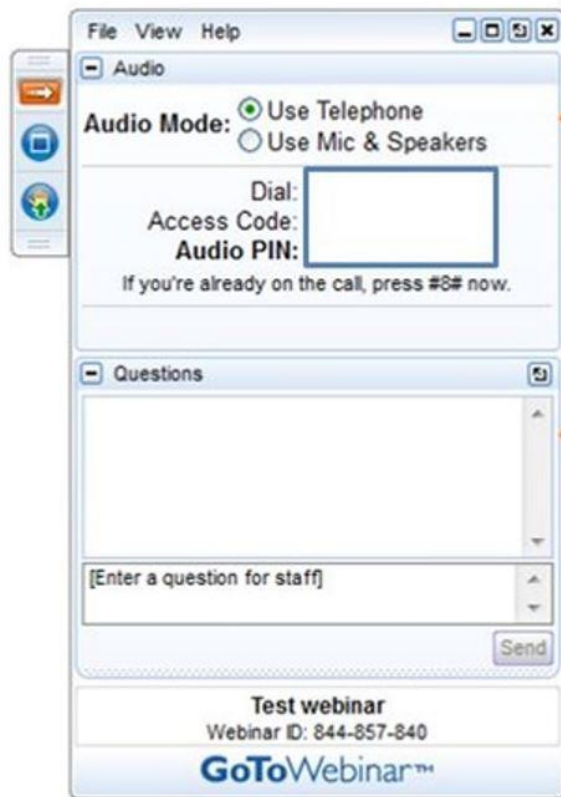


# Solar+Storage for Low- and Moderate-Income Communities

March 16, 2017



# Housekeeping



All participants are in “Listen-Only” mode. Select “Use Mic & Speakers” to avoid toll charges and use your computer’s VOIP capabilities. Or select “Use Telephone” and enter your PIN onto your phone key pad.

Submit your questions at any time by typing in the Question Box and hitting Send.

**This webinar is being recorded.**

You will find a recording of this webinar, as well as all previous CESA webcasts, archived on the CESA website at

[www.cesa.org/webinars](http://www.cesa.org/webinars)

# CleanEnergy States Alliance



NYSERDA



Illinois Department of Commerce & Economic Opportunity



ACEP Alaska Center for Energy and Power



Office of the People's Counsel District of Columbia Advocating, Protecting and Educating DC Consumers



Department of Commerce Innovation is in our nature.



# Sustainable Solar Education Project

- Provides information to state and municipal officials on strategies to ensure distributed solar electricity
  - 1) Remains consumer friendly
  - 2) Benefits low- and moderate-income households
- The project is managed by CESA and is funded through the U.S. Department of Energy SunShot Initiative's Solar Training and Education for Professionals program.

[www.cesa.org/projects/sustainable-solar](http://www.cesa.org/projects/sustainable-solar)





# Sustainable Solar Education Project Resources

The Sustainable Solar Education Project develops a variety of resources on solar equitability and consumer protection:

- **Guides**
- **Webinars**
- **Online course material**
- **In-person training**

The project publishes a free **monthly e-newsletter** highlighting solar equitability and consumer protection news and from across the country.

[www.cesa.org/projects/sustainable-solar](http://www.cesa.org/projects/sustainable-solar)



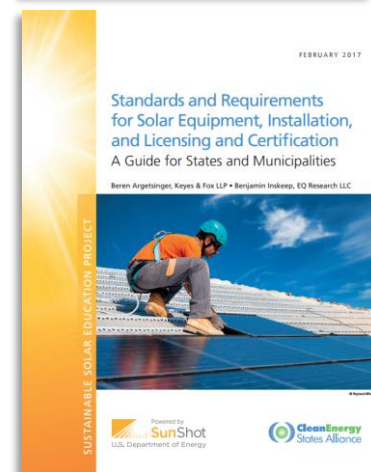
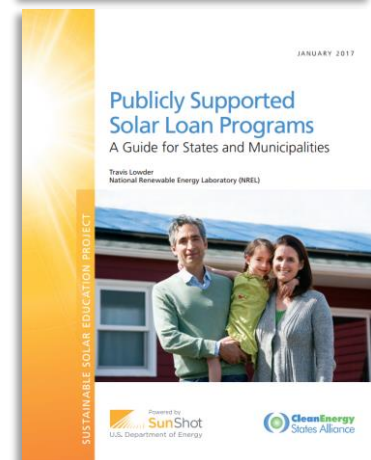
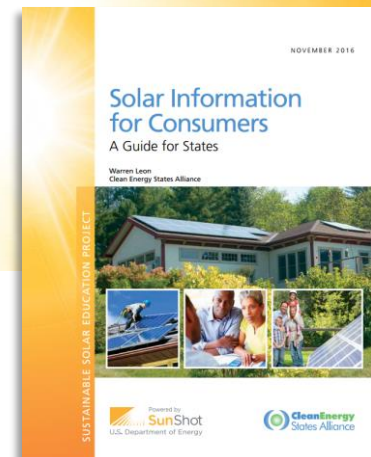
# Other Sustainable Solar Education Project Guides

## Published:

- [\*Solar Information for Consumers: A Guide for States\*](#)
- [\*Publicly Supported Solar Loan Programs: A Guide for States and Municipalities\*](#)
- [\*Standards and Regulations for Solar Equipment, Installation, and Licensing & Certification: A Guide for States and Municipalities\*](#)

## In Development:

- *Programs and Policies to Bring the Benefits of Solar to Low- and Moderate-Income Customers: A Guide for States and Municipalities*
- *Consumer Protections for Community Solar: A Guide for States*



# Panelists

**Todd Olinsky-Paul**, Project Director, Clean Energy States Alliance

**Nate Hausman**, Project Director, Clean Energy States Alliance (Moderator)



# Solar+Storage for Low- and Moderate-Income Communities *A Guide for States and Municipalities*

Clean Energy States Alliance  
Sustainable Solar Education Project

March 2017

**Todd Olinsky-Paul**  
**Project Director**  
**Clean Energy States Alliance**



# Agenda for this Presentation:

- Introduction to ESTAP and Resilient Power Project
- Solar+Storage for Low- and Moderate-Income Communities guidebook
- Questions

# Energy Storage Technology Advancement Partnership (ESTAP)

**ESTAP** is a project of CESA (Clean Energy States Alliance), a non-profit organization supporting state implementation of effective clean energy policies & programs

**Purpose:** Federal-state-private partnerships to advance energy storage, with funding from US DOE-OE and technical assistance from Sandia National Laboratories

**Outcomes:** Large scale energy storage project deployments across the U.S. with co-funding from states and municipalities; state energy storage policy development

[www.cesa.org/projects/energy-storage-technology-advancement-partnership](http://www.cesa.org/projects/energy-storage-technology-advancement-partnership)



States

Vendors

Partners

Oregon: battery demonstration project, utility procurement mandate

New Jersey: \$10 M energy storage solicitation/rebate program

New York \$40 M Microgrids Initiative

Vermont: Battery demonstration project, Airport Microgrid

Massachusetts: \$40 M Resilient Power Program, \$10 M Energy Storage Program, ESI program

New Mexico: Energy Storage Task Force

Connecticut \$45 Million Microgrids Initiative

Kodiak Island Wind/Hydro/Battery & Cordova Hydro/flywheel projects

Pennsylvania Battery Demonstration Project

Northeastern States Post-Sandy Critical Infrastructure Resiliency Project

Maryland Game Changer Awards: Solar/EV/Battery & Resiliency Through Microgrids Task Force



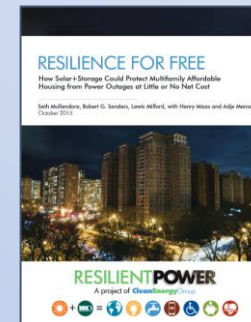
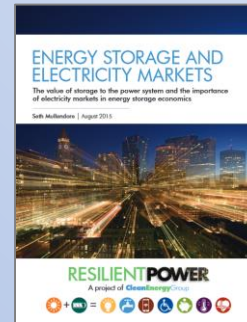
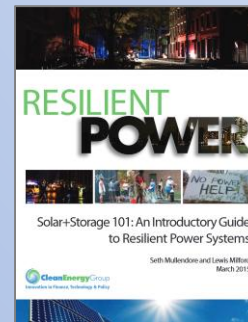
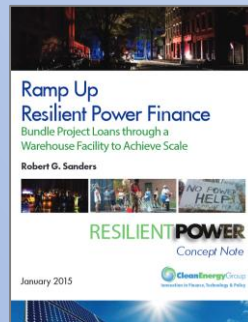
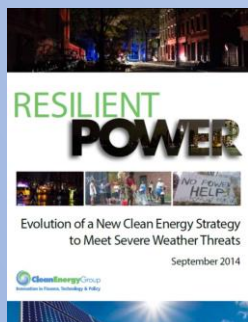
# ESTAP Project Locations



# Resilient Power Project



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



[www.cleangroup.org](http://www.cleangroup.org)

[www.resilient-power.org](http://www.resilient-power.org)



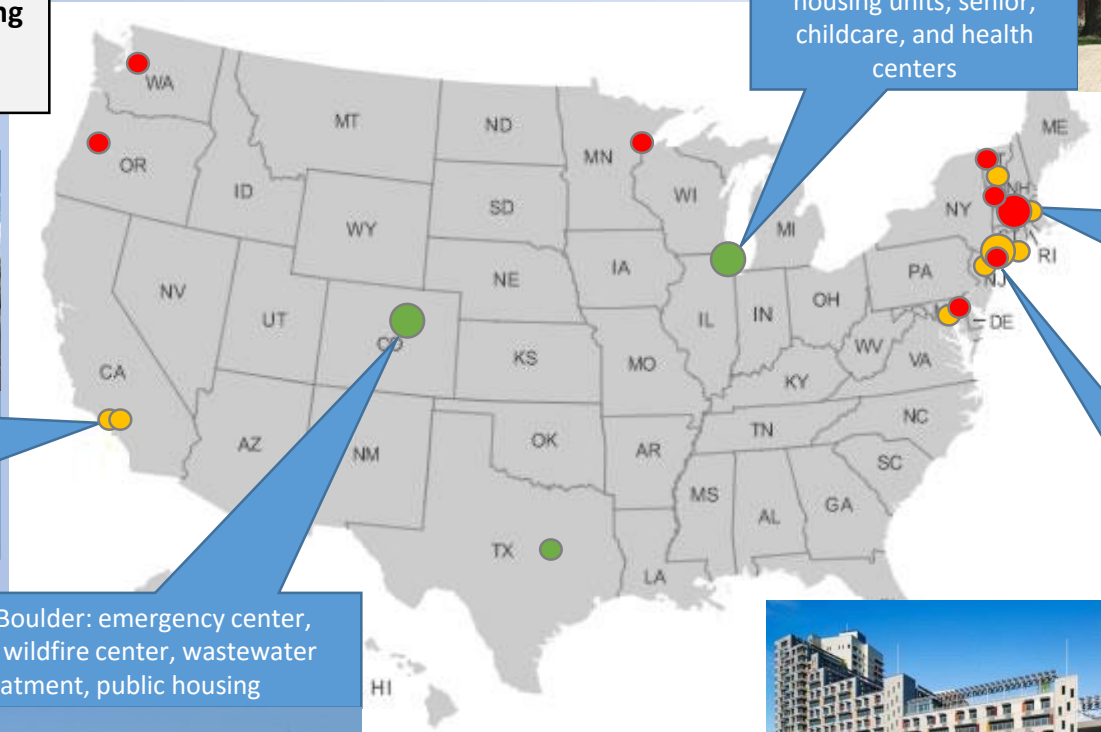


# CEG Resilient Power Project: Supporting More than 50 Projects

- Affordable Housing
- Critical Facilities
- Both



California Multifamily Affordable Housing: AB 693 150,000 units



Chicago Housing Authority: 1,900 public housing units; senior, childcare, and health centers



Massachusetts Community Clean Energy Resiliency Initiative: 11 communities, 28 projects



City of Boulder: emergency center, shelter, wildfire center, wastewater treatment, public housing



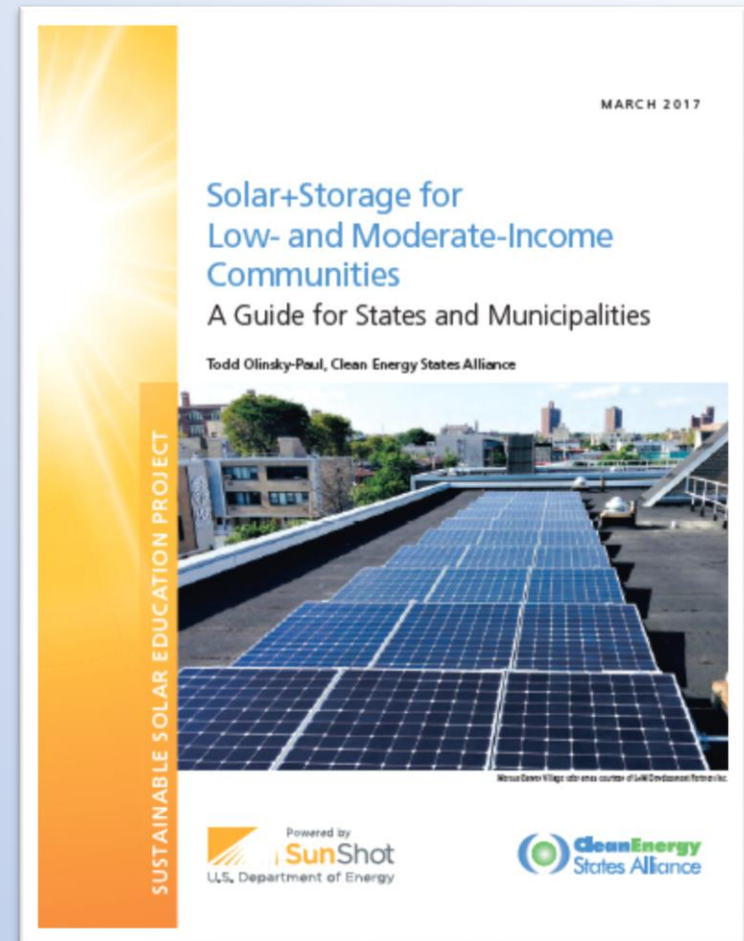
New York/New Jersey: 9 multifamily affordable housing projects, community shelter



# Solar+Storage for Low- and Moderate-Income Communities

## *A Guide for States and Municipalities*

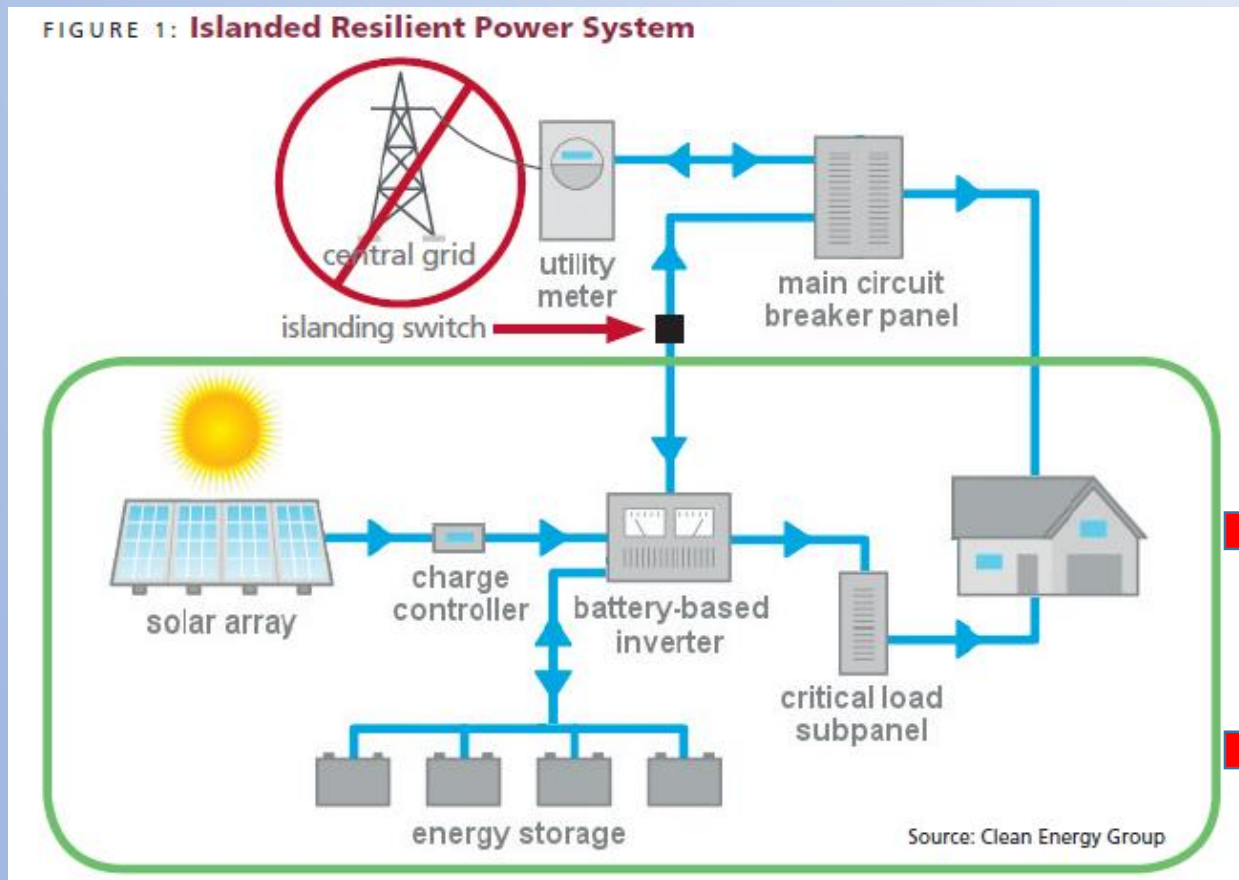
- **What Is Solar+Storage**
- **Why Solar+Storage for LMI Communities?**
  - Cost Savings
  - Resiliency
- **Policy Tools**
  - Grants and Rebates
  - Utility Mandates/Procurement Targets and Portfolio Standards
  - Incorporating Solar+Storage into Existing Programs
  - Tax Incentives and Alternative Ownership Structures
  - Financing and Clean Energy Financial Institutions
  - Market-Based Tools and Regulatory Reform
  - Technical Assistance, Tools, and Resources
- **Conclusions**



<http://bit.ly/Solar-Storage-LMI>

# What Is Solar+Storage?

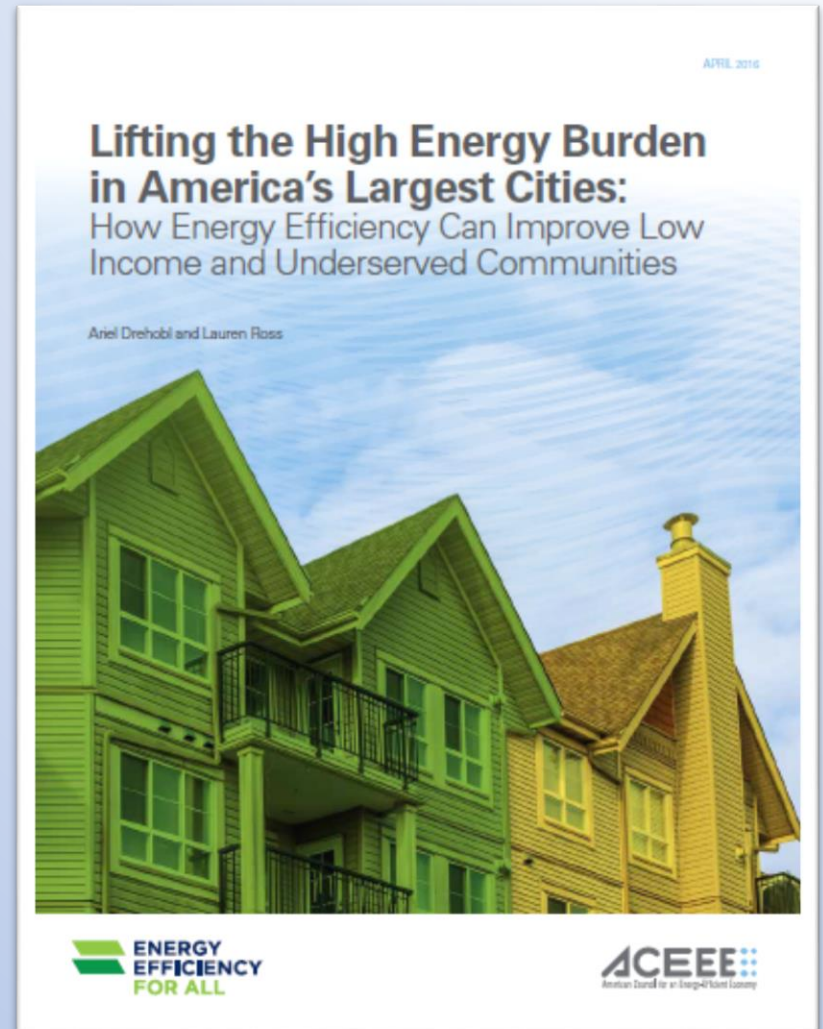
A marriage of two clean energy technologies, solar PV and battery storage, capable of providing unique benefits that cannot be achieved by the use of either solar or storage alone.



# Why Solar+Storage for LMI Communities?

## Energy Costs Disproportionately Burden LMI Communities

- LMI customers, on average, pay a larger portion of their income for energy.
- LMI customers may not be in a position to easily take advantage of energy efficiency and distributed generation technologies, that could provide relief from energy costs.
- Solar PV can provide energy cost savings, but adding batteries can often provide greater savings than solar alone, and in some cases result in a shorter payback period.





# Why Solar+Storage for LMI Communities?

Extreme weather disproportionately hurts LMI communities.



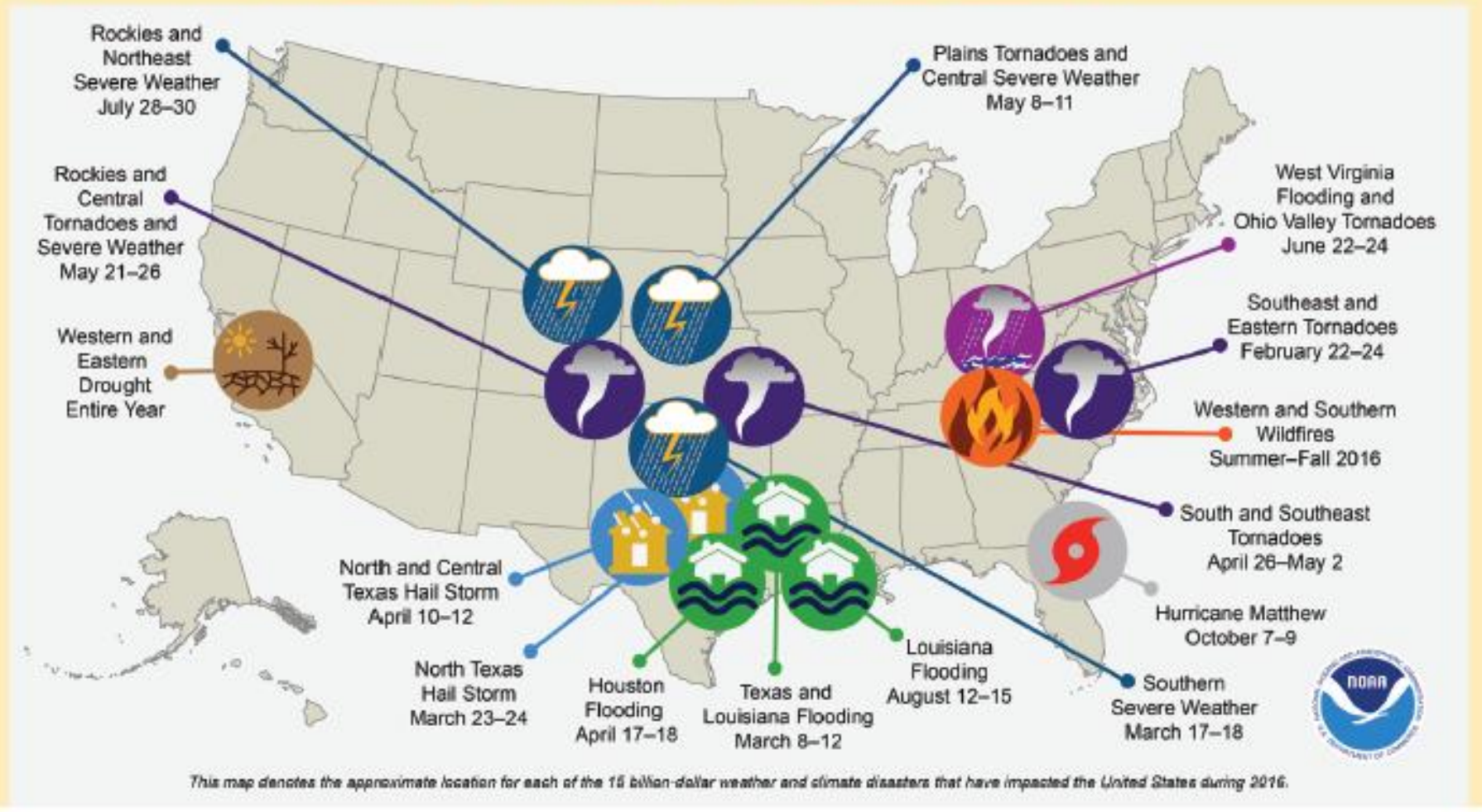
LMI communities may lack income, savings, employment, insurance, communication channels & information – making them less resilient after severe weather.

LMI communities have more difficulty responding & recovering from destruction.



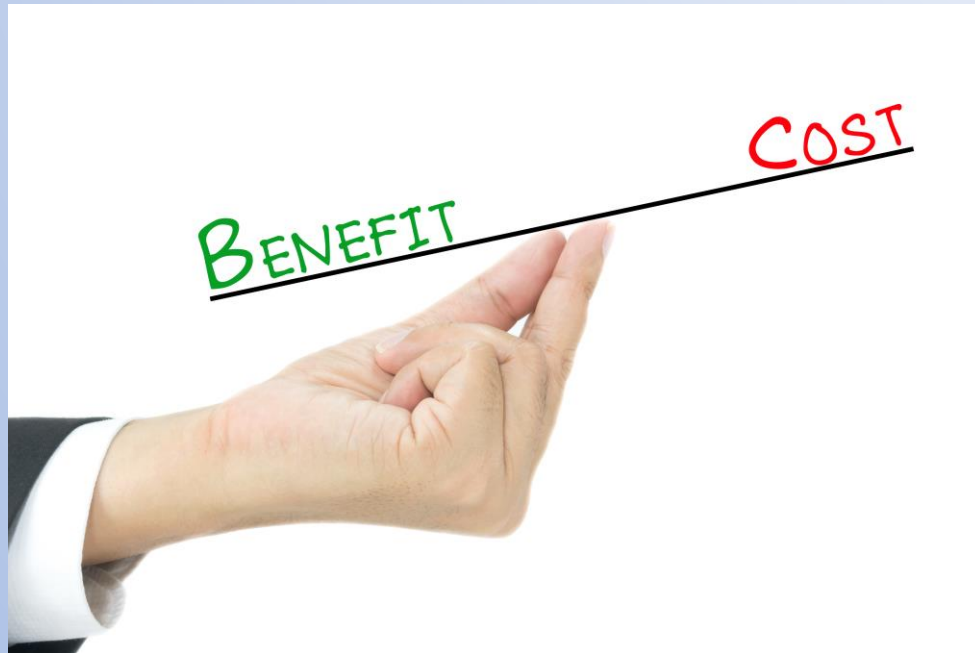
# 2016 Billion-Dollar Weather and Climate Disasters (NOAA)

FIGURE 6: U.S. 2016 Billion-dollar Weather and Climate Disasters





# Energy Storage Business Case



# The business case for solar+storage depends on multiple value streams that are locationally determined

“Locationally” means where on the map *and* where on the grid

## Transmission/Distribution

- T&D investment deferral
- Ancillary services provision
- Utility capacity and transmission cost reductions
- Renewables integration
- Ramping
- Arbitrage
- Frequency regulation

## Behind the meter

- **Demand charge management**
- Utility tariff switching
- Reduced energy purchases
- Demand response
- Frequency regulation
- TOU arbitrage

# Behind the Meter: Solar+storage for energy cost savings

- Demand charge management
- Tariff switching

FIGURE 1  
Explanation of Charges Commonly Found on an Electric Bill

## Charges on an Electric Bill

Electric bills are primarily composed of three types of charges: energy charges, demand charges, and fixed charges.

### Energy charges:

Energy charges (measured in kilowatt-hours) are based on the amount of electricity consumed from the grid over each billing cycle. Energy charges can vary depending on season and the time of day electricity is consumed (time-of-use rates) or the amount of electricity consumed (tiered rates).

### Demand charges:

Demand charges (measured in kilowatts) are based on the highest rate of electricity consumption during a billing cycle, called peak demand. Utilities assess peak demand by measuring the highest average demand that occurs over any 15-minute period each billing cycle. Demand charges can vary depending on season and the time of day when peak demand occurs. Demand charges are typically found only on commercial or industrial customer accounts, where they often represent about half of the cost of an electric bill. Residential customers are usually not assessed these charges.

### SDG1 Annual Electric Bill

ENERGY				
		Usage (kWh)	Cost (\$/kWh)	Total cost (\$)
Max	Summer	13,085	0.11447	1,497.82
	Winter	7,827	0.10565	826.97
Peak	Summer	15,259	0.10568	1,612.59
	Winter	35,189	0.09132	3,213.46
Part-Peak	Summer	26,959	0.07920	2,135.17
	Winter	46,612	0.07160	3,337.42
<b>TOTAL</b>		<b>144,932</b>		<b>\$12,623.43</b>

DEMAND				
		Avg peak (kW)	Cost (\$/kW)	Total cost (\$)
Max	Summer	33	22.55	2,958.56
	Winter	30	22.55	5,195.52
Peak	Summer	33	19.19	2,517.73
	Winter	24	6.86	1,279.49
Part-Peak	Summer	30	0.00	0.00
	Winter	30	0.00	0.00
<b>TOTAL</b>				<b>\$11,951.30</b>

FIXED		Total cost (\$)
Meter charge		1,397.28
<b>TOTAL</b>		<b>\$1,397.28</b>

**TOTAL ANNUAL BILL \$25,972.01**

49%

46%

5%

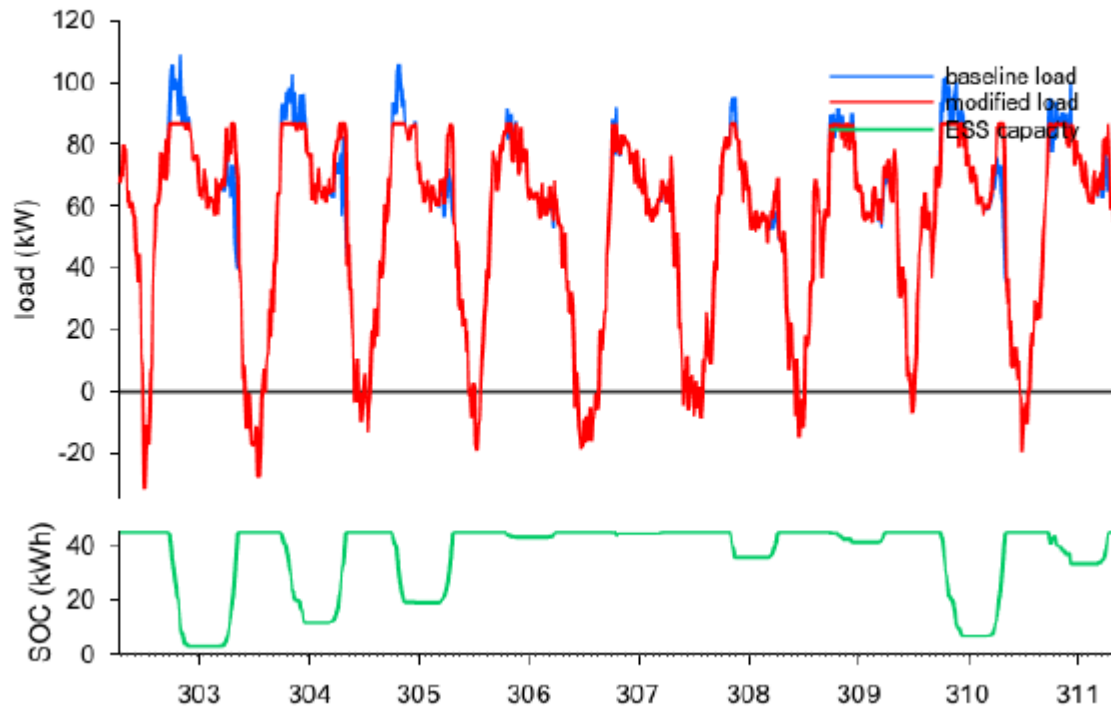
### Fixed charges:

Fixed charges are usually static and do not vary from one billing cycle to the next. These charges typically cover the costs of metering, billing, and other customer-related operating expenses not accounted for in energy and demand charges. Fixed charges can also include additional fees to cover system benefits programs such as energy efficiency and renewable energy programs. For simplicity, only fixed charges related to billing and metering are considered in this analysis.

# Energy storage manages demand charges by shaving peak loads

FIGURE 10 DCM with a 30 kW, 45 kWh ESS

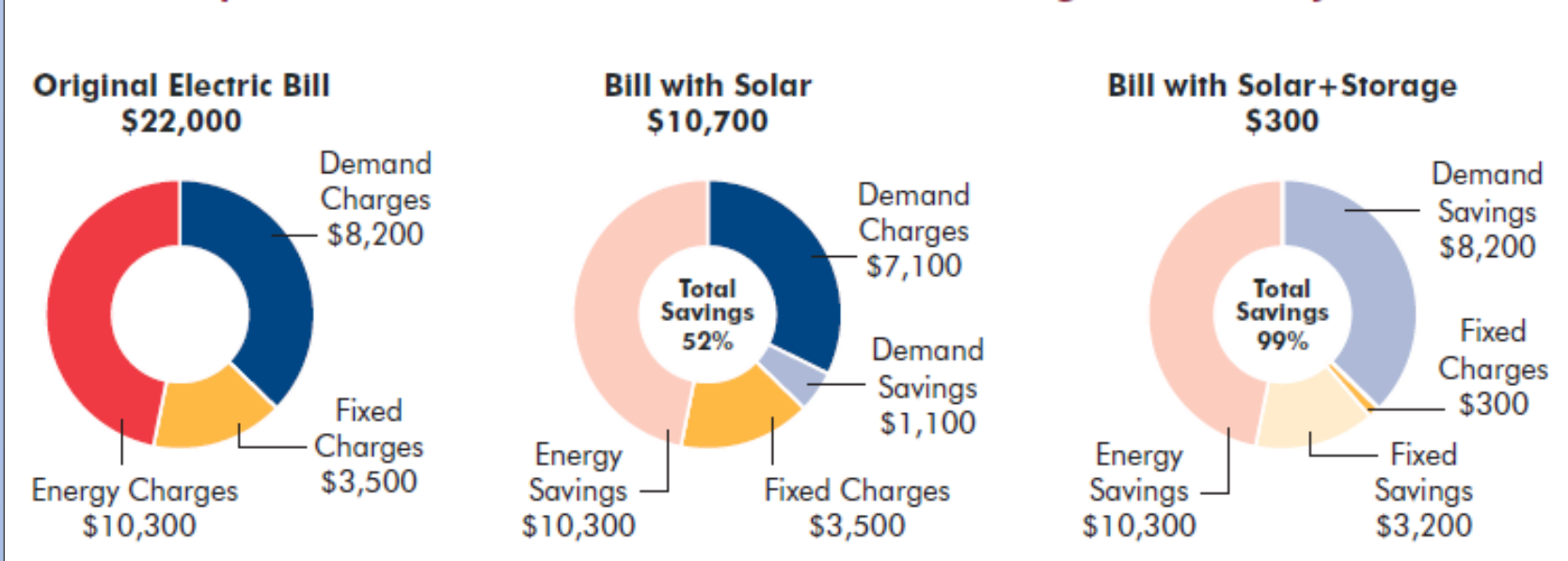
Baseline load before DCM (blue), modified load after DCM (red), state-of-charge (green).



*Solar alone cannot reliably provide peak load management*

# Economic Example: Commercial Facility in Southern California

FIGURE 5: Impacts from the Addition of Solar and Solar+Storage on Electricity Bills



- **Solar eliminates energy consumption expenses and lowers demand charges, saving \$11,400.**
- **Adding a battery eliminates demand charge expenses and lowers fixed charges, saving an additional \$10,300 per year.**

**(Data from Southern California Edison's service territory.)**



# Another Example: Multifamily Affordable Housing

## Impacts of Clean Energy Technologies at Multifamily Affordable Housing in California

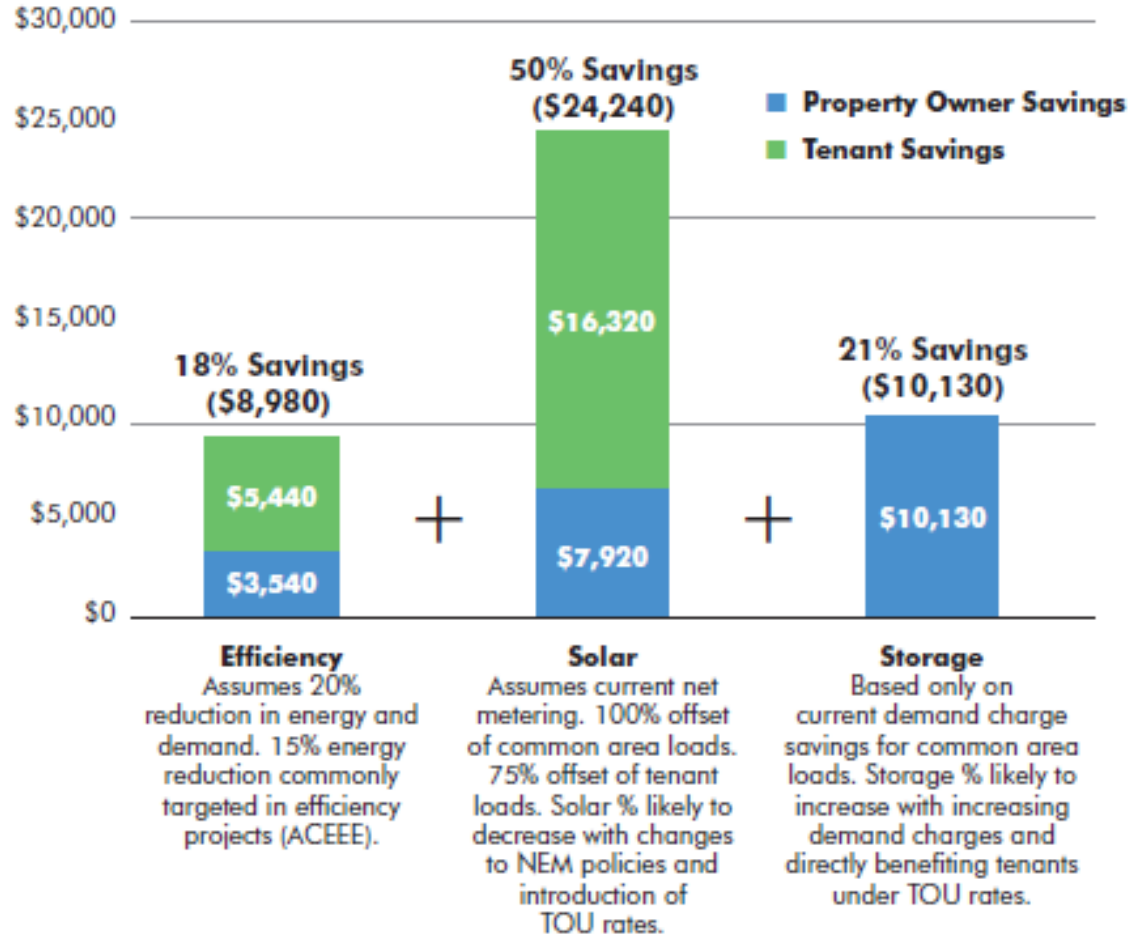
### EXAMPLE

#### 50-Unit Multifamily Affordable Housing in Southern California

Total Annual Electricity Bill for Owners and Tenants **\$48,800**

Total Annual Electricity Bill Savings from Efficiency+Solar+Storage **\$43,350**

Total Annual Electricity Bill Savings with all three technologies combined **89%**



# Three City Analysis: The Economic Impact of Adding Storage

## Chicago Project Summary

System Size	200-kW solar-only	200-kW solar + 100-kW/ 50-kWh lithium-ion battery	200-kW solar + 300-kW/ 150-kWh lithium-ion battery
Initial Cost*	\$493,000	\$606,000	\$832,000
Payback Period	20+ years	11.8 years	6.2 years

\* Initial project costs refer to year zero net project expenses after federal tax credits and any additional tax credits have been applied.

## Washington, D.C. Project Summary

System Size	360-kW solar-only	360-kW solar + 100-kW/ 50-kWh lithium-ion battery
Initial Cost	\$788,000	\$901,000
Payback Period	3.5 years	3.5 years

## New York City Project Summary

System Size	30-kW solar-only	30-kW solar + 30-kW/ 60-kWh lead-acid battery
Initial Cost	\$58,000	\$128,000
Payback Period	4.3 years	14.2 years

# Policy Tools

- Grants and Rebates
- Utility Mandates/Procurement Targets and Portfolio Standards
- Incorporating Solar+Storage into Existing Programs
- Tax Incentives and Alternative Ownership Structures
- Financing and Clean Energy Financial Institutions
- Market-Based Tools and Regulatory Reform
- Technical Assistance, Tools, and Resources

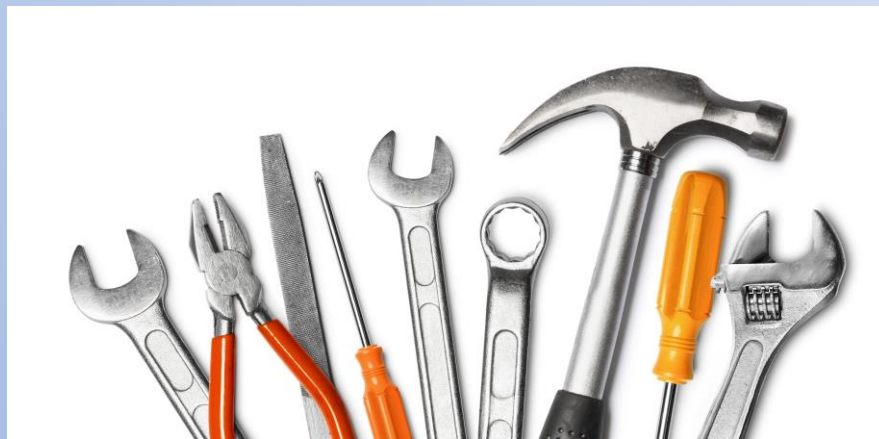


# Grants and Rebates

- Add incentives for projects that serve LMI communities; for example, by scoring such project proposals higher, indexing the size of grants or rebates to community income levels, reserving a portion of the program budget for LMI projects, or offering an adder or multiplier for such projects.
- **Include technical assistance provisions in grant programs to help to ensure projects succeed.**
- Include requirements for monitoring and verification, data collection, and knowledge sharing, to make public information on project economics and operations that would otherwise remain private.

Grant example: *Massachusetts Community Clean Energy Resiliency Initiative*

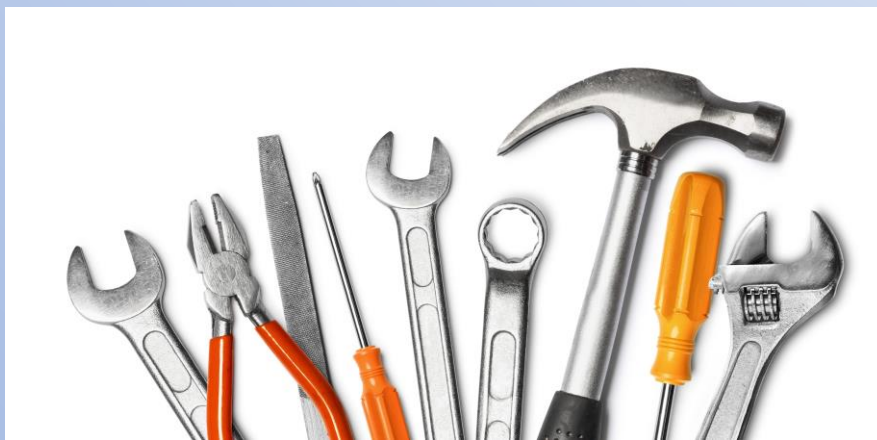
Rebate example: *California Self-Generation Incentive Program*



# Utility Mandates/Procurement Targets and Portfolio Standards

- **Structure mandates to ensure that distributed resources receive a portion of investment dollars, and that some portion of overall investments benefit LMI communities.**
- Alternative compliance payments required from utilities unable to meet procurement targets can be used to directly support LMI solar+storage deployment.
- New technologies, such as energy storage, can be added to existing portfolio standards. California, Kansas, Ohio, and Montana accept energy storage in their RPS. Massachusetts accepts flywheel storage in its Alternative Energy Portfolio Standard and is considering broadening the definition to include batteries.

Utility mandate example: *California Energy Storage Procurement Target*





**TABLE 2: California Energy Storage Procurement Target (in MW)**

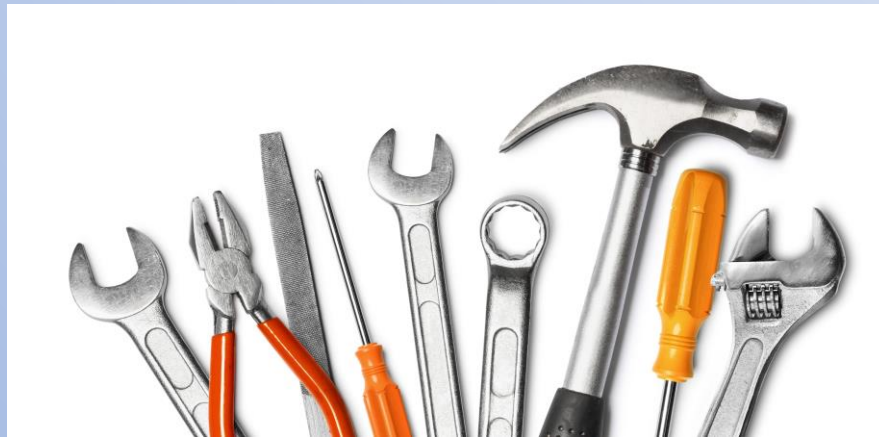
Storage Grid Domain (POINT OF INTERCONNECTION)	2014	2016	2018	2020	Total
<b>Southern California Edison</b>					
Transmission	50	65	85	110	310
Distribution	30	40	50	65	185
Customer	10	15	25	35	85
<b>Subtotal SCE</b>	<b>90</b>	<b>120</b>	<b>160</b>	<b>210</b>	<b>580</b>
<b>Pacific Gas &amp; Electric</b>					
Transmission	50	65	85	110	310
Distribution	30	40	50	65	185
Customer	10	15	25	35	85
<b>Subtotal PG&amp;E</b>	<b>90</b>	<b>120</b>	<b>160</b>	<b>210</b>	<b>580</b>
<b>San Diego Gas &amp; Electric</b>					
Transmission	10	15	22	33	80
Distribution	7	10	15	23	55
Customer	3	5	8	14	30
<b>Subtotal SDG&amp;E</b>	<b>29</b>	<b>30</b>	<b>45</b>	<b>70</b>	<b>165</b>
<b>Total (ALL THREE UTILITIES)</b>	<b>200 MW</b>	<b>270 MW</b>	<b>365 MW</b>	<b>590 MW</b>	<b>1,325 MW</b>

California's energy storage procurement mandate includes procurement targets for customer-sited systems.

# Incorporating Solar+Storage into Existing Programs

- Incorporating energy storage into existing programs underlines the importance of this new technology to achieve the goals of existing programs
- Incorporating energy storage into existing programs makes existing resources available to support new technologies. This can be particularly helpful with regard to **existing programs in the areas of energy efficiency, renewables deployment and integration, public health, and affordable housing.**
- Energy efficiency programs offer a particularly large resource.

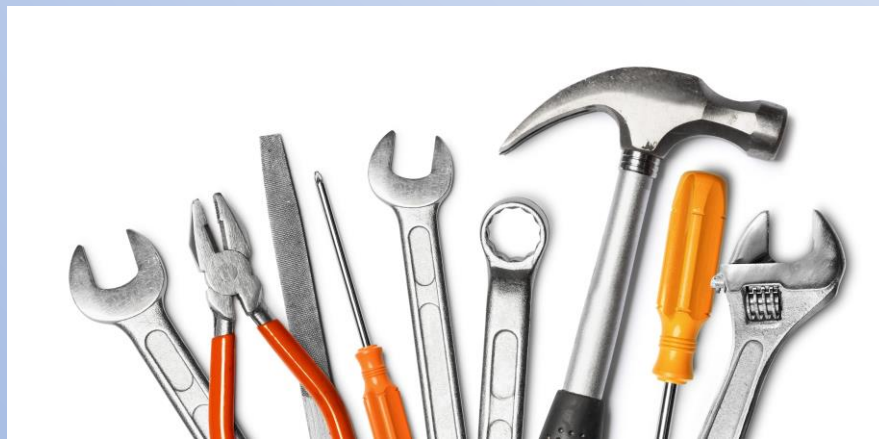
Example: *The Massachusetts Next Solar Incentive Proposal*



# Tax Incentives and Alternative Ownership Structures

Federal ITC applies to solar+storage, and states can also provide tax incentives. **But municipal agencies and nonprofits cannot directly take tax benefits. Allowing alternative ownership structures is very important when designing solar+storage supports for LMI communities.**

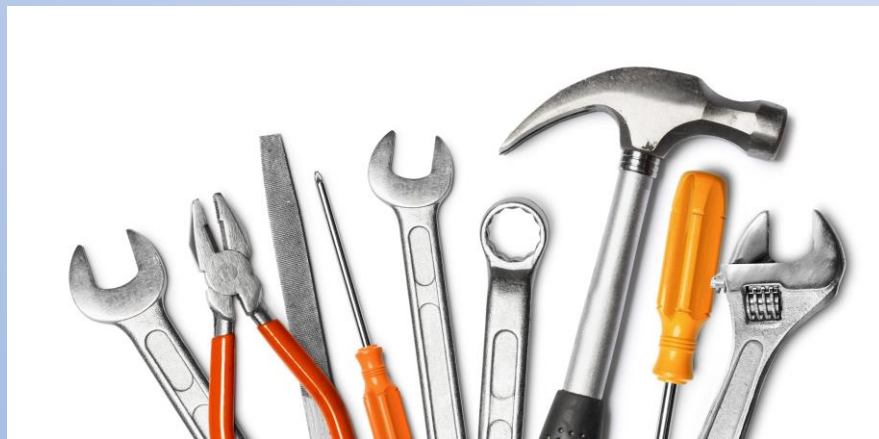
- Third-party ownership
  - Leases
  - lease-to-own
  - ownership flip structures
- community-owned projects
- Utility owned projects on the distribution grid
- virtual power plants



# Financing and Clean Energy Financial Institutions

- Bond Financing (General obligation, Morris model, 501(c)(3), housing, school construction, disaster recovery/climate resiliency, PACE)
- Clean Energy Financial Institutions (State green banks/energy resilience banks, warehouse credit facilities)
- **Alternative Ownership Structures (third-party ownership with PPA, municipal improvement districts, utility ownership)**
- Credit Enhancements (Public benefit funds, loan guaranty)

Example: *The New Jersey Energy Resilience Bank*

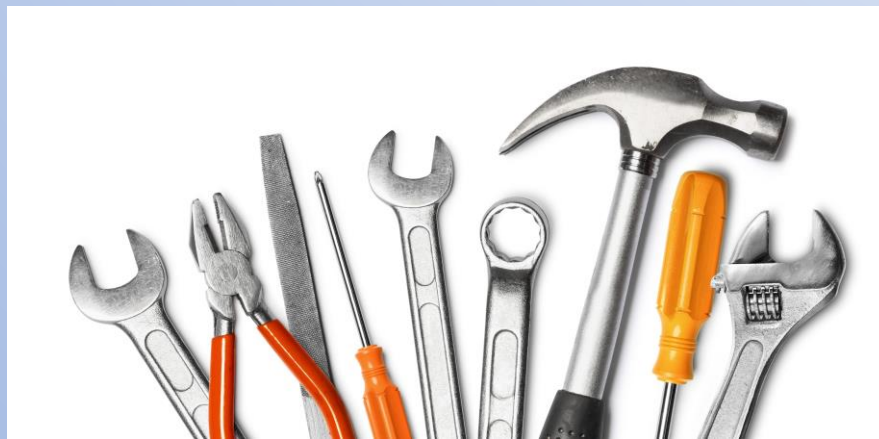




## Note: financing strategies alone are not a substitute for an integrated approach to solar+storage market development

- An integrated approach includes not only a range of financing tools, but also market building support to increase the capacity of project developers and portfolio owners; the collection and evaluation of performance data; and the good design of market rules, incentives and regulatory policies to advance solar+storage technologies in low- and moderate-income communities.

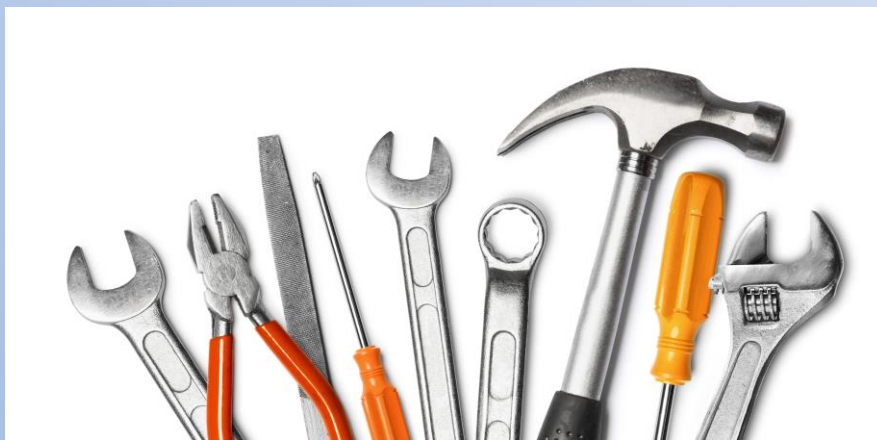
For more details, see Clean Energy Group's report, *Financing for Clean, Resilient Power Solutions*.



# Market-Based Tools and Regulatory Reform

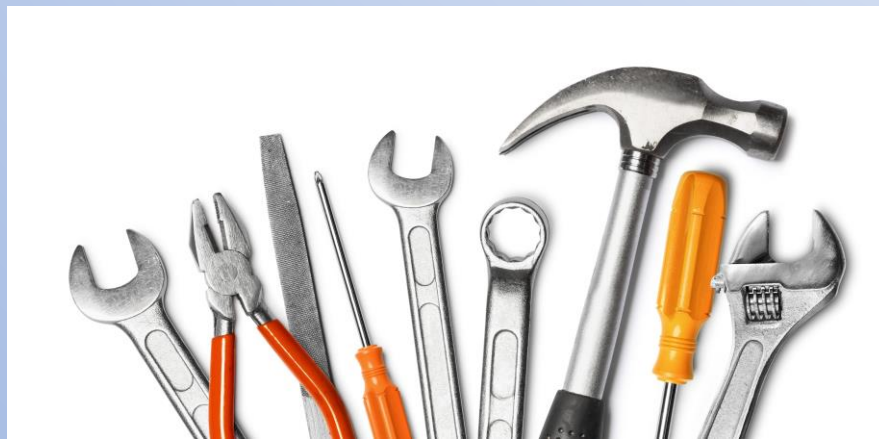
- **Enabling solar+storage to be compensated in open markets sends more accurate price signals and allows the technology to demonstrate its value.**
- Example: demand response programs, which have been supported and enabled by FERC orders.
- Solar+storage can be aggregated and bid into open markets to provide a range of services such as demand response and frequency regulation, if market rules allow this to happen.

A good discussion of energy markets, and what states can do to help energy storage access those markets, can be found in the Massachusetts *State of Charge* report.



# Technical Assistance, Tools, and Resources

- **Publicly funded technical assistance is important to ensure that projects are successful.** LMI communities in particular may not be able to afford out-of-pocket costs for technical consultants.
- For grant programs, technical assistance should be provided for both pre-application feasibility studies and post-award implementation support (development and procurement).
- States should invest in the development of tools and resources, such as online project scoping and economic analysis tools, procurement guidelines, etc.
- States should work with NGOs in the areas of housing and energy to educate them about solar+storage technologies and applications.



# Conclusions

- Solar+storage offers many benefits to society's most vulnerable communities, including energy cost savings, resiliency, and guarding against the devaluation of solar.
- Storage markets are underdeveloped, and many valuable services are not yet monetizable; but state policies and programs can help.
- In some markets, solar+storage systems can pay for themselves, and in many cases can be a sound investment.
- Until markets support the full monetization of all the benefits solar+storage can provide, and until standard third-party financing is widely available, public support will be important.
- There is no silver bullet. A policy suite incorporating a variety of approaches—grants or rebates, utility procurement standards, financing support, opening markets, soft cost reductions—is needed.



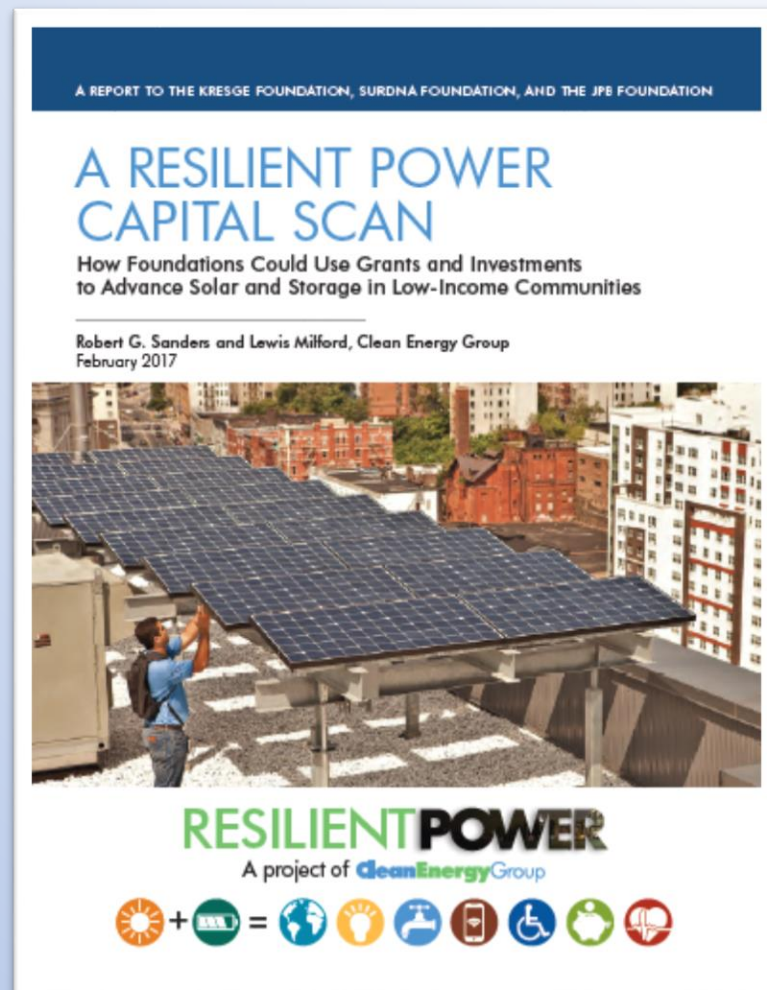
# Conclusions (continued)

- Incorporating storage into existing incentive programs that support solar deployment, such as SREC programs, solar incentives, energy efficiency subsidies and procurement mandates, can be a fast and effective way to provide support for solar+storage; adders can direct additional support toward LMI projects.
- Energy efficiency programs, in particular, can represent a significant untapped resource
- Technical assistance is important to ensure projects will be successful.

**Solar+storage enables numerous social goals, including emissions reductions, renewable generation, resiliency, energy efficiency, economic development and improved public health. To date, however, it has rarely been incorporated into the numerous public policies addressing these issues, nor has its value been fully understood by many NGOs working in these areas. The incorporation of solar+storage into public policy and programs addressing these goals will help in providing access to LMI communities.**

# A Resilient Power Capital Scan: How Foundations Could Use Grants and Investments to Advance Solar and Storage in Low-Income Communities

- CEG report published 2017
- Intended to help foundations direct their philanthropic efforts
- Identifies five market barriers to the deployment of solar+storage technologies in low-income communities
- Proposes more than 50 investment interventions that could address these five primary barriers
- Many of these interventions could be adopted by states and municipalities, and/or by NGOs partners



# Thank You

Todd Olinsky-Paul

Project Director

CEG/CESA

[Todd@cleanegroup.org](mailto:Todd@cleanegroup.org)

ESTAP Website: <http://bit.ly/CESA-ESTAP>

ESTAP Listserv: <http://bit.ly/EnergyStorageList>



# Contact Information

## SUSTAINABLE SOLAR EDUCATION PROJECT

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Visit our website to learn more about the Sustainable Solar Education Project  
and to sign up for our e-newsletter:

[www.cesa.org/projects/sustainable-solar](http://www.cesa.org/projects/sustainable-solar)

Find us online: [www.cesa.org](http://www.cesa.org)

[facebook.com/cleanenergystates](https://facebook.com/cleanenergystates)

@CESA\_news on Twitter





# Upcoming Webinars

## **Solar+Storage Industry Perspectives: JLM Energy**

Wednesday, March 22, 2-3pm ET

## **Low-Income Solar, Part 1: Lessons Learned from Low-Income Energy Efficiency Programs**

Thursday, March 23, 1-2pm ET

## **Low-Income Solar, Part 2: Using the Tools of Low-Income Energy Efficiency Financing**

Thursday, March 30, 1-2pm ET

## **Tools for Building More Resilient Communities with Solar+Storage**

Thursday, April 6, 1-2pm ET

[www.cesa.org/webinars](http://www.cesa.org/webinars)

