SUSTAINABLE SOLAR EDUCATION PROJECT

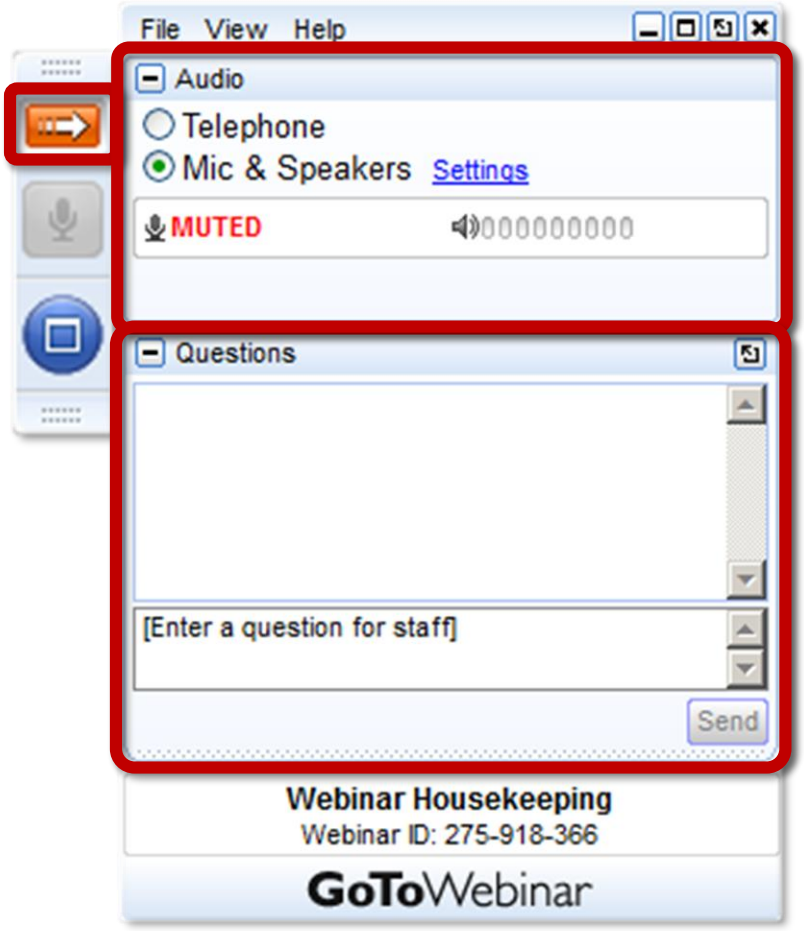
Solar+Storage for Public and Affordable Housing

February 22, 2018

SOLAR ENERGY TECHNOLOGIES OFFICE
U.S. Department Of Energy

CleanEnergy States Alliance

Housekeeping



Join audio:

- Choose Mic & Speakers to use VoIP
- Choose Telephone and dial using the information provided

Use the red arrow to open and close your control panel

Submit questions and comments via the Questions panel

This webinar is being recorded. We will email you a webinar recording within 48 hours. CESA's webinars are archived at www.cesa.org/webinars

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DEPARTMENT OF ENERGY & ENVIRONMENT

EnergyTrust of Oregon

IOWA economic development

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Xcel Energy® Renewable Development Fund

MASSACHUSETTS CLEAN ENERGY CENTER

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SMUD™ Powering forward. Together.

Department of Commerce Innovation is in our nature.

DDER Massachusetts Department of Energy Resources

STATE OF RHODE ISLAND Office of Energy Resources

OEI Wisconsin Office of Energy Innovation

Smart Electric Power Alliance

COMMERCE DEPARTMENT

PRAIRIE ISLAND INDIAN COMMUNITY

IPA ILLINOIS POWER AGENCY

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www.cesa.org

Sustainable Solar Education Project

A project to provide information to state and municipal officials on strategies to ensure distributed solar

- Remains consumer friendly
- Benefits low- and moderate-income households

The project is managed by the Clean Energy States Alliance (CESA) and is funded through the U.S. Department of Energy Solar Energy Technologies Office.

SOLAR ENERGY TECHNOLOGIES OFFICE
U.S. Department Of Energy

CleanEnergy States Alliance

Sustainable Solar Education Project Resources

The project offers a variety of free resources on solar equitability and consumer protection:


CleanEnergy States Alliance

SUSTAINABLE SOLAR EDUCATION PROJECT

NEWSLETTER

Sustainable Solar Education Project Webinars

MAY 2017

Bringing the Benefits of Solar to Low-Income Customers

Thursday, May 18th, 1-2 pm ET

CESA will conduct a webinar on low-income solar program and policy design. The webinar will be based on a recently released CESA guide authored by Bentham Paulos titled Bringing the Benefits of Solar to Low-Income Consumers. The guide identifies successful and promising approaches, offers factors policymakers should consider, and provides policy and program design recommendations for bringing the benefits of solar to low-income consumers. Register here.

Crowd Financing Solar for Nonprofits Serving Low-Income Communities

Thursday, May 25, 1-2 pm ET

Nonprofit community service providers that serve low-income communities have faced challenges in financing solar for their own facilities. One answer that has emerged is crowdfunding, in which many individuals each provide a small amount of money for a project. Crowdfunding can involve donations, or it can involve investments, in which the individuals who participate expect a financial return. In this webinar, Andreas Karelas, Executive Director of RE-volv, and Todd Bluechel, Vice President of Marketing and Sales at CollectiveSun, will present two models that rely on crowdfunding to enable nonprofits to adopt solar. Register here.

Community Solar for Low- and Moderate-Income Consumers

Thursday, June 1, 1-2 pm ET

Because community solar can be made accessible to renters and can include flexible terms, it holds promise for spreading the benefits of solar to low- and moderate-income (LMI) consumers. In this webinar, Kelly Roache, Senior Program Manager at Solstice, and David Miller, Senior Vice President at Alpine Bank,

The Sustainable Solar Education Project provides information and educational resources to state and municipal officials on strategies to ensure distributed solar electricity remains consumer friendly and benefits low- and moderate-income households. The project is managed by the Clean Energy States Alliance (CESA) and is funded through the U.S. Department of Energy SunShot Initiative's Solar Training and Education for Professionals program.

The Sustainable Solar Education Project Newsletter reports on issues related to solar equitability and consumer protection.

For more information about the Sustainable Solar Education Project, please visit our website.

cesa.org/projects/sustainable-solar

CleanEnergy States Alliance

- **Guides**
- **Webinars**
- **Monthly e-newsletter**
- **In-person workshops**

www.cesa.org/projects/sustainable-solar

Solar+Storage for Public and Affordable Housing

- **Seth Mullendore**, Vice President and Project Director, Clean Energy Group
- **Rob Sanders**, Senior Finance Director, Clean Energy Group
- **Jonas Villalba**, VP Project Development, Promise Energy
- **Andy Mannle**, VP Strategic Development, Promise Energy
- **Nate Hausman**, Project Director, Clean Energy States Alliance (moderator)

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Solar+Storage for Multifamily Public and Affordable Housing

RESILIENTPOWER

A project of CleanEnergyGroup

RESILIENT POWER

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- Increase public/private investment in clean, resilient power systems
- Protect low-income and vulnerable communities: affordable housing and critical public facilities
- Advocate for state and federal supportive policies and programs
- Engage city officials to develop resilient power policies/programs
- Technical assistance for pre-development costs to help agencies/project developers get deals done
- See www.resilient-power.org for reports, newsletters, webinar recordings

Resilient Power Project:
Supporting More than 50 Projects Across the Country

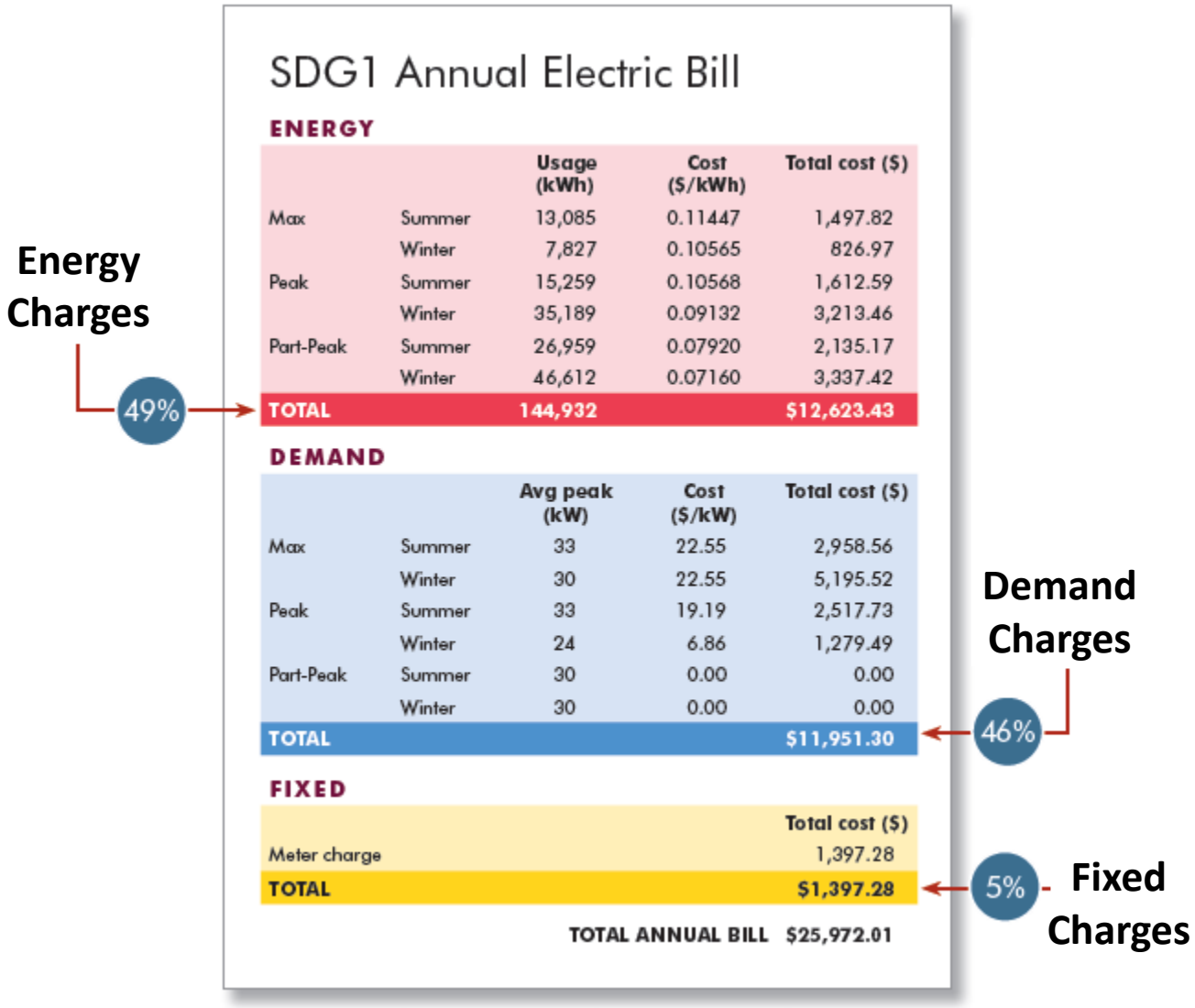
Leadership and Technical Assistance Grant Awardees

Battery Storage Technologies

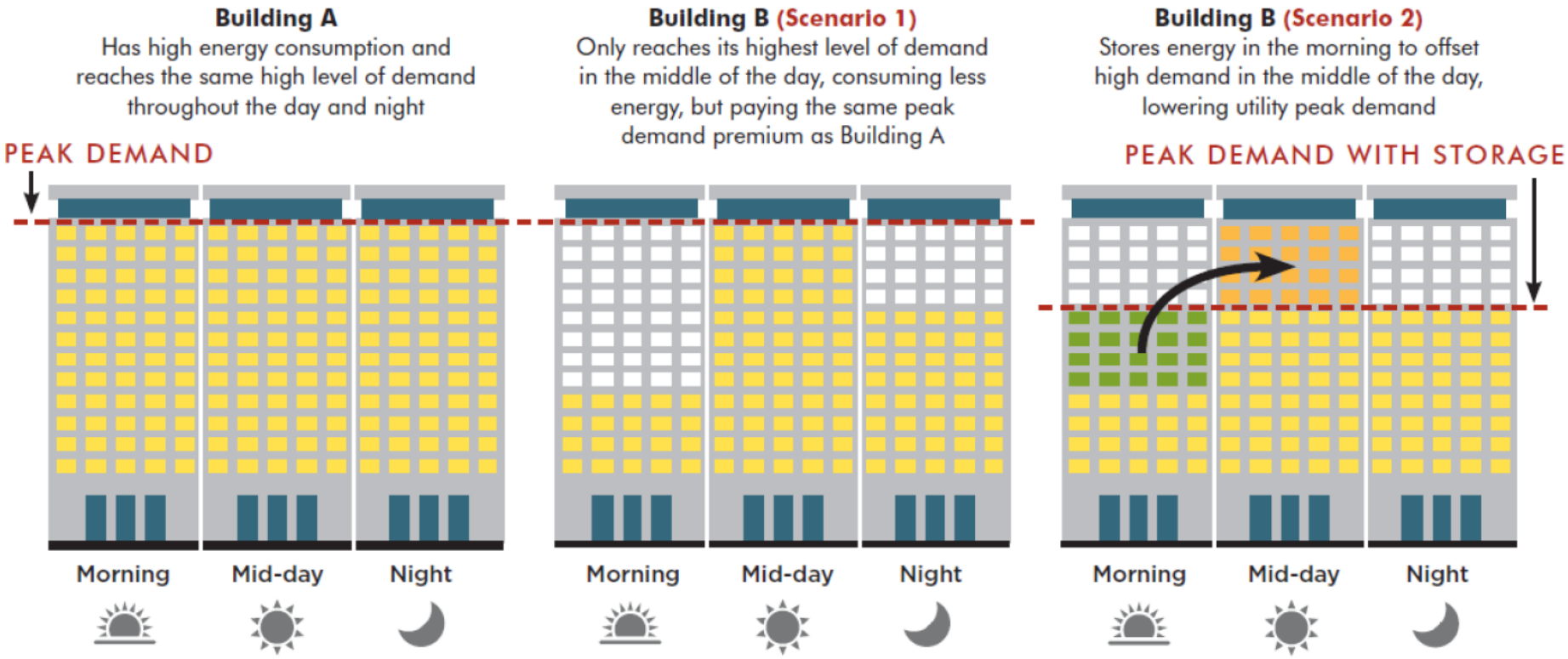
Lithium-ion vs. **Lead acid**

Battery Storage in Affordable Housing

Charges on a Commercial Electric Bill



Consumption vs 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

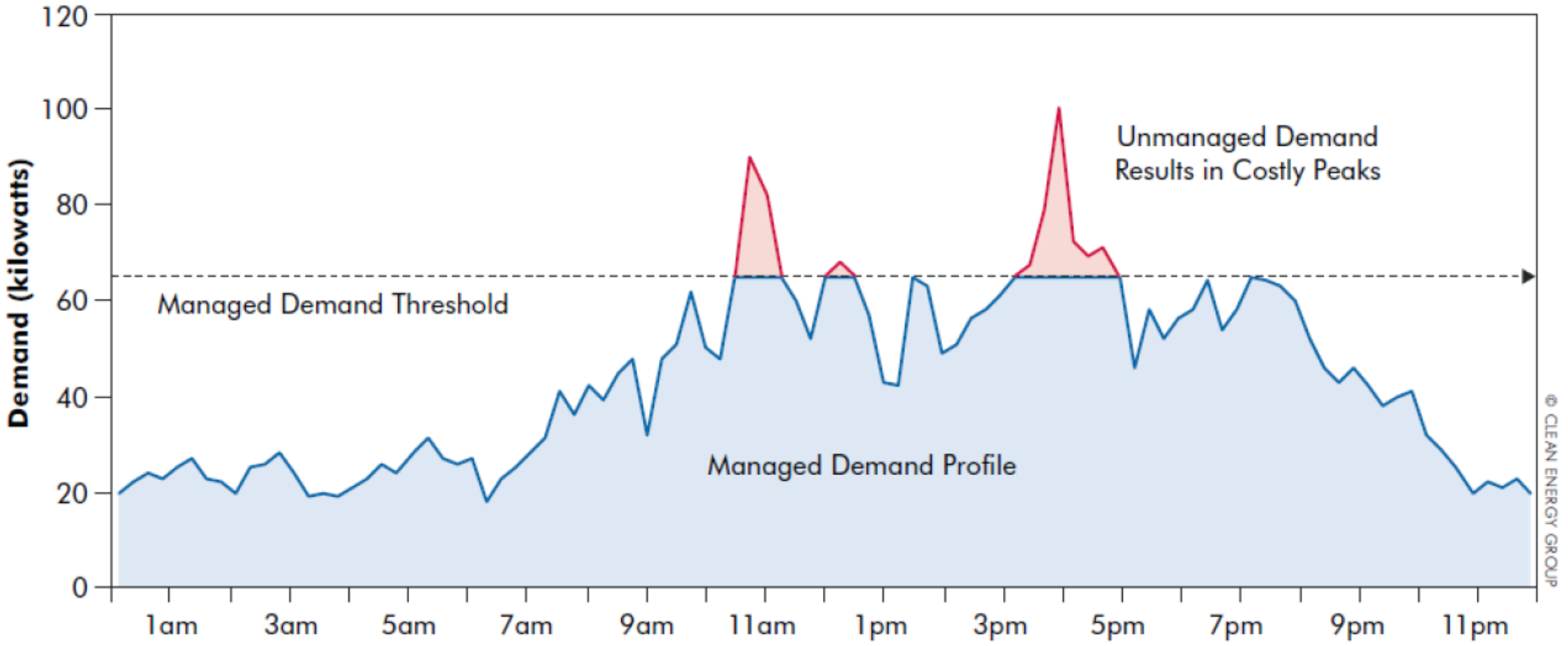
Who pays demand charges?

- Nearly all medium and large commercial customers in every state are obligated to pay demand charges
- This includes traditional commercial customers (private and nonprofit businesses) as well as a wide array of additional customer types such as community facilities, public buildings, and multifamily housing properties

How are customers billed for demand?

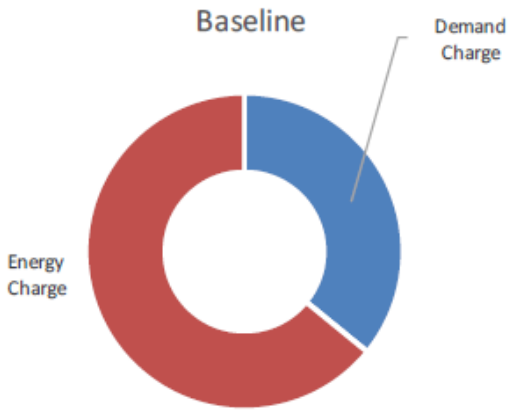
- Demand charges are typically based on a customer's **peak demand** during each billing period
- Peak demand is usually defined as the **highest average electricity usage** occurring within a defined time interval (often 15 minutes)
- Demand charges often account for **30% - 70%** of a customer's monthly electric bill.
- Demand charge rates **vary considerably** across utilities, locations, building sizes, and building types.

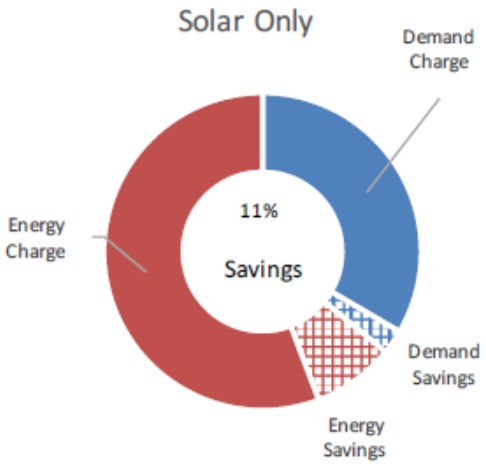
How can battery storage reduce demand charge expenses?

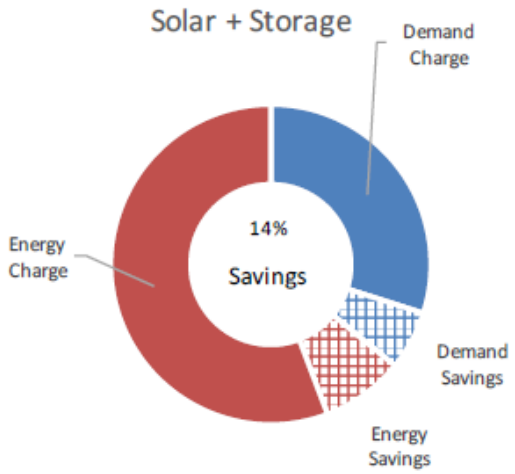


Through the deployment of an energy storage system, peak demand can be effectively capped at a specified level—significantly reducing utility demand charges. Assuming a demand charge of $15 per kilowatt and peak demand reduction from 100 kilowatts to 65 kilowatts each period (as shown here), energy storage could reduce the customer's demand charge by $525 per billing period, amounting to an annual savings of $6,300.

Case Study: Boston Housing Authority







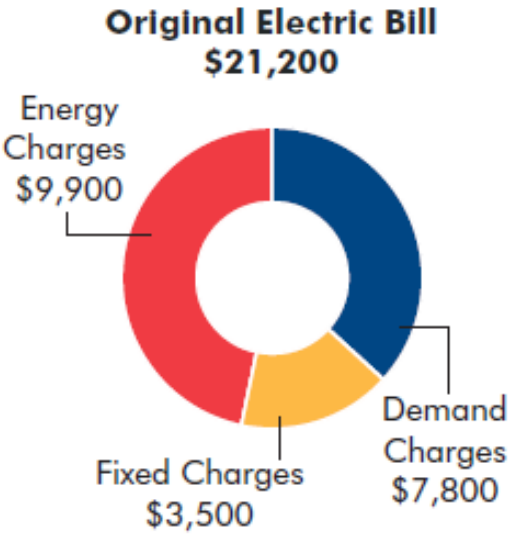
Baseline	
Total Charge	$ 220,188
Energy Charge	$ 139,871
Demand Charge	$ 78,317
Fixed Charge	$ 2,000

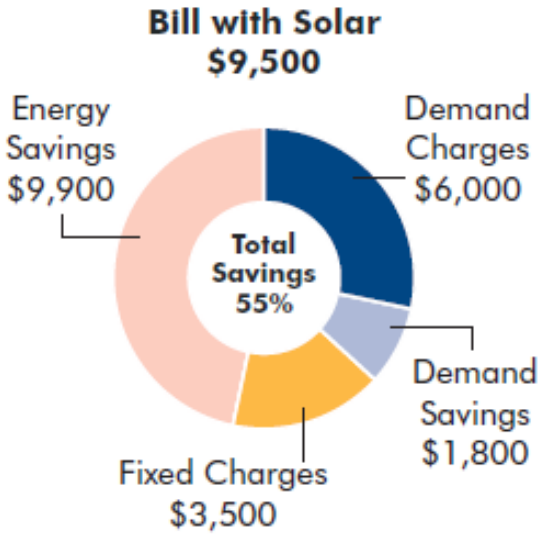
Solar Only	
Total Charge	$ 196,610
Energy Charge	$ 121,667
Demand Charge	$ 72,943
Fixed Charge	$ 2,000
Total Savings	$ 23,578

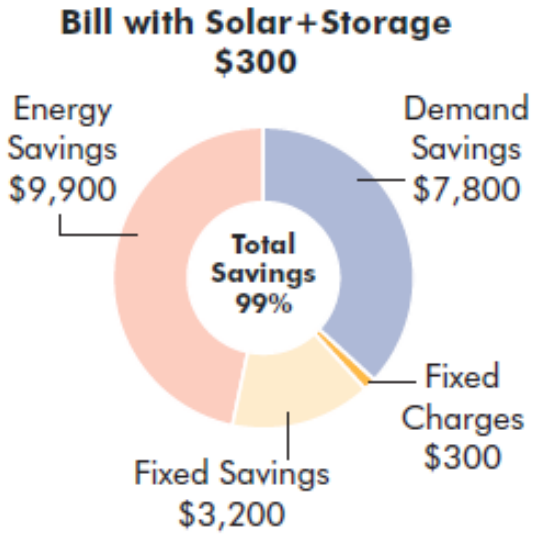
Solar + Storage	
Total Charge	$ 188,965
Energy Charge	$ 121,667
Demand Charge	$ 65,298
Fixed Charge	$ 2,000
Total Savings	$ 31,223

				Year 1 savings		
	Size	Capital cost	Net cost (ITC, MACRS)	Energy charge	Demand charge	Estimated payback
Solar system	150 kW PV	$375,000	$117,787	$18,204	$5,374	5.7 years
Energy Storage system	30 kW/45 kWh battery	$88,604	$27,831	$0	$7,645	4.4 years
Combined system	150 kW PV + 30 kW/45 kWh battery	$463,604	$145,618	$18,204	$13,019	5.3 years

Case Study: Southern California Affordable Housing

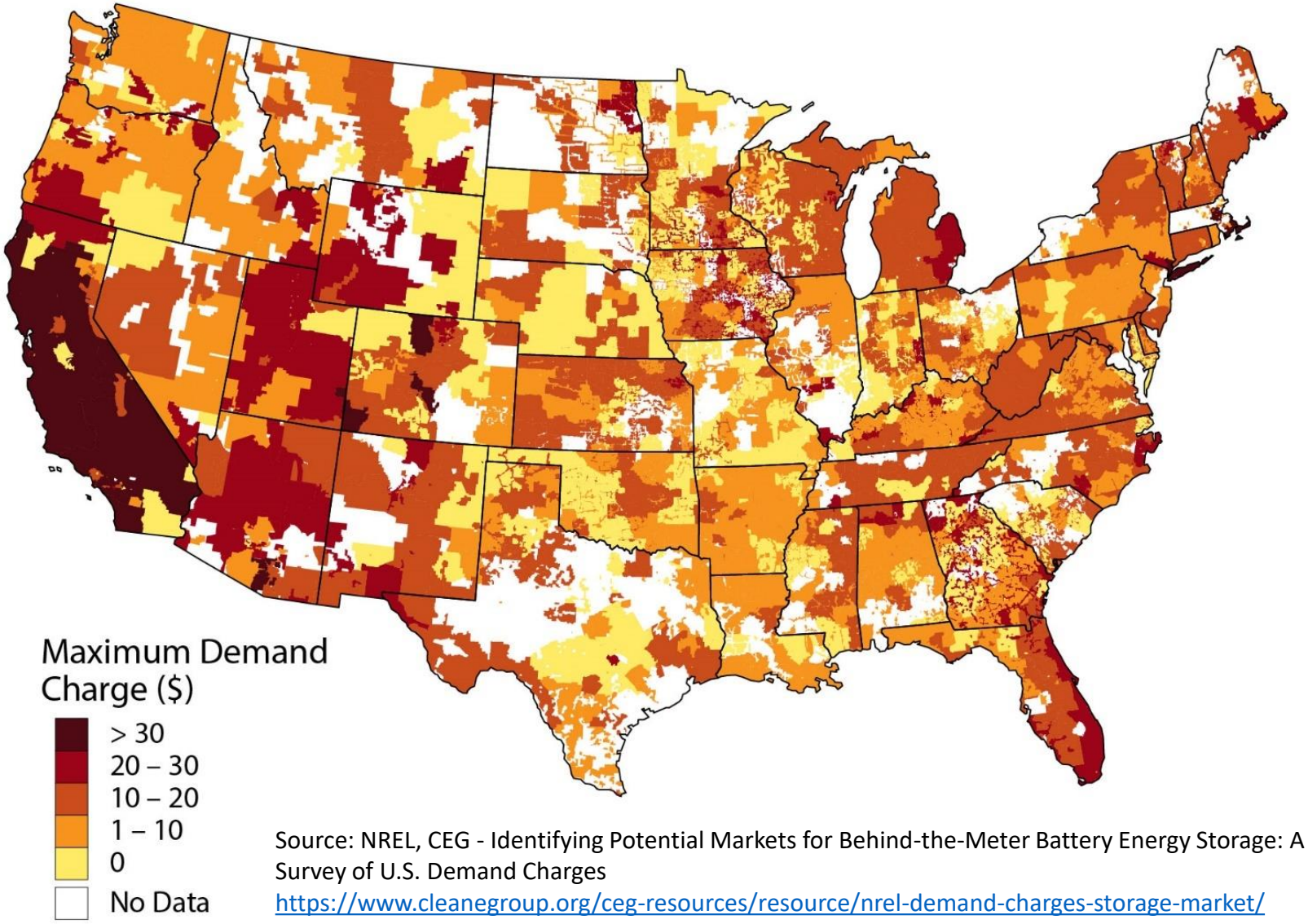






	System size	Installed cost	ITC value	Depreciation tax savings	Additional incentives	Annual bill savings	Percent savings	Payback period (years)
Solar	90 kW PV	$315,000	$94,500	$121,600	$0	$11,700	55%	8.6
Battery storage	30 kW/90 kWh battery	$112,100	$33,600	$43,300	$37,000	$9,200	43%	2.5
Solar+ storage	90 kW PV + 30 kW/90 kWh battery	$427,100	$128,100	$164,900	$37,000	$20,900	99%	5.8

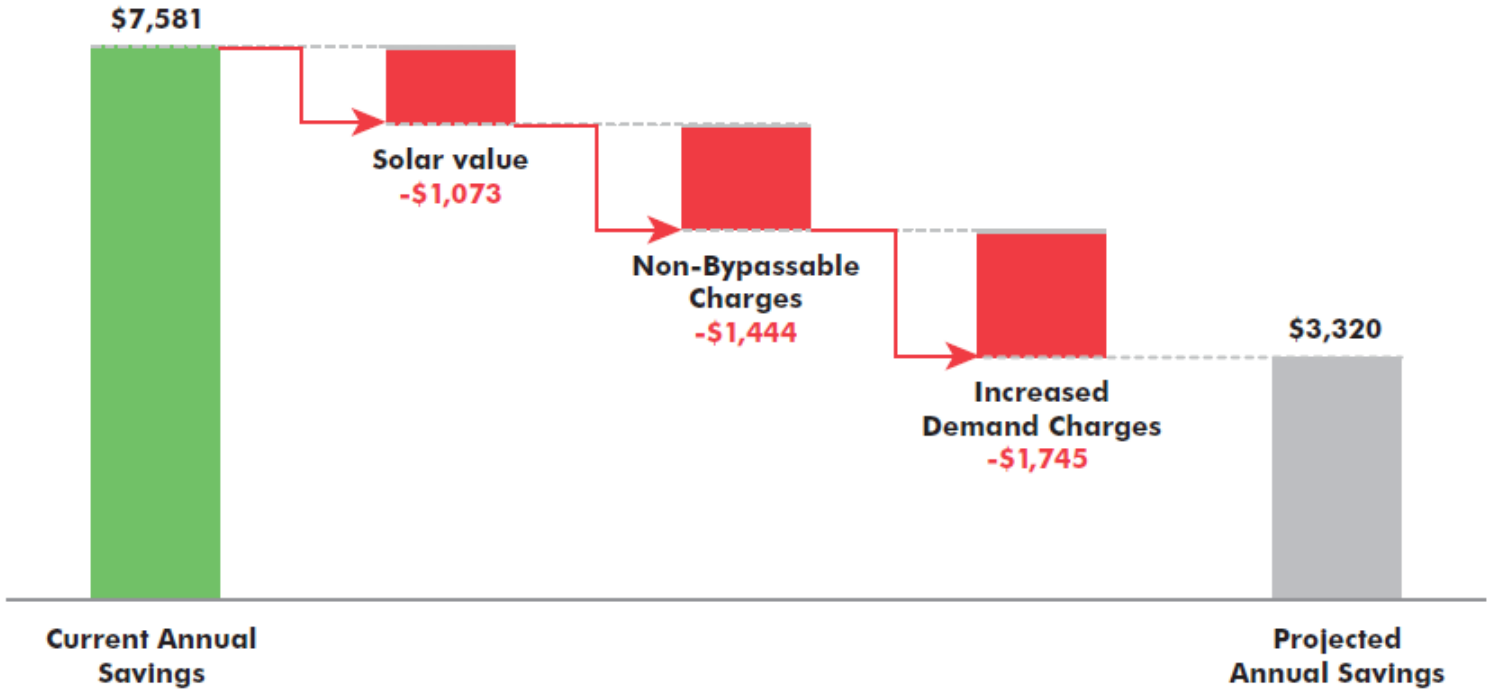
Where are demand charges?



Source: NREL, CEG - Identifying Potential Markets for Behind-the-Meter Battery Energy Storage: A Survey of U.S. Demand Charges
https://www.cleanegroup.org/ceg-resources/resource/nrel-demand-charges-storage-market/

Hedging Against Solar Risk

Proposed Changes Reduce Property Owner's Annual Savings from Solar by $4,262, a 56% Loss

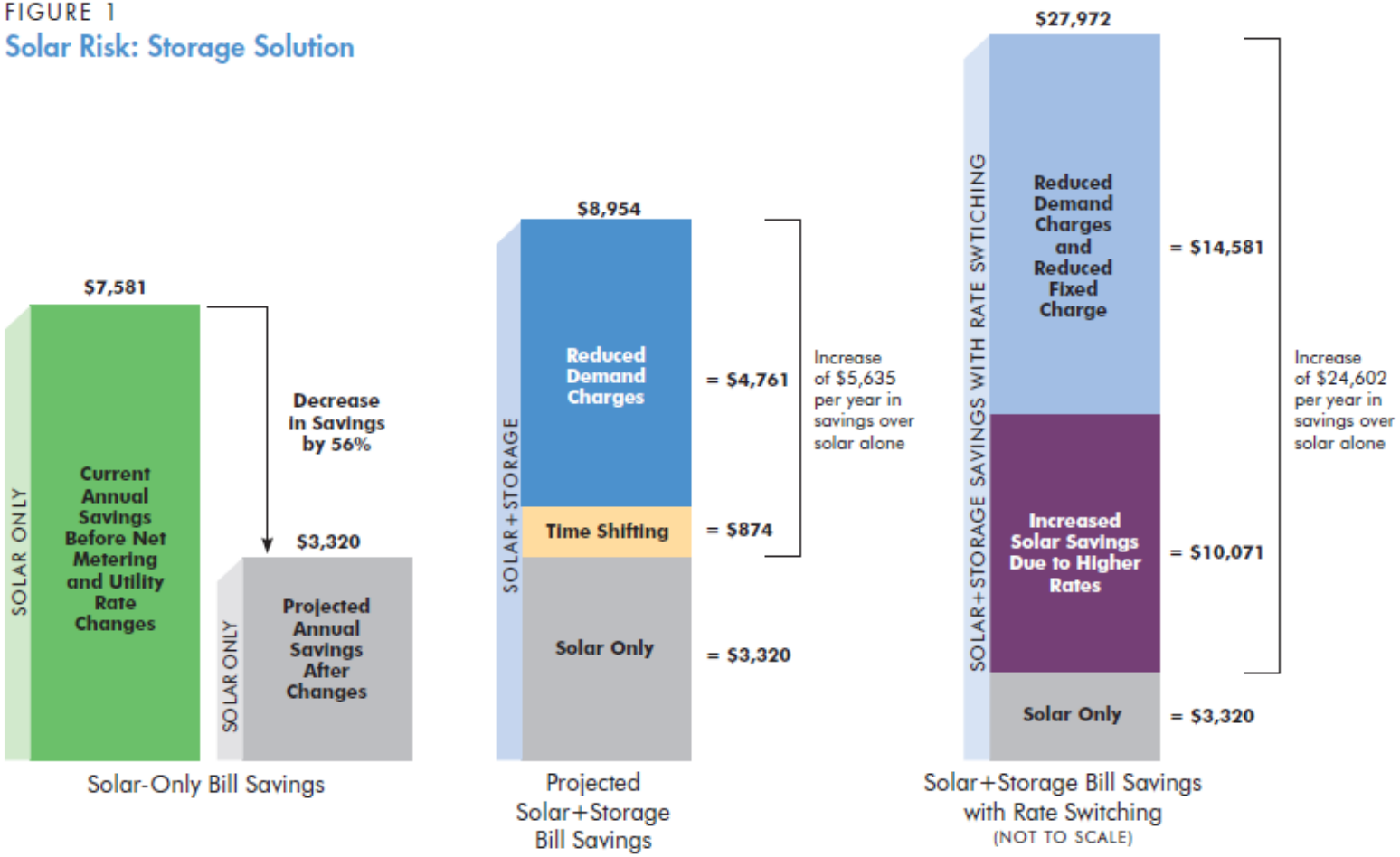


The combined impact of shifting time-of-use pricing periods, non-bypassable charges, and proposed higher demand charges would reduce the annual bill savings delivered by a commercial solar system in San Diego by 56 percent. The annual savings shown in this chart represent a 52-kilowatt PV system producing 75,000 kilowatt-hours per year for an affordable housing property with an annual peak demand of 35 kilowatts billed under the San Diego Gas & Electric TOU-AL rate tariff.

Solar Risk : Storage Solution

FIGURE 1

Solar Risk: Storage Solution



Adding energy storage can reverse the negative impacts on solar bill savings due to net metering changes and proposed utility rate tariffs, which could reduce savings by more than 50 percent. Storage unlocks additional savings through time-shifting solar to be used during peak electricity pricing periods and reducing, or in some cases eliminating, demand charges.

Value of Resilience

Placing a value on the benefits provided by solar with storage during grid outages can significantly impact project economics and system design.

Large Hotel

Value on Resiliency?	Assigned Value of Resiliency ($/hour)	PV Size (kW)	Battery Capacity (kWh)	Net Present Value ($)
No	$0	0	0	$0
Yes	$5,317	363	60	$50,640

Source: NREL, CEG - Valuing the Resilience Provided by Solar and Battery Energy Storage Systems
https://www.cleanegroup.org/ceg-resources/resource/valuing-resilience-solar-battery-energy-storage/

Paying for Battery Storage

- **Savings:** demand charge management, energy arbitrage, solar self-consumption
- **Revenue:** providing grid services, such as demand response, frequency regulation, capacity
- **Federal incentives:** ITC when paired with solar
- **State incentives:** CA Self-Generation Incentive Program (SGIP), MA SMART program, MA Community Clean Energy Resiliency Initiative (CCERI), energy storage mandates, energy efficiency funds

Contact Information

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Financing Solar+Storage in Public and Affordable Housing

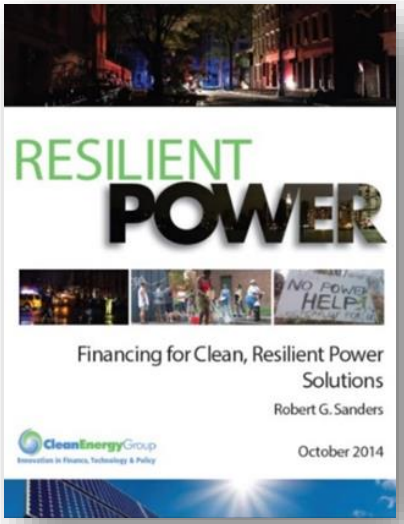
Clean Energy States Alliance (CESA)

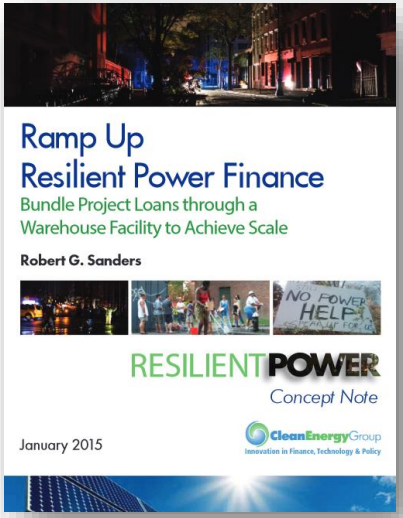
as part of the Sustainable Solar Education Project

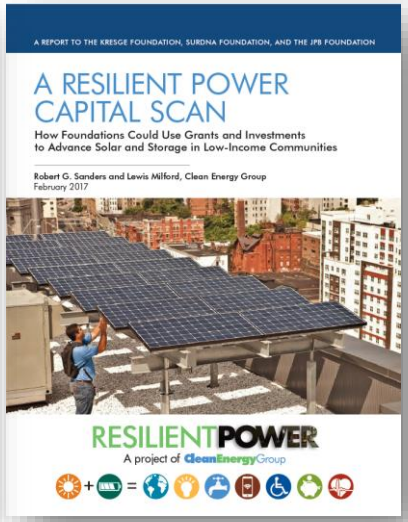
February 22, 2018

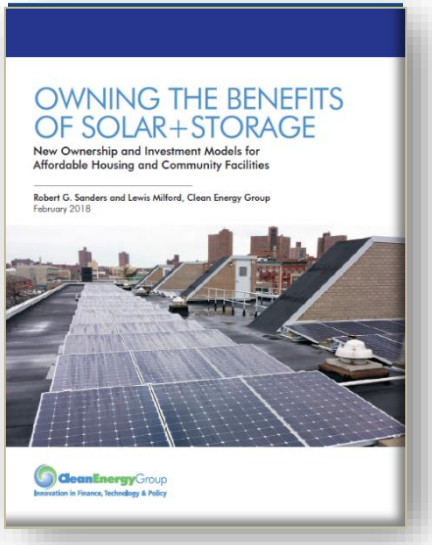
Robert Sanders
Clean Energy Group

www.resilient-power.org









How Solar+Storage Projects are Financed Today

- *State and local incentives* for demonstration projects (MA DOER, CA SGIP, DC DOEE)
- *Federal tax credits* (ITCs, LIHTCs)
- *Utilities* – incentives (Con Edison) and direct ownership or contract for services (3rd party owned, PSE&G)
- *Solar+storage companies* - using project finance funds, venture capital & private equity
- *Large energy services companies* - access to capital markets (MUSH)
- *Bond financing* for municipal projects, schools, large nonprofit institutions
- *Non-recourse project finance* (NYCEEC)

Marcus Garvey Apartments (East Brooklyn)

- **Year Commissioned**: 2017
- **Services Provided**: Demand management, Demand response, Backup power
- **Solar**: 400kW
- **Storage**: 300kW/1200kWh
- **Project Partners**: L+M Development Partners, NYCEEC, Demand Energy, Con Edison
- **Revenue** from Con Edison:
  - Capacity payments
  - Performance payments (demand response events)

NYCEEC Financing (Marcus Garvey)

- *Borrower:* Demand Energy SPE
- *Loan Amount:* $1.25 million (total battery project: $1.32 million)
- *Loan type:* Construction/term loan
- *Loan Term:* 10.5 years
- *Use of proceeds:* Battery storage equipment purchase & installation
- *Collateral:* Battery storage equipment, storage-related incentives
- *Primary sources of repayment:* BQDM incentives (ConEd), demand response payments, peak shaving utility savings

A Resilient Power Capital Scan

- Commissioned by The Kresge Foundation, Surdna Foundation and The JPB Foundation
- Identified 5 key barriers and more than 50 recommended grant, PRI, and MRI investment opportunities in the resilient power solar and storage space.

www.cleanegroup.org/ceg-resources/resource/resilient-power-capital-scan

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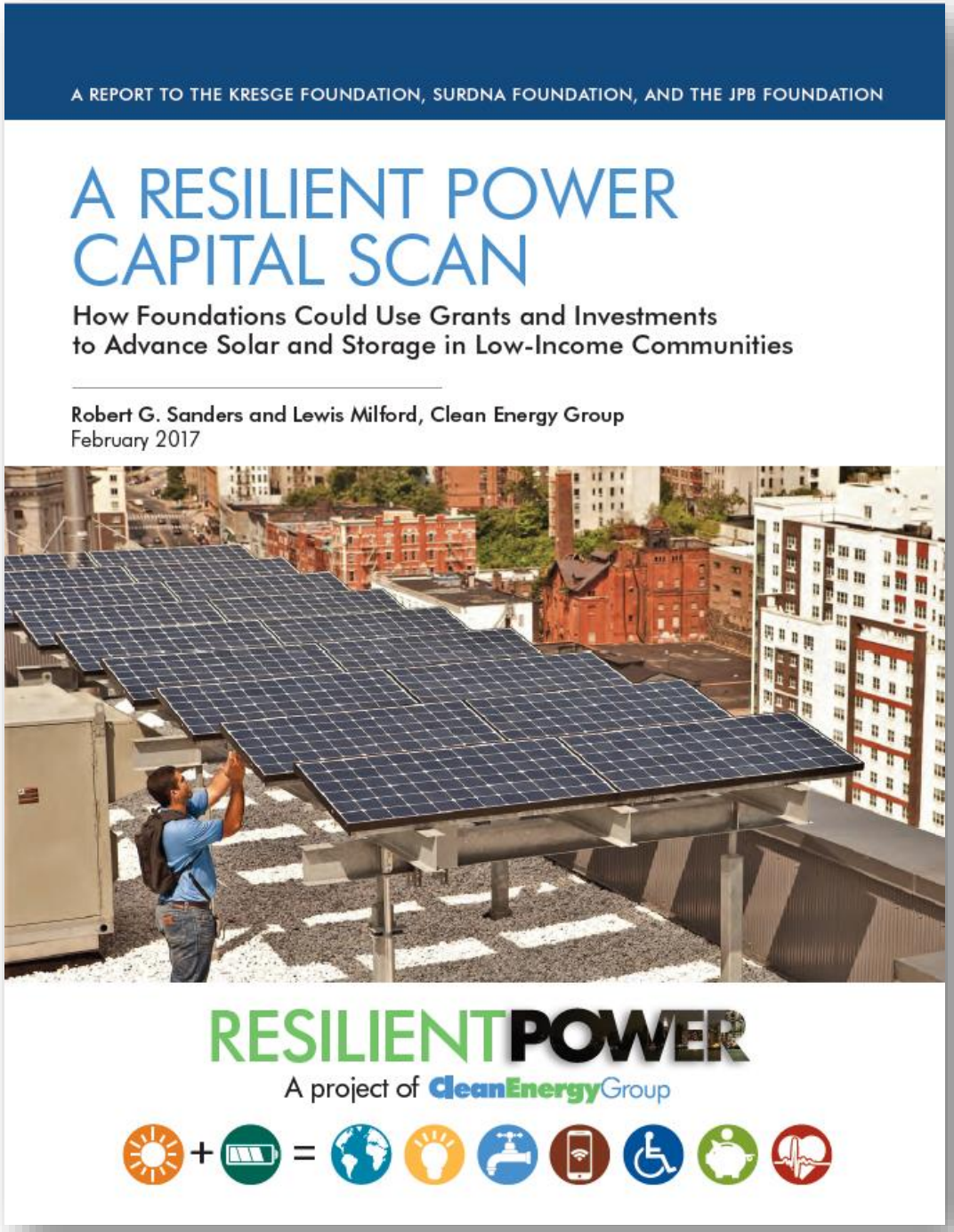
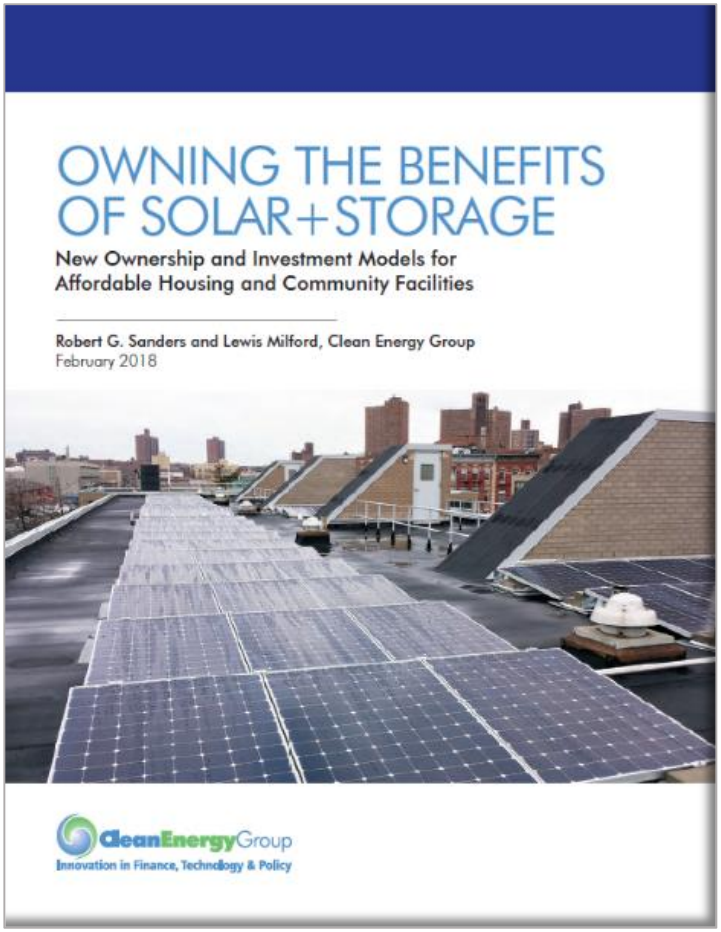


Owning the Benefits of Solar+Storage

"Owning the Benefits of Solar+Storage: New Ownership and Investment Models for Affordable Housing"

- Immediate direct ownership
- Third-party ownership flips
- CivicPACE with third-party ownership
- Third-party ownership under a utility-contracted payment for services agreement



www.cleanegroup.org/ceg-resources/resource/owning-the-benefits-of-solar-storage

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Solar + Storage For Public & Affordable Housing

February 22, 2018

Trusted by Affordable Housing

Energy Storage Use Cases

1. AC Coupled for Resiliency
2. DC Coupled for Peak Shaving and Load Management


the future belongs to data-driven solutions

New Tech = New Opportunities

Solar

+

Storage

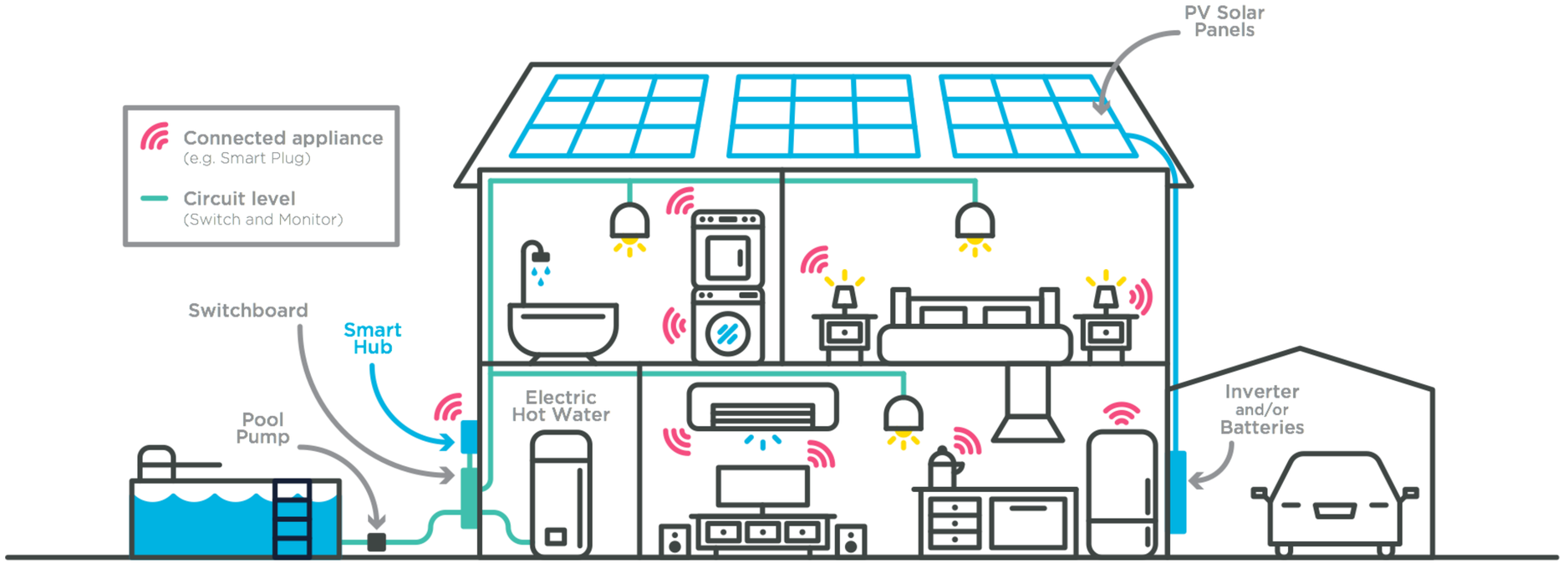
Big Data
Internet of Things
Sharing Economy
Blockchain

Energy Management Is Key!

Your Building Is Going To Need A Brain

naak

The Energy Cloud Economy



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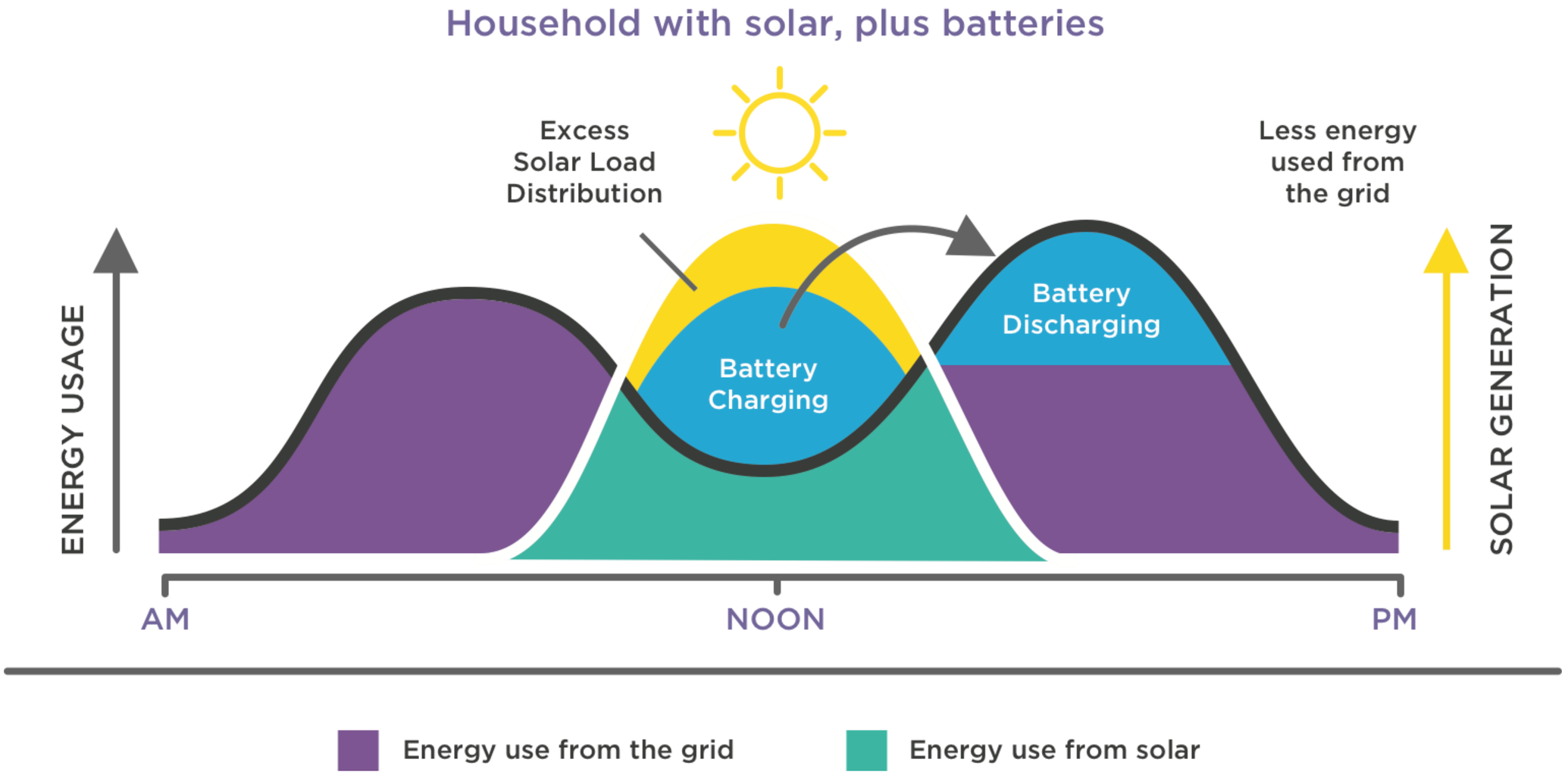
Storage Maximizes The Solar Benefits



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Our Projects

1. **Rancho Verde Farm Worker Housing**
   - AC Coupled for Resiliency
   - USDA funded program
   - Critical load circuit in community room

2. **Mosaic Gardens at Pomona**
   - SCE Pilot program
   - Common area multifamily, one single building - study what battery can do
   - Different options for benefitting community, but also providing grid services - demand response, power control etc.

3. **Silver Star Apartments**
   - Living Building Challenge certification
   - Resiliency for Community Room
   - Perpetual energy source for community room in event of long term outage

energy is evolving….

- Utility Pricing
- Energy Codes
- Technology
- Rebates
- Local Requirements

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Thank You!

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Upcoming Webinars

Promising Solar PV Financing Strategies for Low- and Moderate-Income Customers

Thursday, March 1, 1-2pm ET

New Financing Options for Solar+Storage in Low-Income Communities

Thursday, March 29, 1-2pm ET

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

Contact Information

SUSTAINABLE SOLAR EDUCATION PROJECT

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