensive energy loads and securing our energy future."

Charlie Baker, Governor
Massachusetts

We build turnkey energy storage solutions that serve consumers and producers on both sides of the meter.

- US Storage Division HQ in Silicon Valley
- Over 150 energy storage projects (65 MWh)
- Extensive operating track record (7+ years)
- Pioneer of innovative commercial structures
- Ranked #1 provider by Navigant Research

Key Services

- Energy Site Analysis & System Design
- Hardware Integration, Interconnection & Operations
- Software Service Stacking & Aggregation
- Performance-based Financing Options & Guarantees

Customer Examples

Businesses & Government

SAFEWAY, UPS, Walgreens, KAISER PERMANENTE, 7-ELEVEN, MVLA HIGH SCHOOL DISTRICT, THE COUNTY OF SANTA CRUZ 1850, SIERRA NEVADA

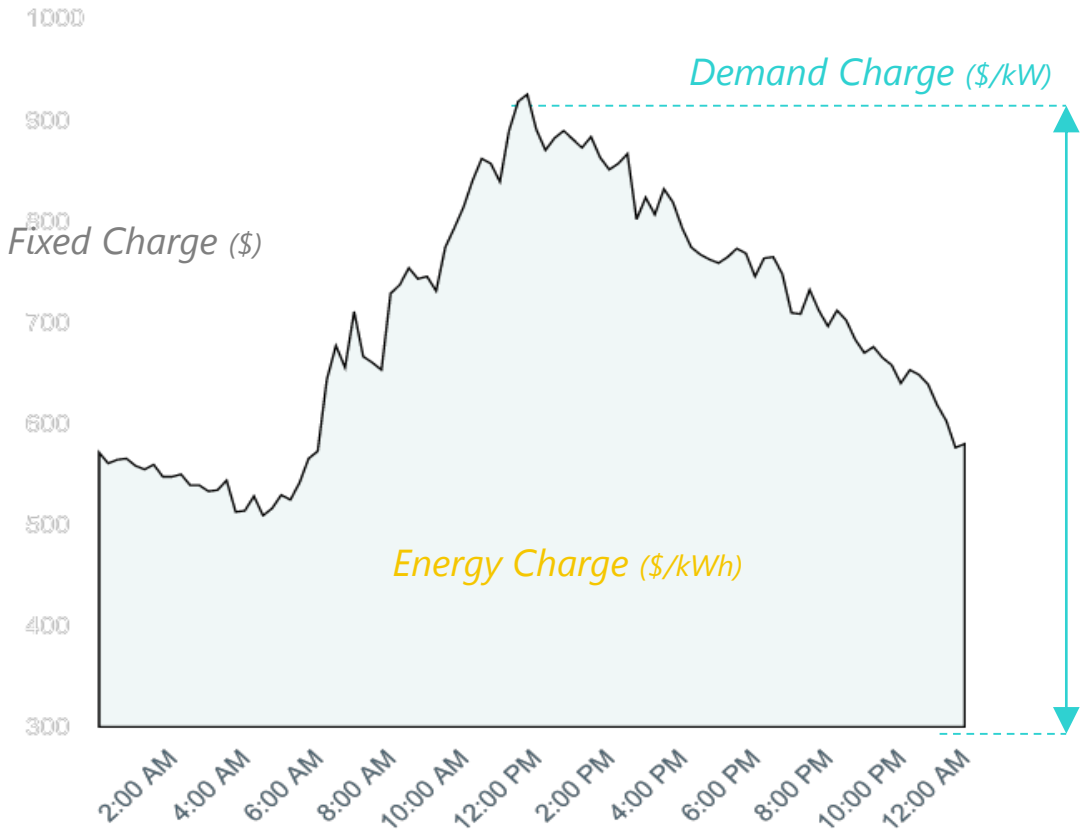
Utilities & Network Operators

SDGE, PG&E, conEdison, HG&E EMPOWERING YOUR WORLD, Alliant Energy, Hawaiian Electric Maui Electric Hawai'i Electric Light, California ISO

How is energy storage being used?

- Reduce Peak Demand charges
- Solar firming/ intermittence
- Arbitrage
- Demand Response
- Back- up Power
- Capacity tag reduction
- Frequency regulation
- Switching Tariffs

A utility bill typically consists of three types of charges.



Energy Charge *($/kWh)*

- Represents the cost of generating energy
- Monthly charge for sum of kWh's consumed from the grid

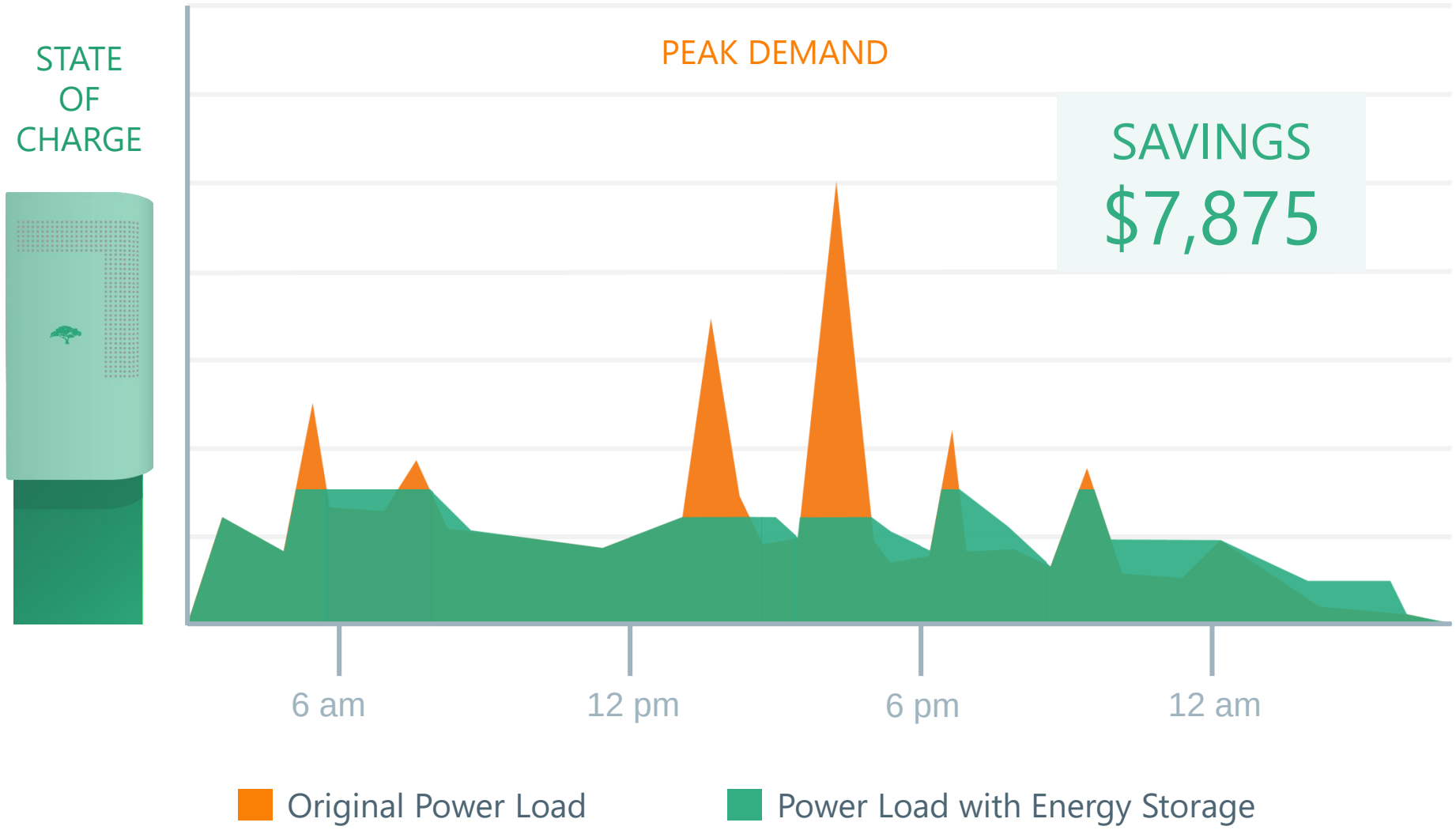
Demand Charge *($/kW)*

- Represents the cost of the grid
- Monthly charge for highest 15-min kW grid offtake

Fixed Charge *($)*

- Represents the administrative cost to serve a customer
- Monthly fixed charge

Creating Savings with Storage



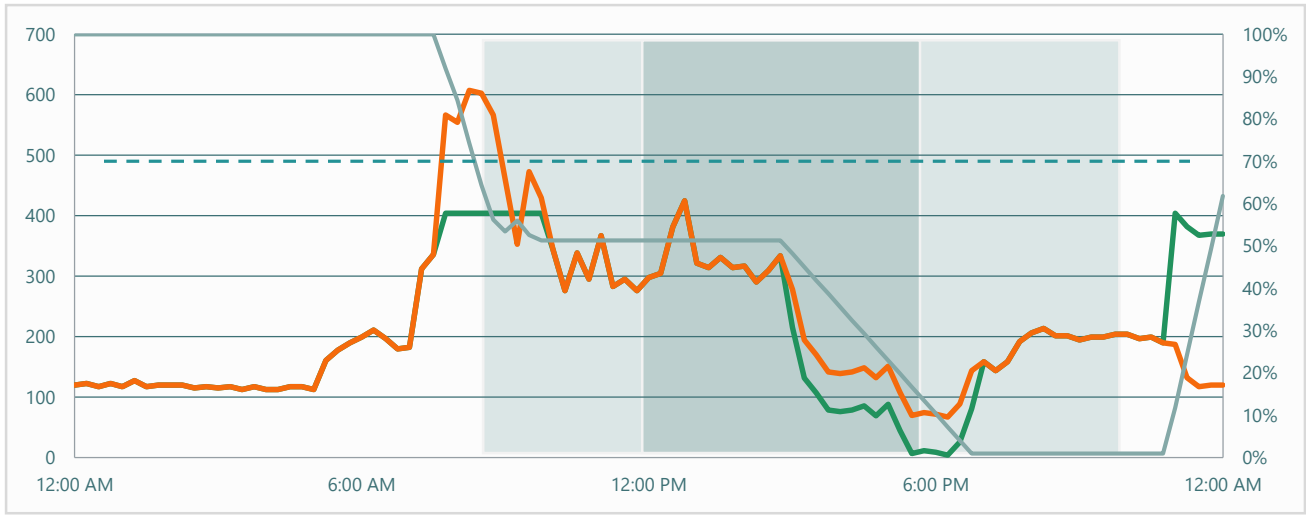
Maximizing the Value of Energy Storage

VALUE STREAMS

- Demand Savings
- Tariff Optimization
- Energy Arbitrage
- Demand Response
- Market Revenues*

*Future Upside

High School in SCE

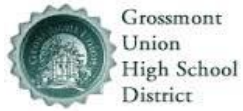


The GridSynergy Software Platform Optimizes Across Multiple Revenue Streams to Maximize Benefits

(2.7MW / 5.4MWh across 17 sites at a CA school district)

Demand Savings	Tariff Optimization	Energy Arbitrage	Demand Response	Annual Total Benefit
$207,908	$144,997	$81,355	$42,660	**$476,920**
44%	31%	17%	9%	-

Hundreds of Operating Systems



ENERGY STORAGE SOLUTION

- Intelligent Cloud-Based Software
- Lithium-ion Energy Storage
- Performance-Based Contracts & Financing

"Each year, we expect to reduce our demand charges by $86,000, if not more. "

Mike Mathiesen, Associate Superintendent, Business Services
Mountain View Los Altos High School District

Control Monitoring Software

Commercial
60KWh-2MWh

Industrial/Utility
2MW-20MWh

Utility
20MWh +

SUNGROW
Green and Effective

BYD

SAMSUNG

TESLA

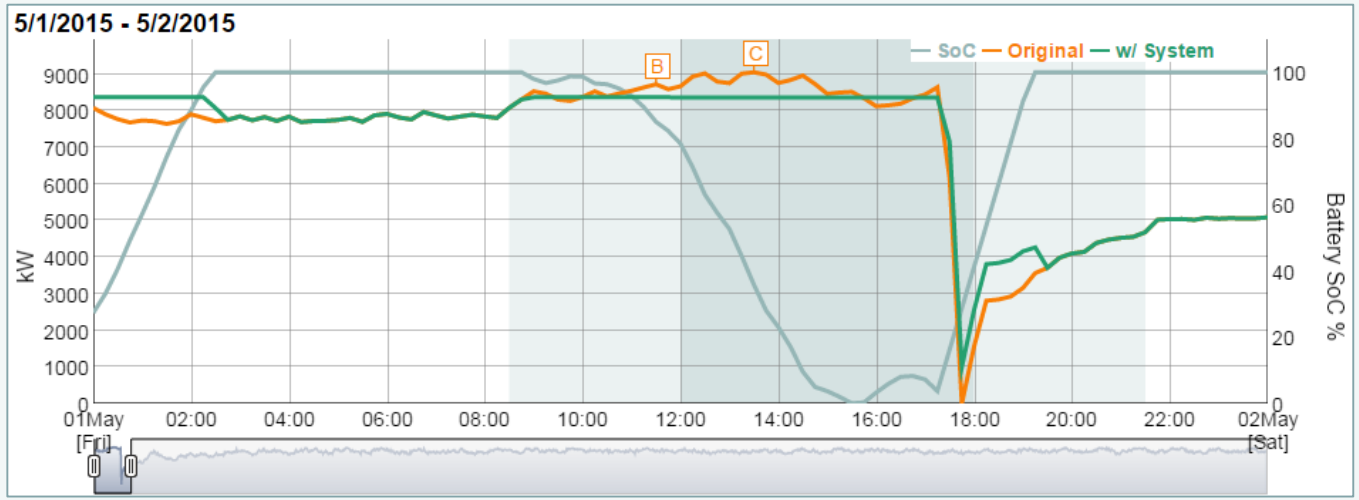
LG Chem

- Factors in determining the right sized system
  - Shape of the load profile
  - Volatility and consistency of load shape
  - Back up power requirements
  - Solar installed
  - Financial returns
- Risk in under sizing and over sizing
- Future changes to building load

Large Manufacturer with a Flat Load

Site Name:	**Manufacturing**
ESS Size:	**1000kW / 2000kWh**
Annual Savings:	**$198,236**
Utility Tariff:	**PG&E E-20 Primary**

Actual Load Profile

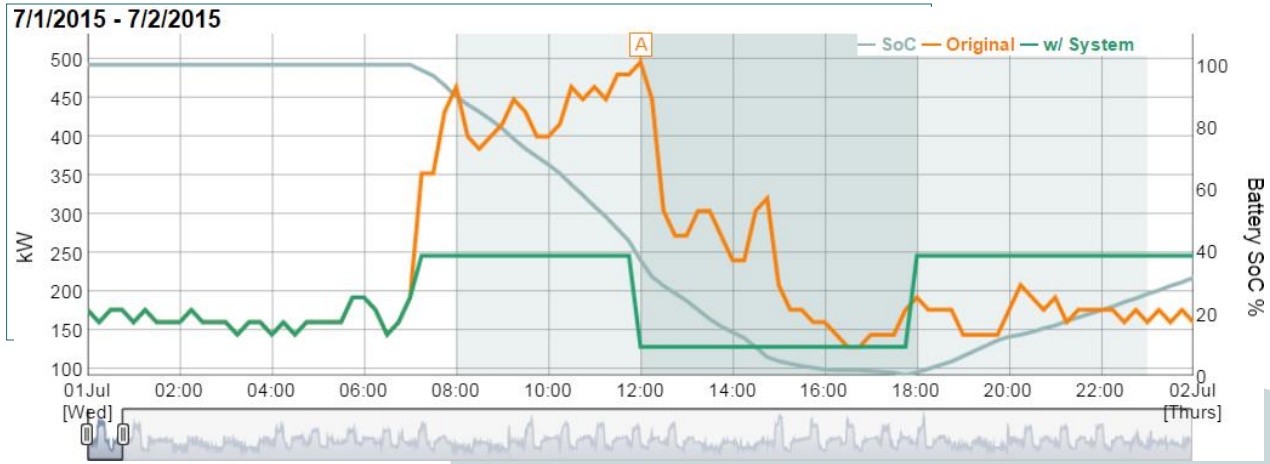


Original Load Profile - Revised Load Profile with Storage - State of Charge - TOU Periods (background)

Load Leveling – Intelligent and predictive algorithms make charge/ discharge decisions to cap your demand (setpoint)

Additional Revenues – With battery SOC often at or near 100 percent, ability to engage in additional markets…

Southern California High Schools



Name:	SCE SD
ESS Size	750 kW / 1500 kWh
Meter No.	
Recommended Tariff	SCE TOU-8 B

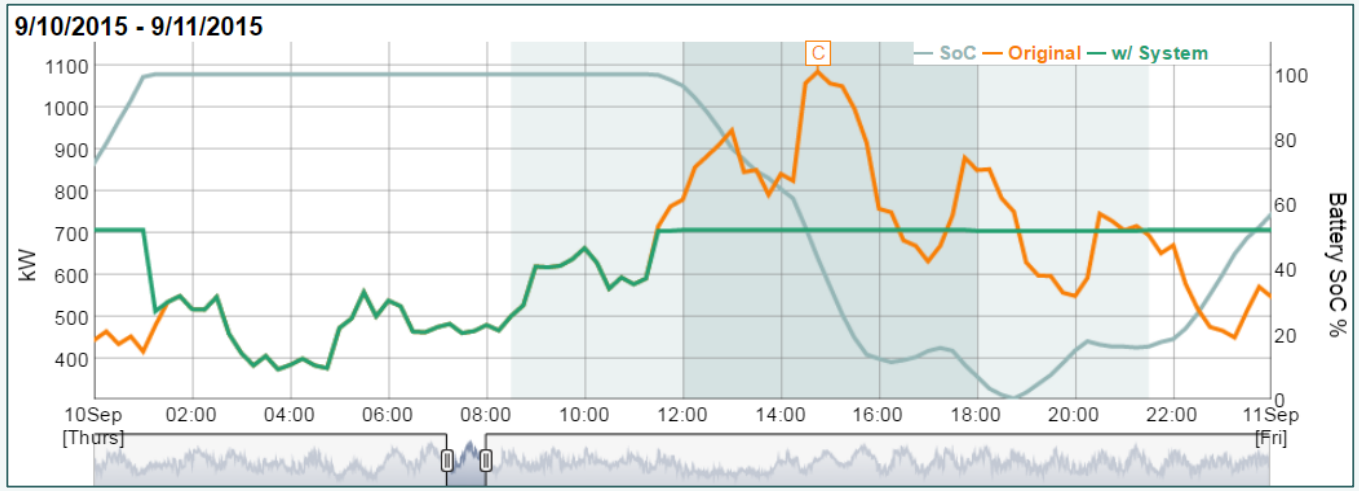
Bill Month	Full Peak				Partial-Peak				Maximum Daily Peak				Monthly Demand Savings
	Current Demand (kW)	New Demand (kW)	Demand Shaved (kW)	Tariff ($/kW)	Current Demand (kW)	New Demand (kW)	Demand Shaved (kW)	Tariff ($/kW)	Current Demand (kW)	New Demand (kW)	Demand Shaved (kW)	Tariff ($/kW)	
May-15	-	-	-	-	-	-	-	-	720	425	295	$17.58	$5,184
Jun-15	816	462	354	$16.92	784	552	232	$4.79	816	552	264	$17.58	$11,738
Jul-15	496	128	368	$16.92	576	246	330	$4.79	576	246	330	$17.58	$13,605
Aug-15	832	388	444	$16.92	880	750	130	$4.79	880	750	130	$17.58	$10,417
Sep-15	1088	633	455	$16.92	1104	1002	102	$4.79	1104	1002	102	$17.58	$9,976
Oct-15	-	-	-	-	-	-	-	-	1024	732	292	$17.58	$5,132
Nov-15	-	-	-	-	-	-	-	-	656	287	369	$17.58	$6,485
Dec-15	-	-	-	-	-	-	-	-	512	259	253	$17.58	$4,446
Jan-16	-	-	-	-	-	-	-	-	496	260	236	$17.58	$4,147
Feb-16	-	-	-	-	-	-	-	-	768	400	368	$17.58	$6,468
Mar-16	-	-	-	-	-	-	-	-	624	330	294	$17.58	$5,167
Apr-16	-	-	-	-	-	-	-	-	1512	762	750	$17.58	$13,183
											Total 12-Month Savings:		$95,948

Assumptions for above figures: See slide above highlighting demand savings

Northern CA Brewery

Site Name:	**Brewery**
ESS Size:	**500kW / 1000kWh**
Annual Savings	**$103,453**
Recommended Tariff:	**PG&E E-19 / COM-19 Secondary**

Actual Load Profile (September 10, 2015)



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Load Leveling – Intelligent and predictive algorithms make charge/ discharge decisions to cap your demand (setpoint)

Additional Revenues – With battery SOC often at or near 100 percent, ability to engage in additional markets…

Procurement Options

- Cash Purchase (3-6 year payback)
- Financed Solutions
  - Shared Savings Agreement
  - Fixed Payment
  - Public Financing
  - PPA with Solar
  - Performance Contracting

LARGE SCALE DEPLOYMENTS THROUGHOUT THE U.S.

POWAY UNIFIED SCHOOL DISTRICT

SAFEWAY


DC DISCONNECT
WARNING
Arc Flash and
Shock Hazard
Appropriate PPE Required
GridSynergy
STORAGE
GS 30-60 P
GreenCharge

MVLA

HIGH SCHOOL DISTRICT


RUNNING READY FAULT
West PCS Inverter
DC INPUT
AC OUTPUT


GreenCharge
GridSynergy
STORAGE
WARNING
Arc Flash and
Shock Hazard
Appropriate PPE Required
UNIT ENERGIZED

QUIDEL

ENGIE Storage

Intelligent Energy Storage

Steve Kelley, SVP of Sales

info@engiestorage.com

Thank you for attending our webinar

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A Project of Clean Energy Group

Upcoming Webinars

Resilient Power in Practice: Lessons from the Field

Wednesday, June 27, 2-3pm ET

The Future of Electrification and What It Means for Clean Energy

Tuesday, June 26, 1-2pm ET

Building Markets: Energy Storage in Massachusetts and Offshore Wind in Rhode Island

Thursday, August 9, 1-2:30pm ET

Read more and register at www.cleanegroup.org/webinars