Solar+Storage in Boston
An Economic Analysis

NESEA Building Energy Conference
Boston, MA
March 2017

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

CleanEnergyGroup
Innovation in Finance, Technology & Policy

CleanEnergy
States Alliance

Thank You to:

Barr Foundation

US DOE Office of Electricity

Sandia National Laboratories

Agenda for this presentation:

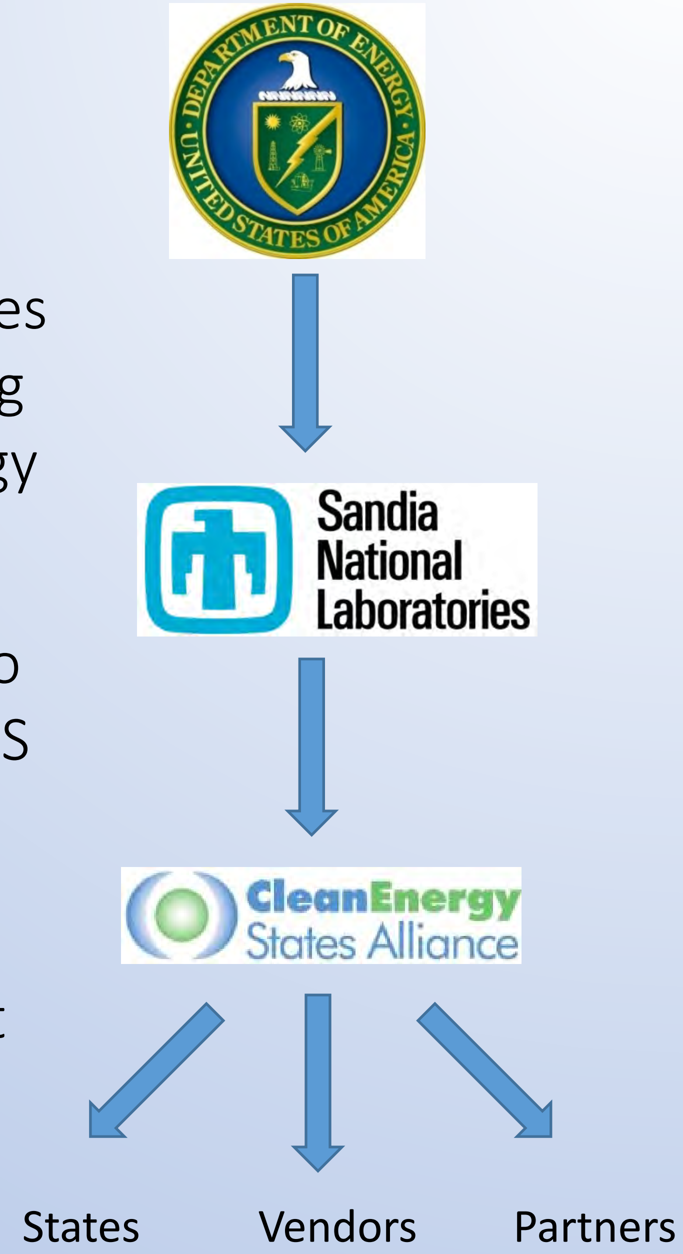
- Introduction to CEG/CESA
- Introduction to ESTAP and Resilient Power Project
- Demand charge management for C/I customers
- Economics of solar+storage in a multifamily, affordable housing facility in Boston
- Upcoming policy and program expansions in MA

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



ESTAP Project Locations

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

CleanEnergy States Alliance

Sandia National Laboratories

U.S. DEPARTMENT OF ENERGY

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 for reports, newsletters, webinar recordings

www.cleanegroup.org

www.resilient-power.org

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CleanEnergy States Alliance

Meridian Institute
Connecting People to Solve Problems

Cummings Foundation

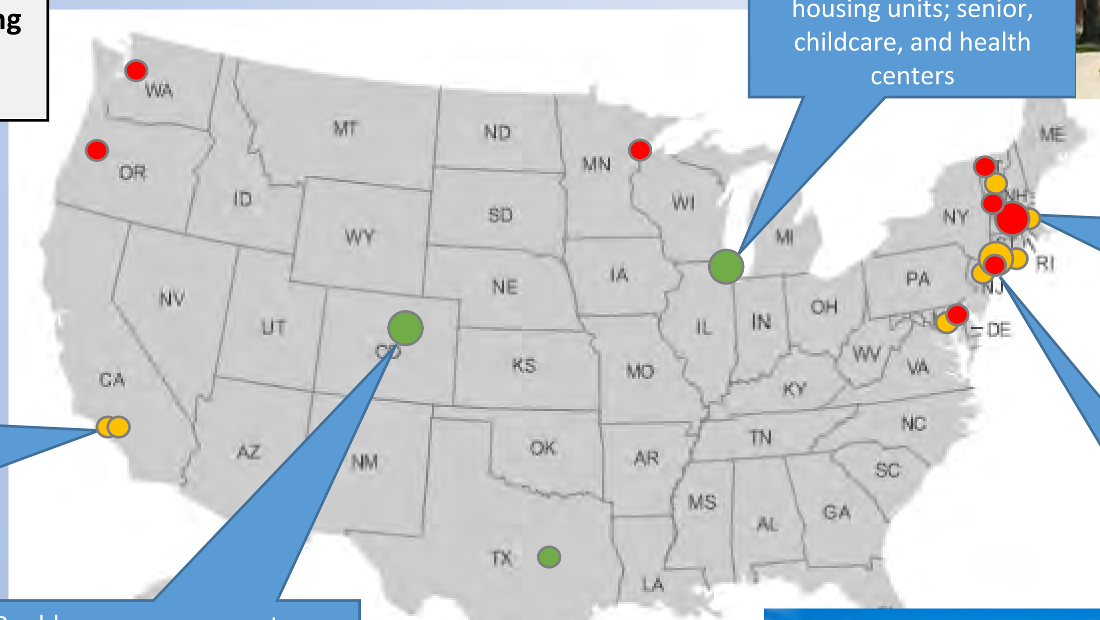
Barr Foundation

THE KRESGE FOUNDATION

SURDNA FOUNDATION
Fostering sustainable communities in the United States

CEG Resilient Power Project: Supporting More than 50 Projects

- Affordable Housing
- Critical Facilities
- Both



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

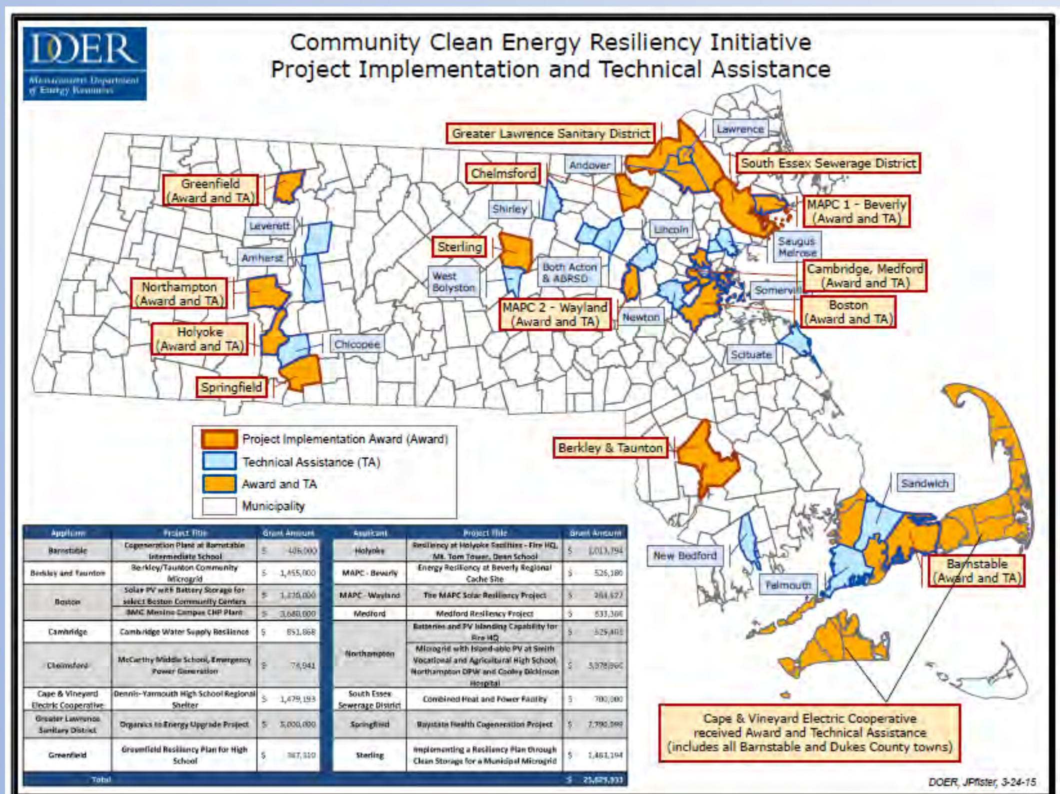
Massachusetts Community Clean Energy Resiliency Initiative:
11 communities, 28 projects

California Multifamily Affordable Housing:
AB 693 150,000 units

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

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

Sterling, Massachusetts Utility Energy Storage Project



Applicant	Project Title	Grant Amount
Barnstable	Cogeneration Plant at Barnstable Intermediate School	$ 406,000
Berkley and Taunton	Berkley/Taunton Community Microgrid	$ 1,455,000
Boston	Solar PV with Battery Storage for select Boston Community Centers	$ [illegible]
	BMC Menino Campus CHP Plant	$ 3,680,000
Cambridge	Cambridge Water Supply Resilience	$ 851,868
Chelmsford	McCarthy Middle School, Emergency Power Generation	$ 74,941
Cape & Vineyard Electric Cooperative	Dennis-Yarmouth High School Regional Shelter	$ 1,479,193
Greater Lawrence Sanitary District	Organics to Energy Upgrade Project	$ 5,000,000
Greenfield	Greenfield Resiliency Plan for High School	$ 387,310
Holyoke	Resiliency at Holyoke Facilities - Fire HQ, Mt. Tom Tower, Dean School	$ 1,013,794
MAPC - Beverly	Energy Resiliency at Beverly Regional Cache Site	$ 526,180
MAPC - Wayland	The MAPC Solar Resiliency Project	$ [illegible]
Medford	Medford Resiliency Project	$ 633,306
Northampton	Batteries and PV Islanding Capability for Fire HQ	$ 525,403
	Microgrid with Island-able PV at Smith Vocational and Agricultural High School, Northampton DPW and Cooley Dickinson Hospital	$ 3,978,966
South Essex Sewerage District	Combined Heat and Power Facility	$ 700,000
Springfield	Baystate Health Cogeneration Project	$ 7,790,099
Sterling	Implementing a Resiliency Plan through Clean Storage for a Municipal Microgrid	$ 1,463,194
Total		$ [illegible]

U.S. DEPARTMENT OF ENERGY
NNSA National Nuclear Security Administration
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Summary of Monetizable Benefits – Sterling, MA

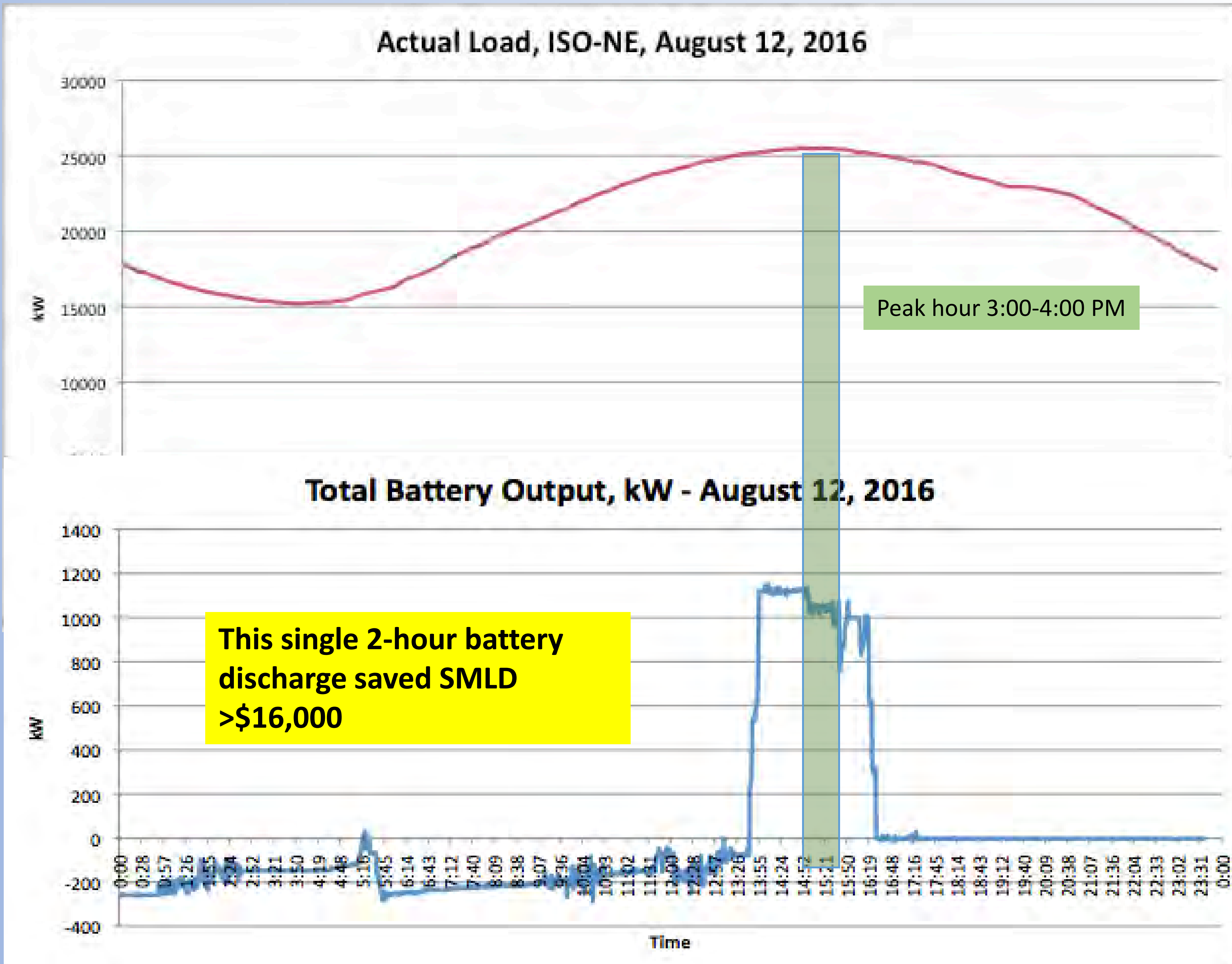
PRELIMINARY RESULTS

Total potential revenue, 1MW, 1MWh system:

Description	Total	Percent
Arbitrage (transmission)	$40,738	16.0%
RNS payment (capacity)	$98,707	38.7%
FCM obligation*	$115,572	45.3%
Total	$255,017	100%

For a capital cost of ~1.7M, the simple payback is 6.67 years *without subsidy*

*2017-2018 data. Rates will be higher in 2018-2019, resulting in additional savings.


Actual Load, ISO-NE, August 12, 2016
30000
25000
20000
15000
10000
kW
Peak hour 3:00-4:00 PM
Total Battery Output, kW - August 12, 2016
1400
1200
1000
800
600
400
200
0
-200
-400
kW
This single 2-hour battery discharge saved SMLD >$16,000
Time

History of CEG and Resilient Power

THE NEW YORK TIMES **OP-ED** TUESDAY, JULY 13, 1999

The Lesson Hidden In the Blackout

By Lewis Milford

MONTPELIER, Vt.

Cancer and AIDS researchers at Columbia University are trying to figure out what crucial material they may have lost when some of their backup generators didn't work during last week's power blackout.

This sad state of affairs should prompt the rest of us to confront a simple truth: our 19th-century electricity system is not suited for 21st-century needs. If we are to prevent similar critical failures in the future, we must look now for smarter energy solutions.

Some companies already have a head start. The First National Bank of Omaha has stopped using electricity from the grid — the interconnected system from which almost everyone gets electricity — as its primary power source. It is now producing its own energy and is using the grid only as a backup. First National, the largest privately held bank in the country, runs the seventh-largest credit card processing operation. The bank needs to be able to crunch large amounts of data 24 hours a day, seven days a week.

That's why the bank has purchased its own system of four fuel cells, which, like batteries, create energy through a chemical process instead of by burning fossil fuels. They are so clean that they are exempt from most air pollution rules.

The bankers aren't doing this because they are environmental activists. The real value of the fuel cell system is that it's nearly 100 percent reliable.

The bank competes with other companies for credit card business. The more time its computers can keep running, the more credit card transactions it can process — and the more business it can attract. Fuel cells can run almost all the time without interruption, allowing computers to operate constantly without crippling breakdowns.

According to industry statistics, a typical bank of corporate computers experiences nearly 300 power interruptions of one kind or another each year. American businesses lose an estimated $26 billion a year from these failures. And in cases like the damage to the research materials at Columbia, there is no way to put a price on potential losses to science and public health.

These problems will only get worse. The growing number of desktop computers and data centers running the Internet will increase the demand for high-quality power sources. As a result, computer-grade energy may soon add up to nearly 10 percent of demand for electricity, a figure that will only increase with greater Internet activity.

Most companies spend billions on back-up power systems, batteries o[r] diesel generators to keep their com[-] puters running smoothly. These sy[s-] tems are necessary because the r[eg-] ular power system can be quite [un-] reliable. But such stopgap meas[ures] can't supply the guaranteed p[ower] that computers or other sen[sitive] electric loads need. The New [York] power blackout proved that. C[olum-] bia University's emergency [back-up] generators weren't adequate

First National Bank of [Omaha] isn't the only company tha[t ...] turn to fuel-cell technology. [...] post offices, telecomm[...] businesses, computer chi[p ...] turers — virtually any c[...] critical city service that [...] able electric service c[...] from using fuel cells.

Just last week, befor[e ...] bia lab shutdown, Har[vard ...]

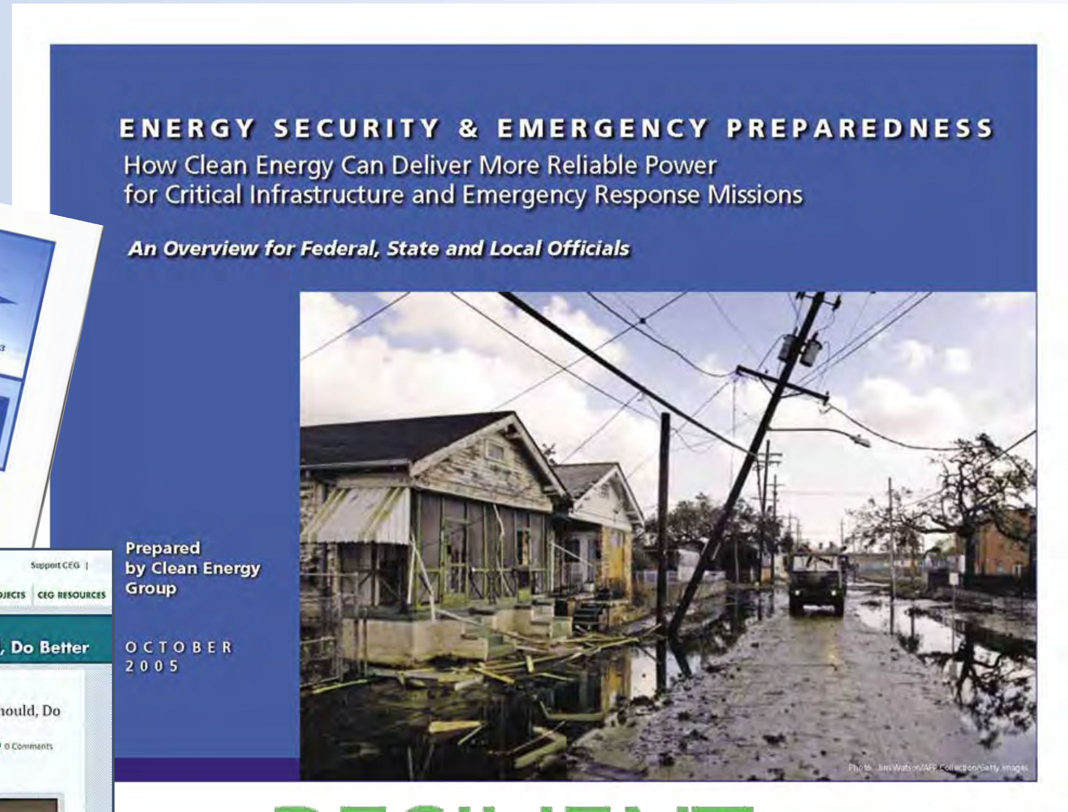
Time to r[...] our out[...] power

School began a compre[...] vestigation to see if fuel cells coul[d] power its teaching and laborator[y] sites. The Pew Charitable Trusts ha[s] given my organization a grant [to] help Harvard create a model for th[e] entire health care industry.

But the Harvard initiative cove[rs] only health care. We need to broade[n] the use of fuel cells in every industr[y] that needs computer-grade powe[r.] This would start to replace our ou[t-] moded electric system, and woul[d] also reduce energy-related pollutio[n,] including greenhouse gases. Fu[el] cells are one of the cleanest energ[y] technologies available.

If money or political will or som[e] other excuse is standing in the way [of] this effort, ask yourself this questio[n:] What's the price of losing a cure f[or] cancer because an outmoded dies[el] generator failed to work?

Lewis Milford is president of Clean Energy Group, a nonprofit group.

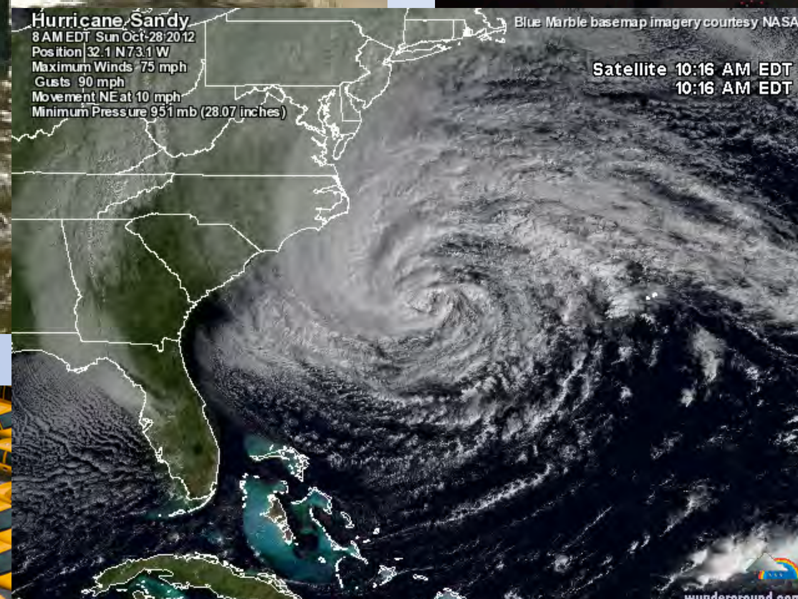


RESILIENT POWER

A Project of Clean Energy Group


86
Street


Hurricane Sandy
October 29, 2012
$37 Billion in damages


Hurricane Sandy
8 AM EDT Sun Oct 28 2012
Position 32.1 N 73.1 W
Maximum Winds 75 mph
Gusts 90 mph
Movement NE at 10 mph
Minimum Pressure 951 mb (28.07 inches)
Blue Marble basemap imagery courtesy NASA
Satellite 10:16 AM EDT
10:16 AM EDT
wunderground.com

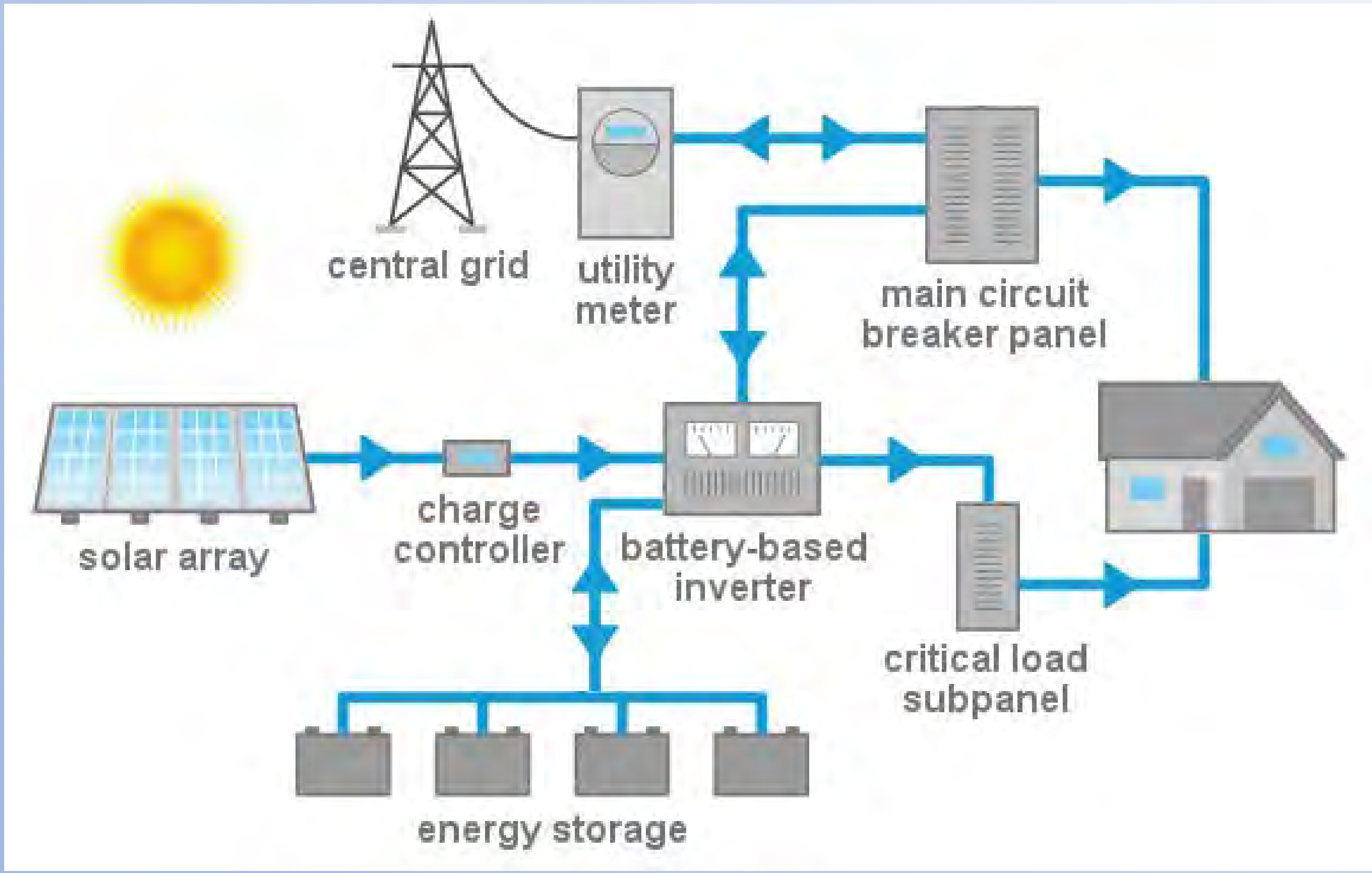
Northeastern States
Resilient Power Initiatives

Following Superstorm Sandy, the Northeastern states came to CEG/CESA seeking help in developing resilient power solutions.

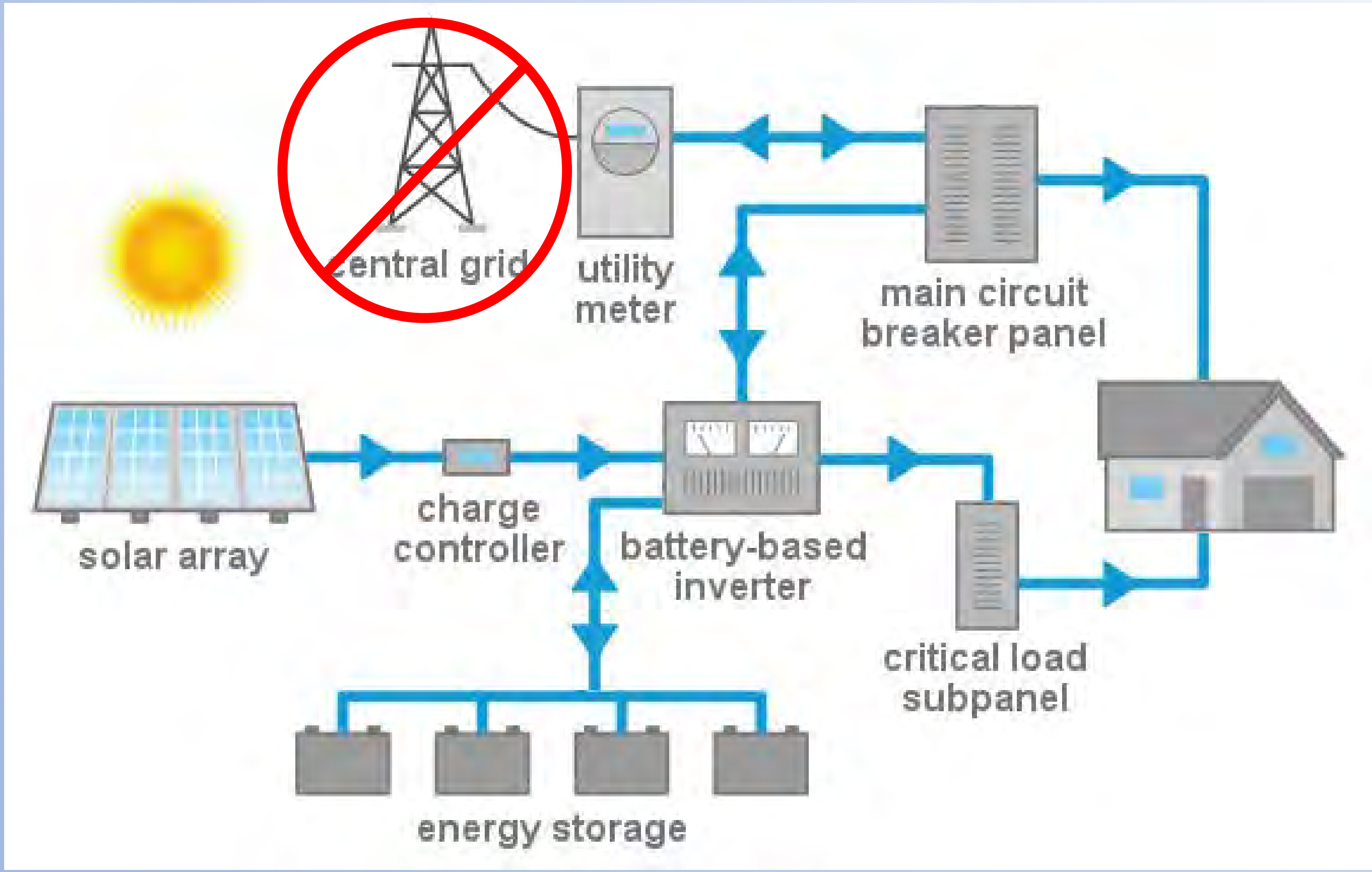
CEG/CESA role:

- Assist states in policy and RFP development
- Provide information to project developers
- Technical assistance to support qualifying projects
- Monitor and evaluate project performance
- Economic analysis
- Publications and webinars

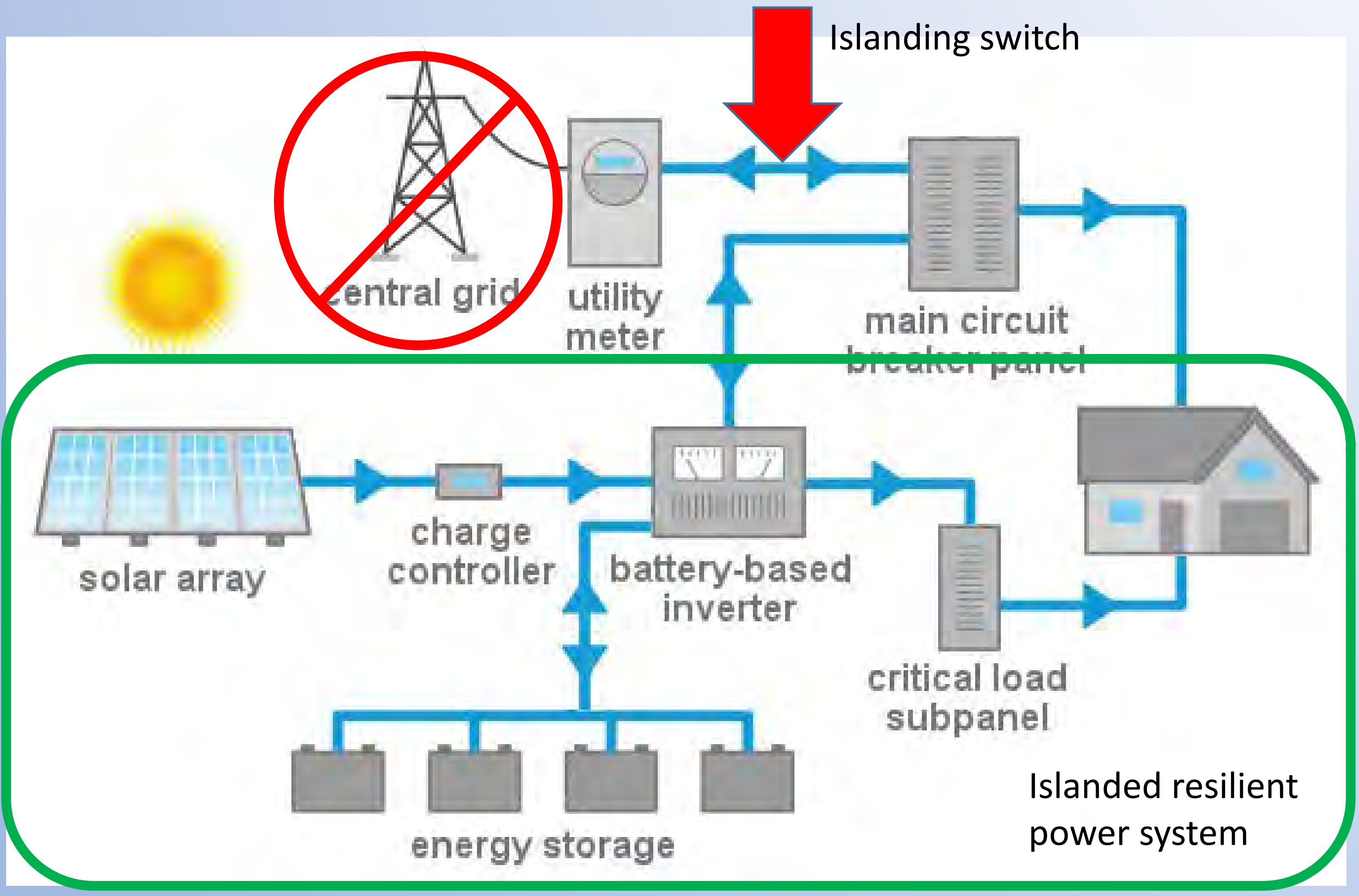
Solar+Storage: The Resilient Power Solution



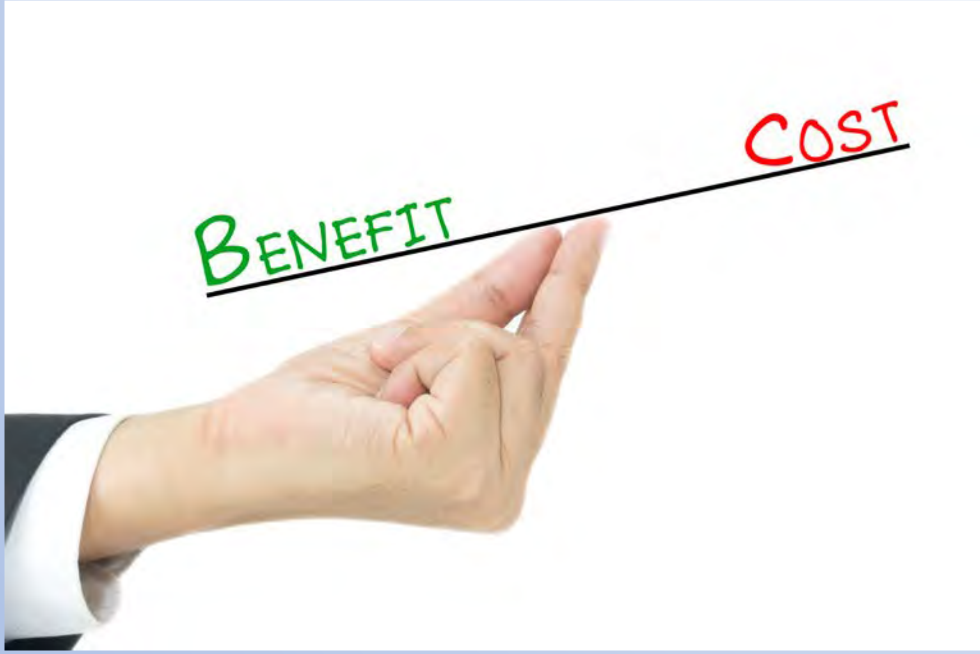
Solar+Storage: The Resilient Power Solution



Solar+Storage: The Resilient Power Solution



Energy Storage Business Case



The business case for 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: Storage for resiliency and 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).

49%

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
TOTAL		**144,932**		**$12,623.43**

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
TOTAL				**$11,951.30**

FIXED

	Total cost ($)
Meter charge	1,397.28
TOTAL	**$1,397.28**

TOTAL ANNUAL BILL $25,972.01

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.

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 benefit programs such as energy efficiency and renewable energy programs. For simplicity, only fixed charges related to billing and metering are considered in this analysis.

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

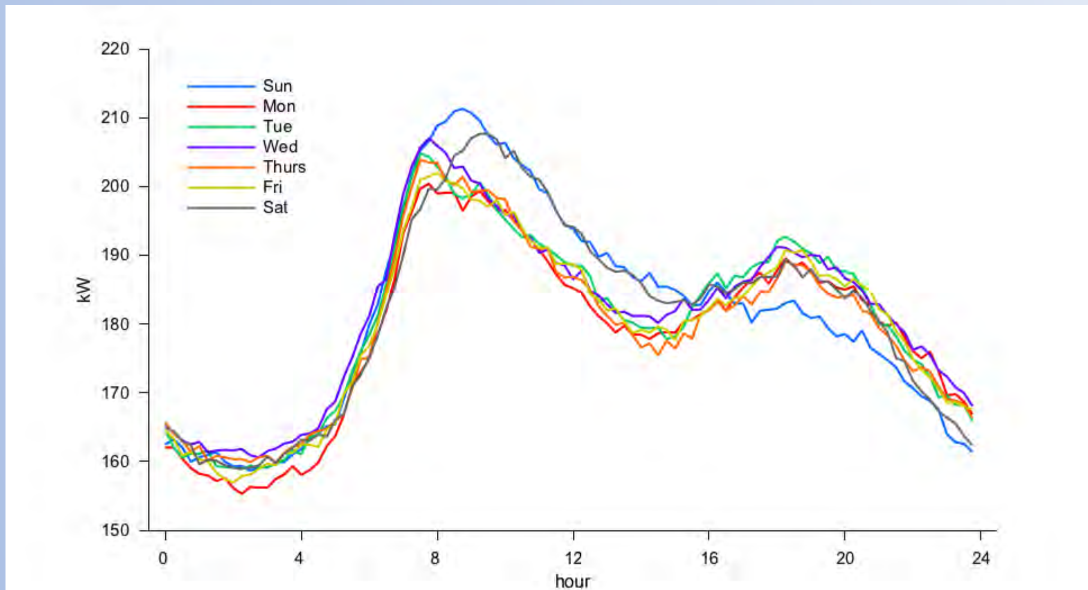
New York City Project Summary		
System Size	30-kW solar-only	30-kW solar + 30-kW/ 60-kWh lead-acid battery
Initial Cost	$58,000	$128,000
Payback Period	4.3 years	14.2 years

Economic Case Study:
Edwards D. Hassan Apartments, Hyde Park

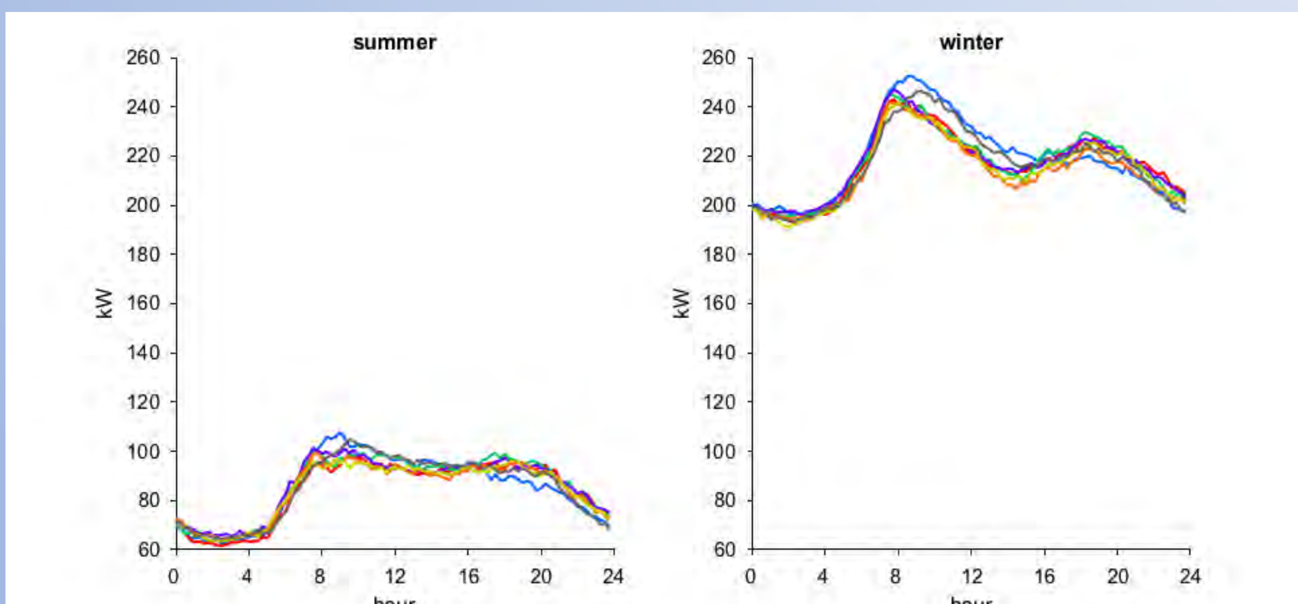
Analysis by Geli

- Boston Housing Authority affordable senior housing facility
- 100 apartments
- **Electric heating**
- Common areas include kitchen, four laundry facilities, common room, 2 elevators
- ~60 kVA diesel generator for backup power

Baseline Facility Load



Average daily load profile



Seasonal load profile

Electric heat = high winter peak loads

Baseline Utility Bill

Analysis is on common loads only – not individual apartment loads

Baseline utility bill

ENERGY				baseline (T2)
		Usage, kWh	Cost, $/kWh	Total Cost, $
Peak	Summer	72,196	$0.0925	$6,678
	Winter	489,413	$0.0925	$45,271
Part-peak	Summer	-	$0.0000	$0
	Winter	-	$0.0000	$0
Off-peak	Summer	176,967	$0.0925	$16,369
	Winter	773,548	$0.0925	$71,553
TOTAL, /yr		1,512,124		**$139,871**

Energy

DEMAND				
		Avg Peak, kW	Cost, $/kW	Total Cost, $
Max	Summer	153	$29.80	$18,221
	Winter	352	$21.35	$60,096
Peak	Summer	0	$0.00	$0
	Winter	0	$0.00	$0
Part-Peak	Summer	0	$0.00	$0
	Winter	0	$0.00	$0
TOTAL, /yr				**$78,317**
Meter Charge, $/yr				**$2,000**
TOTAL, $/yr				**$220,188**

Demand

Solar+storage system modeled:

Solar (DC): 150 kW (cost: $375,000)

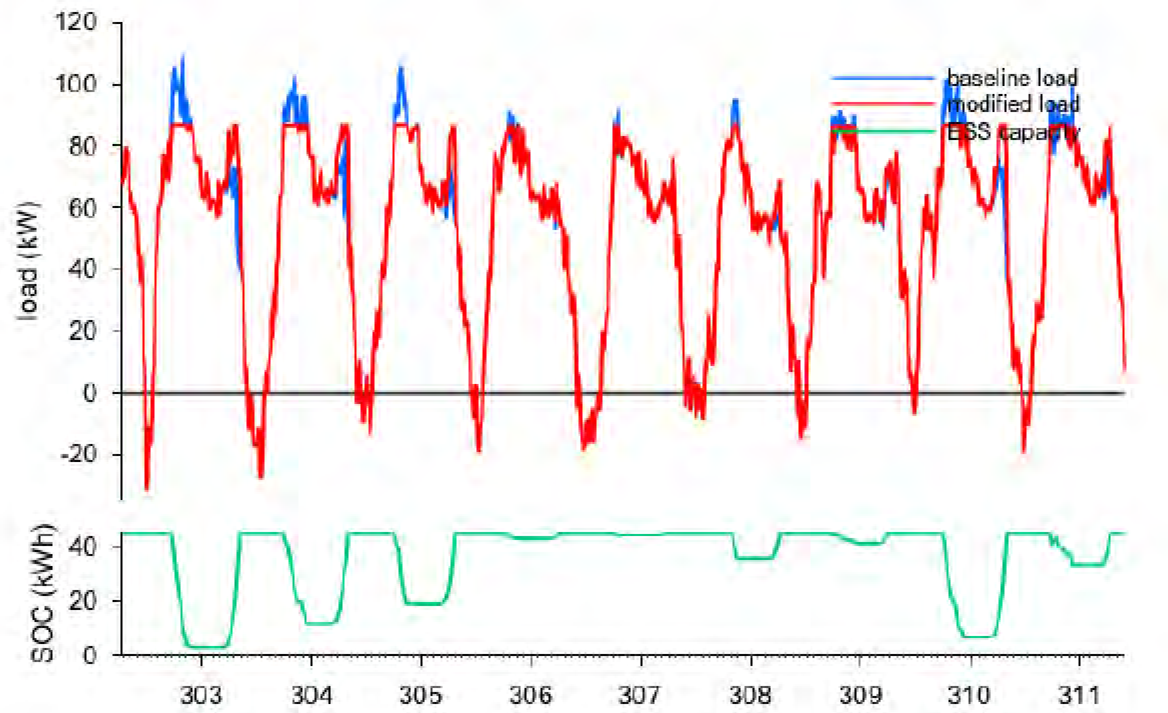
Storage: 30 kW / 45 kWh lithium ion battery (cost: $88,604)

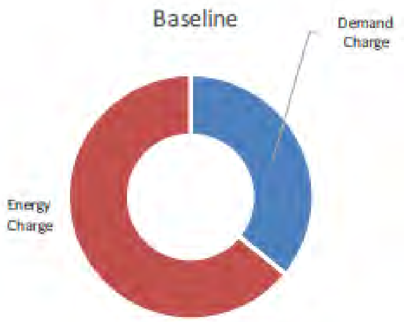
Total capital cost: $463,604

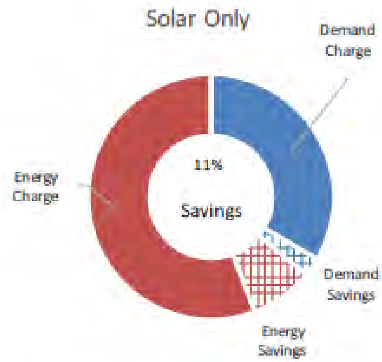
Energy storage manages demand charges by shaving peak loads

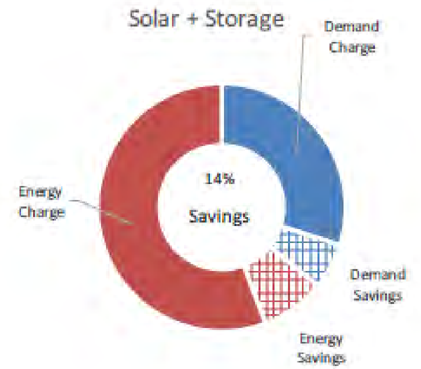
FIGURE 10 *DCM with a 30 kW, 45 kWh ESS*

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









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
Energy Savings	$	18,204
Demand Savings	$	5,374
Tariff Switch	$	-
PV (unfirmed)	$	5,374
Fixed Charge	$	-
Solar, kW DC		150
Solar capital cost ($2.5/W)	$	375,000
Net Remaining, year 1	$	174,043
Energy savings	$	18,204
Solar Rebate, y1	$	-
Tax Credit	$	112,500
Tax Savings, y1	$	70,253
Solar Payback ($2.5/W), yr		5.7
NPV (20 yr, @ 6%)	$	177,183
IRR (20 yr)		14.48%

Solar + Storage		
Total Charge	$	188,965
Energy Charge	$	121,667
Demand Charge	$	65,298
Fixed Charge	$	2,000
Total Savings	$	31,223
Energy Savings	$	18,204
Demand Savings	$	13,019
Fixed Charge	$	-
Solar, kW DC		150
Solar capital cost ($2.5/W)	$	375,000
Max power (kW)		30
Capacity (kWh)		45
Total capital cost	$	463,604
Solar capital cost ($2.5/W)	$	375,000
ESS capital cost	$	88,604
Net Remaining, year 1	$	206,448
Energy savings	$	18,204
Demand savings	$	13,019
Solar rebate	$	-
Solar tax credit	$	112,500
Solar tax savings	$	70,253
SGIP, y1	$	-
ESS Tax Credit	$	26,581
ESS Tax Savings, y1	$	16,599
Project Payback, yr		5.3
NPV (15 yr, @ 6%)	$	169,977
IRR (15 yr)		14.28%
NPV (20 yr, @ 6%)	$	235,807
IRR (20 yr)		15.33%

Solar payback: 5.7 years

Solar+Storage payback: 5.3 years

Payback Comparison

What the analysis includes:

- Federal ITC applies to solar+storage installed costs
- Federal accelerated depreciation
  (Federal ITC scheduled to phase out)

What it doesn't include:

- State solar incentives
- State solar incentive adders for low income projects, energy storage, roof mounted solar
- Alternative Energy Certificates
- Potential energy efficiency incentives

From DOER SMART Solar Incentive Program Proposal

(Expected to take effect in January, 2018)

Project Categories

- Incentive values primarily based on project size:
  - ➢ Rates set based on index following initial procurement
    - Less than 25 kW AC (Low Income)
    - Less than 25 kW AC
    - 25 – 250 kW AC
    - 250 – 500 kW AC
    - 500 kW AC – 1,000 kW AC
  - ➢ Competitively Set Rates for Block 1, with fixed percentage declines thereafter
    - 1,000 – 2,000 kW AC
    - 2,000 – 5,000 kW AC
- Adders for different project types:
  - ➢ Location Based:
    - Brownfields
    - Building Mounted
    - Landfills
    - Solar Canopies
  - ➢ Off-taker Based:
    - Community Shared Solar (CSS)
    - Low Income CSS
    - Low Income Property
    - Public
  - ➢ Solar + Storage
- Unlike SREC II, adders can be combined together from different categories to encourage optimal siting of projects and further policy goals
- All capacity based rates and adders will decrease by 4% per block

Creating A Clean, Affordable, and Resilient Energy Future For the Commonwealth

DOER
Massachusetts Department of Energy Resources

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    - 25 – 250 kW AC
    - 250 – 500 kW AC
    - 500 kW AC – 1,000 kW AC
  - Competitively Set Rates for Block 1, with fixed percentage declines thereafter
    - 1,000 – 2,000 kW AC
    - 2,000 – 5,000 kW AC
- Adders for different project types:
  - Location Based:
    - Brownfields
    - Building Mounted
    - Landfills
    - Solar Canopies
  - Off-taker Based:
    - Community Shared Solar (CSS)
    - Low Income CSS
    - Low Income Property
    - Public
  - Solar + Storage
- Unlike SREC II, adders can be combined together from different categories to encourage optimal siting of projects and further policy goals
- All capacity based rates and adders will decrease by 4% per block

Creating A Clean, Affordable, and Resilient Energy Future For the Commonwealth

DOER
Massachusetts Department of Energy Resources

From DOER SMART Solar Incentive Program Proposal

(Expected to take effect in January, 2018)

Adder Values

All adder values will decline by 4% per capacity block

Location Based Adders	
Type	**Adder Value ($/kWh)**
Building Mounted	$0.02
Brownfield	$0.03
Landfill	$0.04
Solar Canopy	$0.06

Off-taker Based Adders	
Type	**Adder Value ($/kWh)**
Public Entity	$0.02
Community Shared Solar (CSS)	$0.05
Low Income Property Owner	$0.03
Low Income CSS[1]	$0.06

Solar + Energy Storage	
Type	**Adder Value ($/kWh)**
Storage + PV	Variable

1. Must be at least 50% R-2 customers

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Energy Storage Adder Matrix

	Storage Hours @ Rated Capacity								
	Minimum								Maximum
Storage kW as % of Solar	2	2.5	3	3.5	4	4.5	5	5.5	6
25%	$0.0247	$0.0271	$0.0291	$0.0307	$0.0321	$0.0334	$0.0345	$0.0356	$0.0365
30%	$0.0321	$0.0352	$0.0377	$0.0399	$0.0418	$0.0434	$0.0449	$0.0462	$0.0474
35%	$0.0382	$0.0419	$0.0450	$0.0476	$0.0498	$0.0517	$0.0535	$0.0551	$0.0565
40%	$0.0428	$0.0470	$0.0504	$0.0533	$0.0558	$0.0579	$0.0599	$0.0617	$0.0633
45%	$0.0460	$0.0504	$0.0541	$0.0572	$0.0599	$0.0622	$0.0643	$0.0663	$0.0680
50%	$0.0481	$0.0527	$0.0565	$0.0598	$0.0626	$0.0650	$0.0673	$0.0692	$0.0711
55%	$0.0494	$0.0542	$0.0581	$0.0614	$0.0643	$0.0668	$0.0691	$0.0712	$0.0730
60%	$0.0502	$0.0551	$0.0591	$0.0625	$0.0654	$0.0680	$0.0703	$0.0724	$0.0743
65%	$0.0507	$0.0557	$0.0597	$0.0631	$0.0661	$0.0687	$0.0710	$0.0731	$0.0750
70%	$0.0511	$0.0560	$0.0601	$0.0635	$0.0665	$0.0691	$0.0715	$0.0736	$0.0755
75%	$0.0513	$0.0562	$0.0603	$0.0638	$0.0667	$0.0694	$0.0717	$0.0739	$0.0758
80%	$0.0514	$0.0564	$0.0605	$0.0639	$0.0669	$0.0696	$0.0719	$0.0740	$0.0760
85%	$0.0515	$0.0565	$0.0606	$0.0640	$0.0670	$0.0697	$0.0720	$0.0742	$0.0761
90%	$0.0515	$0.0565	$0.0606	$0.0641	$0.0671	$0.0697	$0.0721	$0.0742	$0.0762
95%	$0.0515	$0.0566	$0.0607	$0.0641	$0.0671	$0.0698	$0.0721	$0.0743	$0.0762
100%	$0.0516	$0.0566	$0.0607	$0.0641	$0.0671	$0.0698	$0.0722	$0.0743	$0.0763

Reflects value for year 1 projects based on size & duration

Massachusetts Energy Diversity Act of 2016

SECTION 15. (a) On or before December 31, 2016, the department of energy resources shall determine whether to set appropriate targets for electric companies to procure viable and cost-effective energy storage systems to be achieved by January 1, 2020. As part of this decision, **the department may consider a variety of policies to encourage the cost-effective deployment of energy storage systems, including** the refinement of existing procurement methods to properly value energy storage systems, the use of alternative compliance payments to develop pilot programs and **the use of energy efficiency funds** under section 19 of chapter 25 of the General Laws **if the department determines that the energy storage system installed at a customer's premises provides sustainable peak load reductions on either the electric or gas distribution systems** and is otherwise consistent with section 11G of chapter 25A of the General Laws.

From “State of Charge” report recommendations:

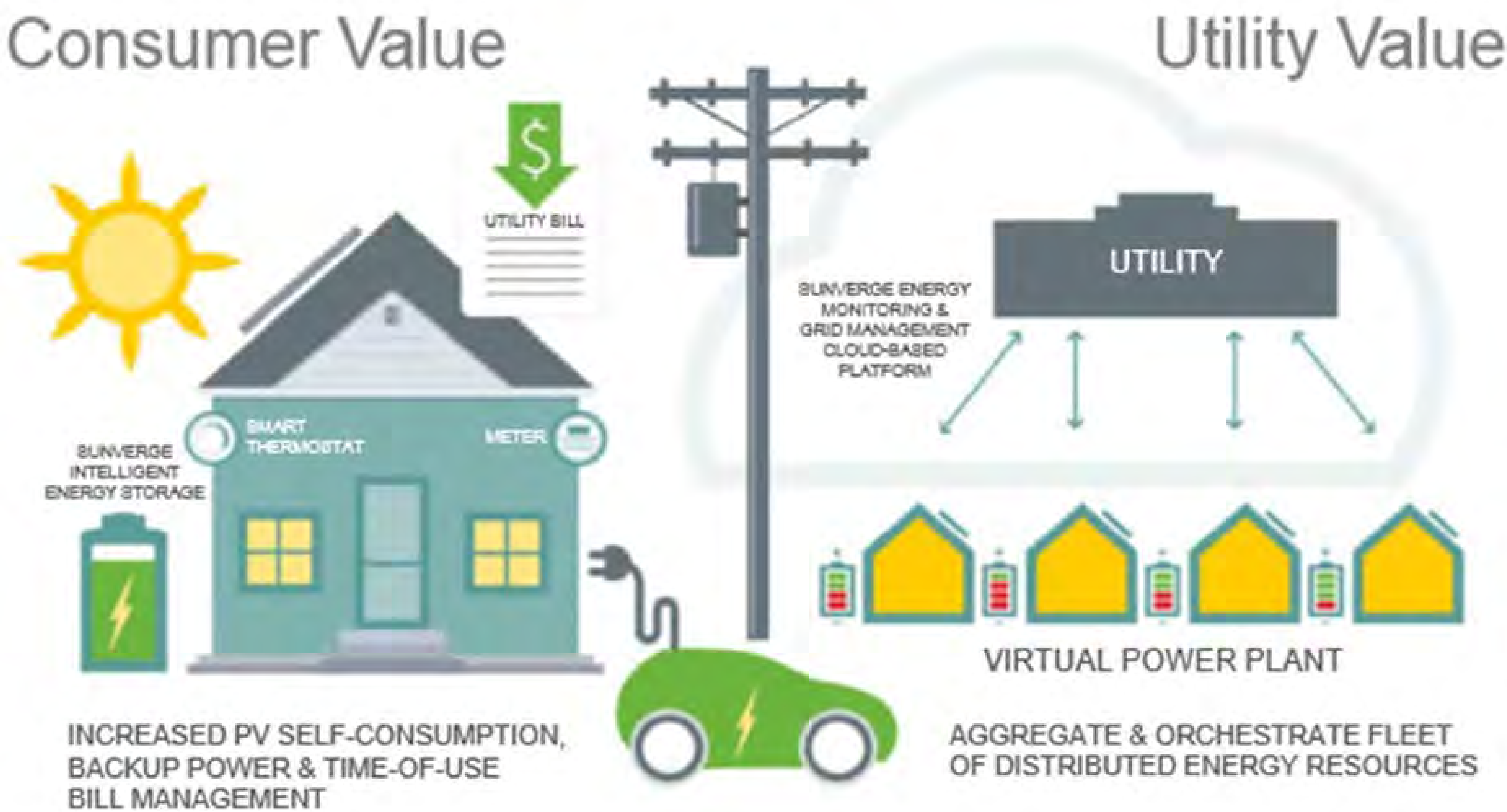
Storage as Peak Demand Savings Tool in Energy Efficiency Investment Plans

Massachusetts state law, M.G.L. c.25, §21, the Green Communities Act (the “Act”), requires that investor-owned utilities and approved municipal aggregators (“Program Administrators”) seek “…all available energy efficiency and demand reduction resources that are cost effective or less expensive than supply.” **In 2016-2018 the Statewide Three Year Energy Efficiency Plans have a new focus on Peak Demand Savings**, including demonstrations and assessment of current incentives and cost-effectiveness framework. **Energy storage, used to shift and manage load as part of peak demand reduction programs, can be deployed through this existing process but may require changes in the current DPU Guidelines’ benefit-cost test methodology to accommodate storage in these demand reduction programs.**

Energy Efficiency = big potential $ for storage

- Massachusetts Energy Efficiency three year plan budgets for 2016-2018: **$2.5 billion**
- Utilities are supposed to be doing storage demonstration projects now to inform 2019-2021 EE plans
- EEAC needs to be convinced that solar+storage behind the meter can provide cost-effective efficiency benefits
- EEAC does not generally deal with demand management
- DOER and DPU will have to collaborate effectively to get storage into next 3-year EE plan
- Opportunities for stakeholder engagement with EEAC

The Coupling of Consumer and Utility Value via VPPs



(Source: Sunverge Energy, Inc.)

Thank You

Todd Olinsky-Paul

Project Director

CEG/CESA

Todd@cleanegroup.org

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

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

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