Energy Storage Landscape in New England: Policies, Programs & Activities

Commission To Study the Economic, Environmental and Energy Benefits of Energy Storage to the Maine Electricity Industry

10/22/19

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

What is Clean Energy Group?

THE KRESGE FOUNDATION

Meridian Institute
Connecting People to Solve Problems

CleanEnergy States Alliance

SURDNA FOUNDATION
Fostering sustainable communities in the United States

THE NATHAN CUMMINGS FOUNDATION

THE JPB FOUNDATION

CleanEnergyGroup
Innovation in Finance, Technology & Policy

Barr Foundation

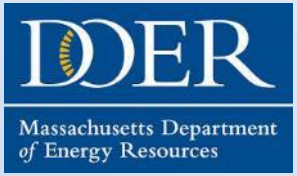
11TH HOUR PROJECT
THE SCHMIDT FAMILY FOUNDATION

MFF

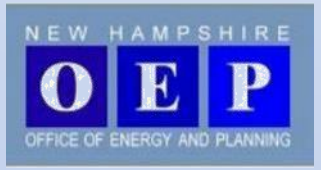
JANE'S TRUST

Clean Energy States Alliance (CESA)
www.cesa.org

Renewable Development Fund



Department of Commerce
Innovation is in our nature.



This presentation:

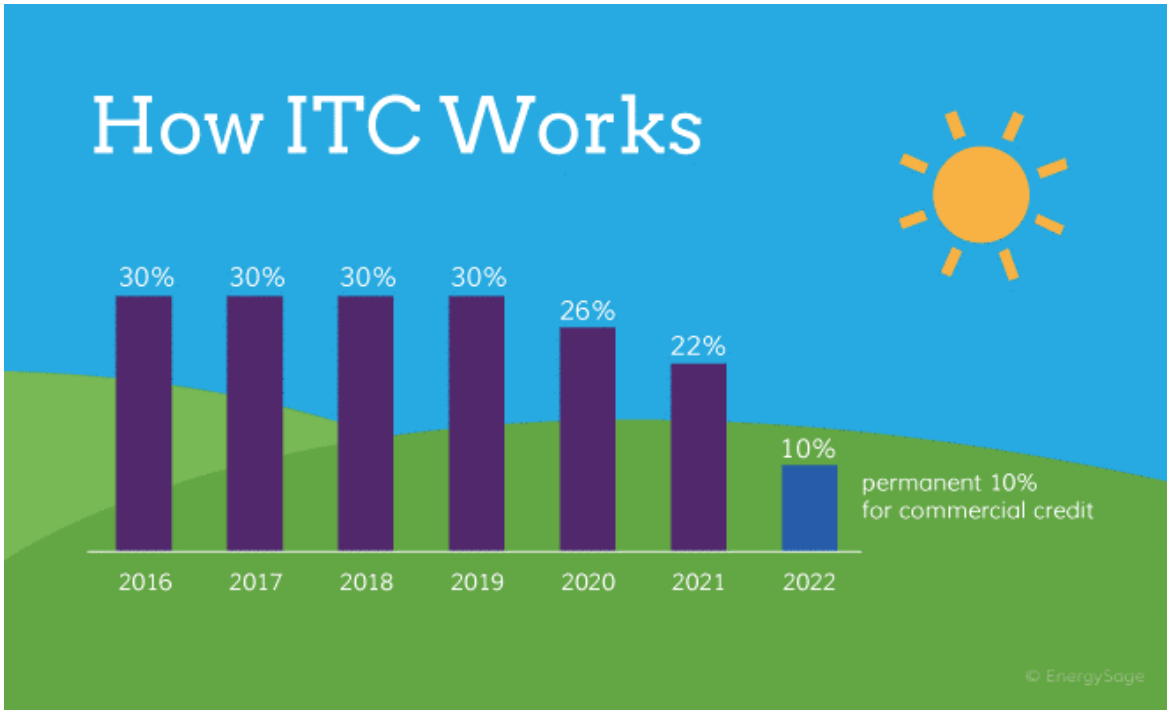
1. Federal energy storage policy landscape
2. State energy storage policy landscape
   A. Storage procurement mandates and targets
   B. Storage rebates
   C. Storage in solar incentive programs
   D. Storage in energy efficiency programs
   E. Storage for demand charge management
   F. Other: state tax incentives, soft cost reductions, related programs and market reforms, storage as a right
3. New England energy storage programs and policies
4. Utility customer battery programs in New England
5. Conclusions

1. Federal landscape

- Investment Tax Credit (ITC)
  - Storage qualifies if charged by solar
  - ITC is sunsetting
- FERC orders regulating wholesale markets
  - FERC 841 is being implemented by ISOs and RTOs
- State policy/regulatory support (DOE-OE, national labs)

Federal Investment Tax Credit (ITC)

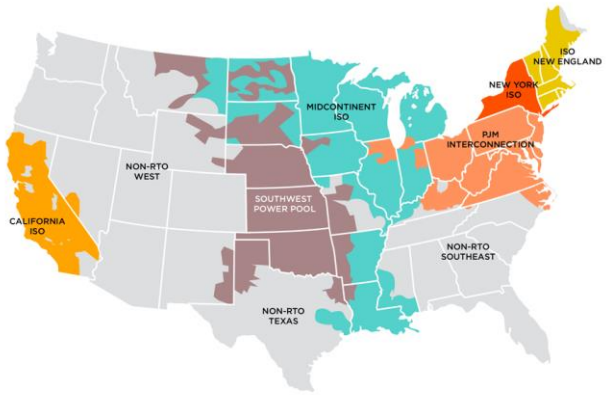
- Can be applied to both solar and storage that is renewably charged (75% cliff)
- Will decline beginning in 2020. Residential ITC disappears by 2022. Commercial ITC will remain at 10% after 2022.



NOTE: The federal Investment Tax Credit (ITC) is available to US for-profit companies. PPAs and lease/ownership flip arrangements can allow non-profit and municipal entities to benefit from the ITC.

- **2016 – 2019:** The tax credit remains at **30 percent** of the cost of the system.
- **2020:** The tax credit declines to **26 percent** of the cost of the system.
- **2021:** The tax credit declines to **22 percent** of the cost of the system.
- **2022 onwards:** Owners of new **commercial** solar energy systems can deduct **10 percent** of the cost of the system from their taxes. *There is no longer a federal credit for residential solar energy systems.*

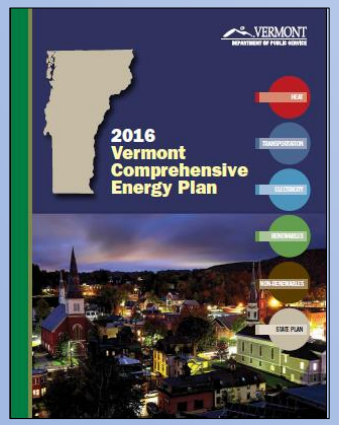
FERC orders in wholesale markets

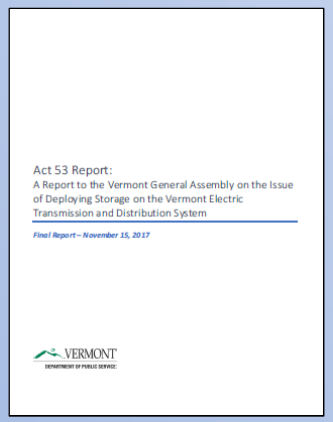


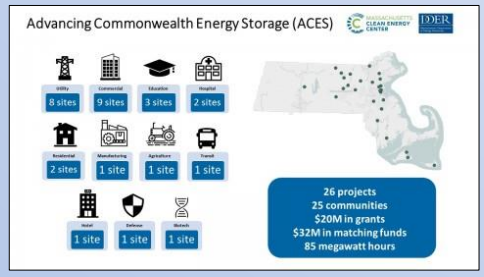
- FERC Order 841: Requires wholesale electric power markets to allow for the participation of energy storage resources, taking into account the operational characteristics of storage
- FERC Order 890: Allows participation by non-generator resources in the RTO/ISO ancillary services markets, including regulation; prevents undue discrimination and preference in transmission service
- FERC Orders 719 and 745: Improves DR participation in the wholesale power markets
- FERC Order 755: Requires pay for performance in frequency regulation
- FERC Order 784: Allows third-party provision of ancillary services and regulates accounting and financial reporting for new electric storage facilities
- FERC Order 794: Defines the amount of frequency response required; regulates measurement and provision of frequency response

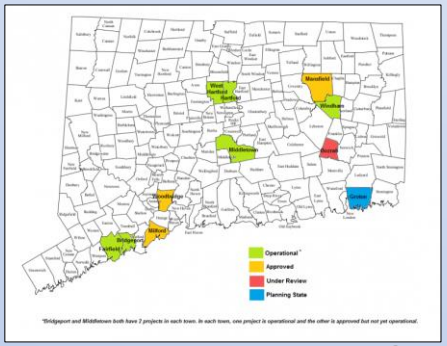
State policy & regulatory support (DOE-OE, national labs)

- **Regulatory support examples**
  - **Regional utility regulators' storage workshops in Pacific Northwest, Southwest and Southeast**
- **Policy support examples**
  - **Connecticut**: technical support for DEEP microgrid grant program, CT Green Bank energy storage rebate (in development)
  - **Massachusetts**: technical support for MA Clean Energy Council to help develop ACES energy storage demonstration grant program; technical support to projects
  - **Vermont**: technical support to Vermont Department of Public Service to write state energy storage study for the state legislature

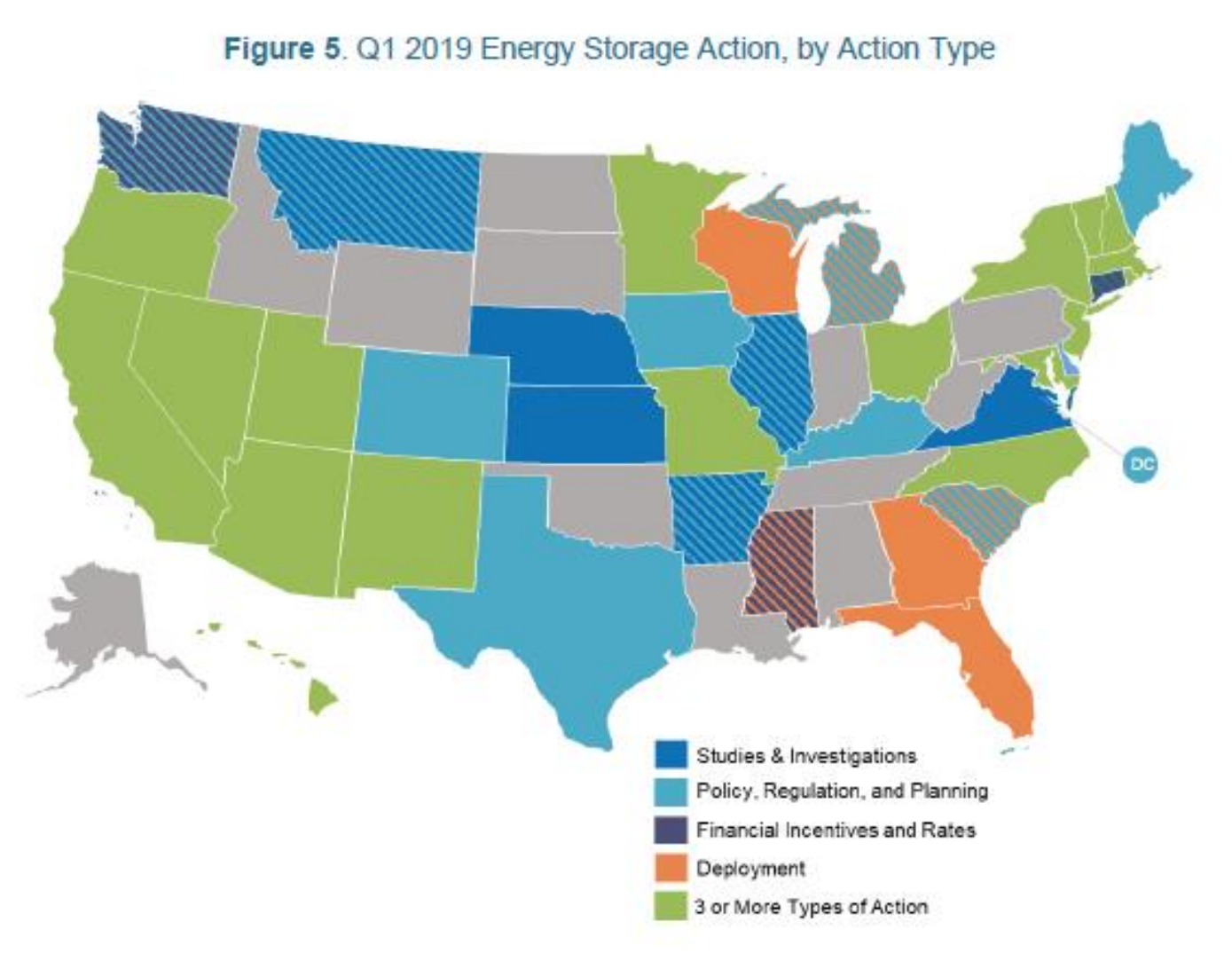






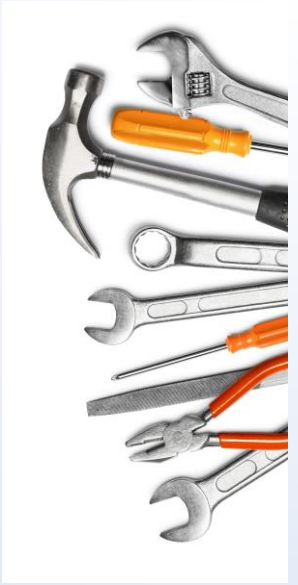


2. State energy storage policy landscape



Source: The 50 States of Grid Modernization: Q1 2019 Quarterly Report

State Policy Tools



- Studies and planning (CA, NY, MA, NJ etc)
- Grants (demonstration projects) (MA, VT, CT etc)
- Longer-term policy and programs
  - Utility mandates/procurement targets (CA, MA, NJ, NY etc)
    - Storage procurement targets
    - Storage in renewable/clean energy portfolio standards
    - Clean peak standards (MA)
  - Storage rebates (CA SGIP)
  - Storage in solar incentive programs (MA SMART)
  - Storage in energy efficiency programs (MA Energy Efficiency Plan)
  - Tax incentives (MD tax credit)
  - Financing/clean energy financial institutions (green banks)
  - Market and regulatory reform
  - Removal of barriers/soft costs
  - Technical assistance, tools, and resources

2A. Utility Mandates/Procurement Targets

- **CA:** 1,825 MW by 2020 (CEC added 500 MW to the original 1,325)
- **MA:** 1,000 MWh by 2025
- **NJ:** 2,000 MW by 2030 (600 MW by 2021)
- **NY:** 3,000 MW by 2030 (1,500 MW by 2025)
- **OR:** 5 MWh by 2020 (capped at 1% of utility's peak load)

Example: California procurement targets (2013)

Proposed Energy Storage Procurement Targets (in MW)[22]

Storage Grid Domain Point of Interconnection	2014	2016	2018	2020	Total
Southern California Edison					
Transmission	50	65	85	110	310
Distribution	30	40	50	65	185
Customer	10	15	25	35	85
Subtotal SCE	**90**	**120**	**160**	**210**	**580**
Pacific Gas and Electric					
Transmission	50	65	85	110	310
Distribution	30	40	50	65	185
Customer	10	15	25	35	85
Subtotal PG&E	**90**	**120**	**160**	**210**	**580**
San Diego Gas & Electric					
Transmission	10	15	22	33	80
Distribution	7	10	15	23	55
Customer	3	5	8	14	30
Subtotal SDG&E	**20**	**30**	**45**	**70**	**165**
Total - all 3 utilities	**200**	**270**	**365**	**490**	**1,325**

Notes: - Utilities may own up to 50% of required storage capacity
- CA added another 500 MW to this requirement (total 1,825 MW)
- CPUC prioritizes "public sector and low-income customers"

California storage procurement progress (8/2018)

Table 1: IOU AB 2514 Energy Storage Procurement

Pacific Gas and Electric					
	Target	On-Line Storage	Approved, Some Are In Progress	Pending Approval	TOTAL PROCURED
Transmission	310	0	0	692.5	692.5
Distribution	185	6.5	10	20	36.5
Customer	85	26.1	0	20	46.1
Southern California Edison					
	Target	On-Line Storage	Approved, Some Are In Progress	Pending Approval	TOTAL PROCURED
Transmission	310	20	100	0	120
Distribution	185	56	65.5	10	131.5
Customer	85	110	195	0	305
San Diego Gas & Electric					
	Target	On-Line Storage	Approved, Some Are In Progress	Pending Approval	TOTAL PROCURED
Transmission	80	40	39	0	79
Distribution	55	43.6	13.5	0	57.1
Customer	30	30	0	0	30
TOTAL – All IOUs	1,325	332.2	423	742.5	1,497.7

2B. Storage rebates

CA – Self Generation Incentive Program (SGIP) (re-funded in 2018 at $830 million through 2025): LMI incentives recently increased due to no LMI participation

NY – Market Acceleration Bridge Incentive Program ($350 million)

CA SGIP

Summary: The program was originally conceived in 2001 as a peak load reduction program supporting mainly solar PV. It was modified in 2011 to focus on greenhouse gas emissions reductions, and again in 2016 to focus 79% of the program budget on energy storage. The program is ratepayer-funded.

Program design: The SGIP program offers an up-front rebate in a declining block structure. There is a 25% "Equity" (low income) carve-out, defined geographically by environmentally disadvantaged and low-income communities, and affordable housing. 15% of SGIP budget is reserved for residential customers.

Program statistics: Since it was refocused on storage in 2016, SGIP has:

- Disbursed $158 million in incentive payments
- Supported 828 behind-the-meter battery projects (residential and nonresidential) representing almost 67 MW of SGIP rebated capacity (defined as average discharge power across two hours). Another $31 million is reserved or pending.

Rebates – Pros and Cons

Advantages:

- Gives customers needed assistance in defraying up-front capital and installation costs
- Provides a reliable, long-term, financeable market structure for developers
- Helps to build markets
- Developers can provide marketing and aggregation services
- Works for residential and commercial customers, regardless of tax status or system size
- Gives the state complete control over incentive rates and overall program budget
- Can be modified to provide extra support for LMI customers, in the form of adders, carve-outs, and low- or no-cost financing
- Rates can be adjusted to meet state goals
- Program statistics are easy to track
- Declining block structure compensates for declining system costs, encourages early adoption
- Works well in tandem with utility procurement mandate (which has a BTM carve-out)

Disadvantages:

- Equity carve-out has not been effective at stimulating LMI participation in SGIP, and small equity rate adders are likely not sufficient to address the problem (could be addressed by providing a more meaningful LMI adder, low- or no-cost financing, etc).
- Rebate provides little opportunity for price signals and no direct control over system operations. Without price signals or direct control, energy storage deployed through rebates may not be effective at meeting state goals such as peak load reduction or greenhouse gas emissions reduction. This is documented in the 2017 SGIP impact evaluation report.
- Initially, all SGIP program funds became available on a specific day, with the result that the majority were claimed by commercial/industrial projects, leaving little for residential customers. This was remedied by making rebates in later steps available throughout the year, but could have been avoided through the use of carve-outs for residential customers.

2C. Storage adders in existing solar incentive programs

Massachusetts, New York, Nevada

Example: Solar Massachusetts Renewable Target (SMART)

Summary: The SMART solar rebate replaced the previous SREC program in 2018. SMART is a declining block tariff program that provides fixed base compensation over a 10- or 20-year term. In addition to offering solar rebates, the SMART program offers a storage adder for new batteries connected with new solar PV behind customer meters. SMART is now being expanded and LMI participation (hopefully) increased.

The storage adder is stackable with other adders:

- Building Mounted Solar
- Floating Solar
- Solar on a Brownfield
- Solar on an Eligible Landfill
- Canopy Solar
- Agricultural Solar
- Community Shared Solar
- Low Income Property Solar
- Low Income Community Shared Solar
- Public Entity Solar
- **Energy Storage**
- Solar Tracking

In order to be eligible, energy storage must meet certain SMART program requirements:

- **Power rating:** storage must be at least 25% of the rated capacity of the associated solar; capacity above 100% of solar will not receive the incentive.
- **Capacity rating:** storage must be at least two hours in capacity. Capacity above 6 hours will not receive the incentive.
- **Efficiency:** storage must achieve at least 65% round trip efficiency.
- **Data reporting:** storage must report 15-minute interval data to the solar program administrator for at least the first year of operation, and up to five years on request.
- **Operations:** storage must discharge at least 52 complete cycle equivalents per year. If decommissioned or non-functional for more than 15% of a year, storage may be disqualified from continuing to receive the incentive.
- **Services provided:** The storage system must either a) reduce on-site customer peak demand or b) increase self-consumption of on-site generated solar energy.

How are SMART storage incentives calculated?

The SMART program uses an extremely complicated formula to calculate the storage adder:

$$Energy\ Storage\ Adder = \left[\frac{\left(\frac{ESkW}{PVkW}\right)}{\left(\left(\frac{ESkW}{PVkW}\right) + \exp\left(0.7 - \left(8 * \left|\left(\frac{ESkW}{PVkW}\right)\right|\right)\right)\right)}\right] * \left[0.8 + \left(0.5 * \ln\left(\frac{ESkWh}{ESkW}\right)\right)\right] * Base\ Adder$$

The short version of this is that the SMART solar incentive ranges from $0.28 - $0.34/kWh and the storage adder ranges from $0.045 - $0.075/kWh (based on solar generation).

To find out what your system might qualify for, use the SMART energy storage adder calculator at https://www.mass.gov/media/1909851/download?_ga=2.171629923.213713902.1536675176-483334923.1493903549

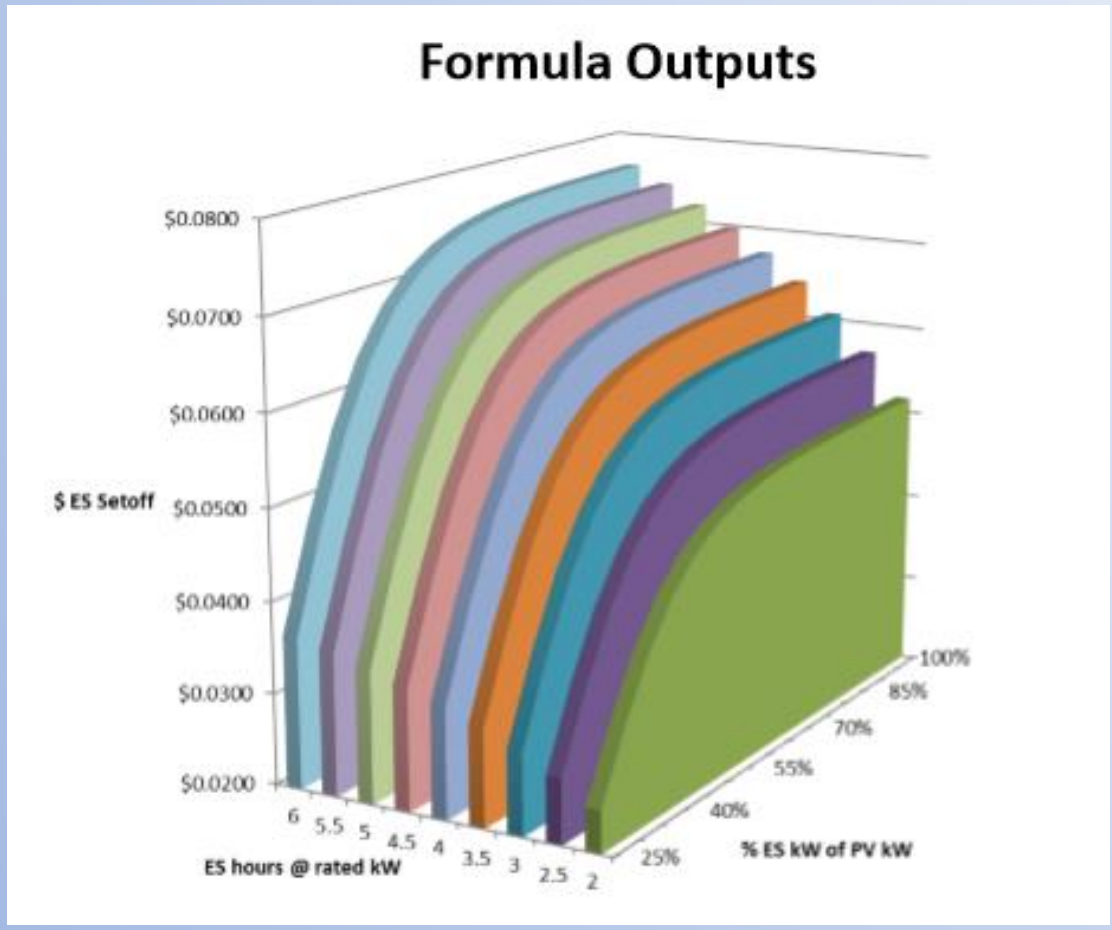
More program guidelines on the SMART energy storage adder can be found at https://www.mass.gov/files/documents/2018/09/13/Energy%20Storage%20Guideline%20FINAL%20091318.pdf

These and other program guidance documents are at https://www.mass.gov/info-details/solar-massachusetts-renewable-target-smart-program#general-information-

For a rough idea of the value of the SMART energy storage adder, consult this 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



Visually, you can see that the energy storage adder increases up to about 50% of solar capacity, and then flattens out.

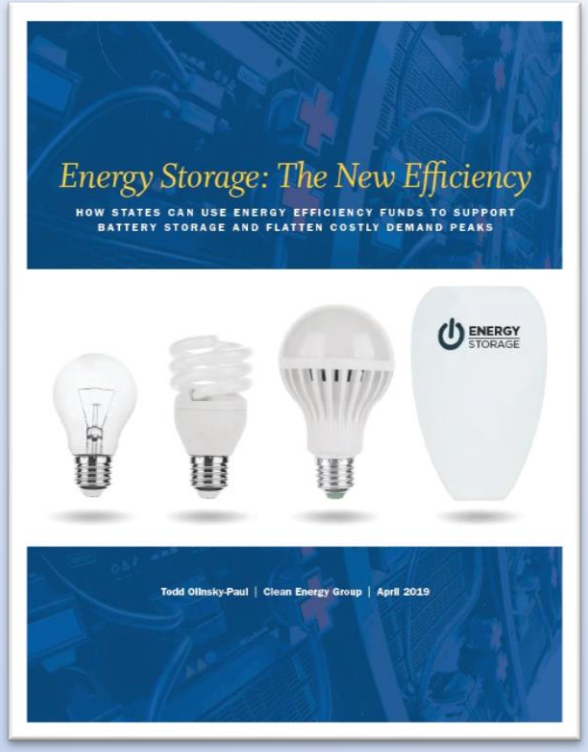
2D. Energy Storage in State Energy Efficiency Programs

Energy Storage: The New Efficiency

How States Can Use Efficiency Funds to Support Battery Storage and Flatten Costly Demand Peaks

Report does four things:

1. Explains **how Massachusetts incorporated battery storage into its energy efficiency plan, and how other states can do the same**
2. Discusses issues and best practices in **battery incentive design**
3. Introduces **battery storage cost/benefit analysis**
4. Assigns, for the first time, dollar values to **seven non-energy benefits of storage**



Published April 4, 2019 by Clean Energy Group

www.cleanegroup.org/ceg-resources/resource/energy-storage-the-new-efficiency

The Massachusetts story

In 2019, battery storage was included in the Massachusetts energy efficiency program as a peak reduction measure (first in nation).

To achieve this, two conditions needed to be met:

1. **Redefining efficiency.** In order to include storage within the energy efficiency plan, Massachusetts first had to **include peak demand reduction, a major application of battery storage, within the efficiency plan.**

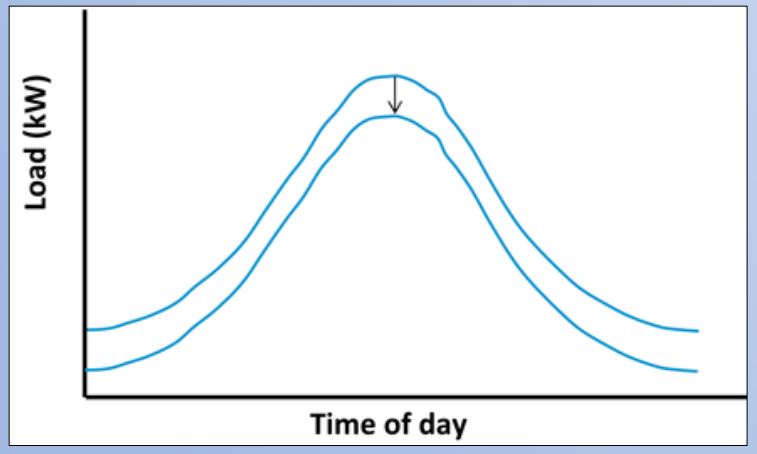
2. **Showing that storage is cost-effective.** In order for energy storage to qualify for the efficiency plan, it first had to be shown to be cost-effective. This meant that **storage had to be able to pass a Total Resource Cost** (TRC) test.

1. Redefining efficiency

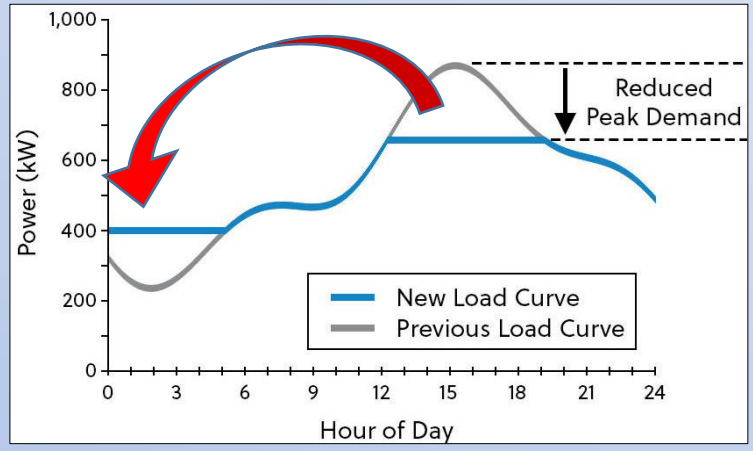
- **Traditionally, electrical efficiency is thought of as reducing consumption**
  - Storage does not normally qualify due to round trip losses
- **Through legislation, Massachusetts expanded the traditional definition of efficiency to include peak demand reduction**
  - Storage is well-suited to reducing peak demand, something traditional passive efficiency measures don't do

Key concept: Not all load hours should be valued the same!

Traditional efficiency reduces overall consumption, but does not shift peaks

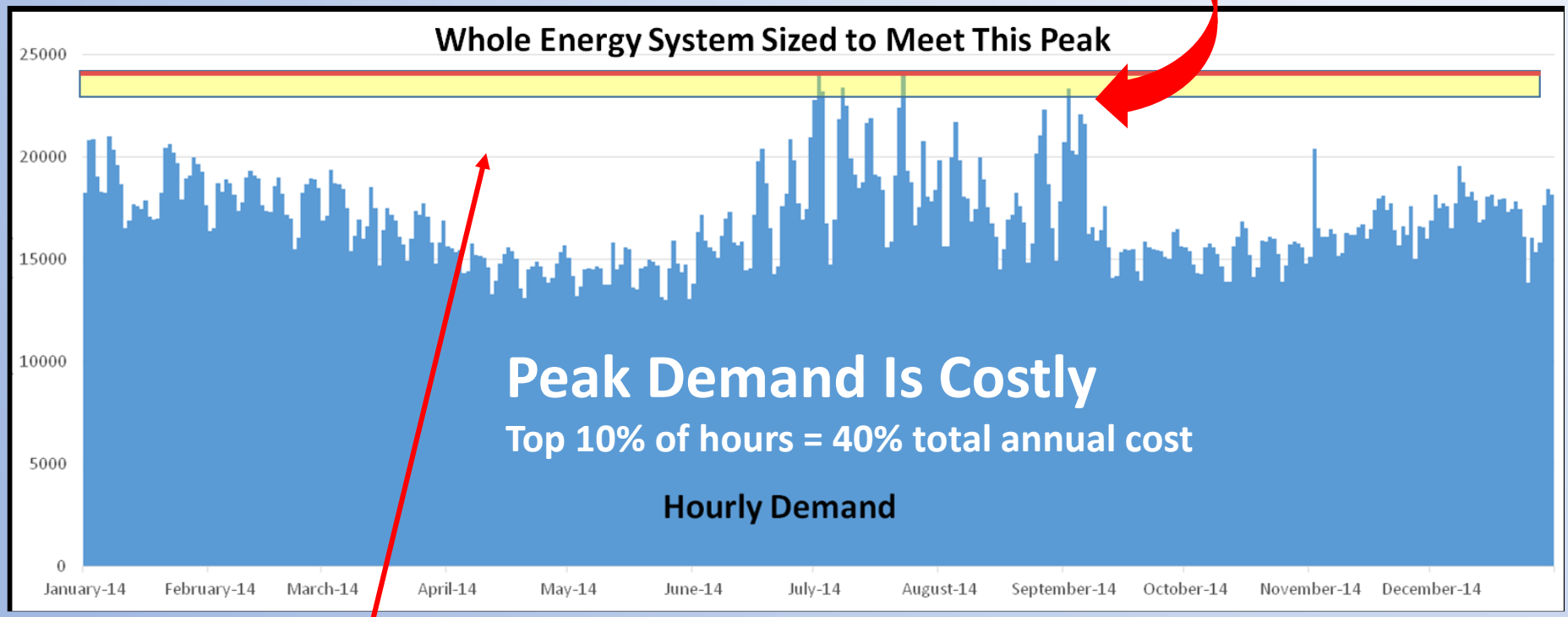


Peak demand reduction reduces peaks, but does not reduce net consumption



The monetizable value of storage is partly due to the high costs of our oversized grid

The highest value of storage is in providing *capacity* to meet demand peaks… *not* in providing bulk energy.



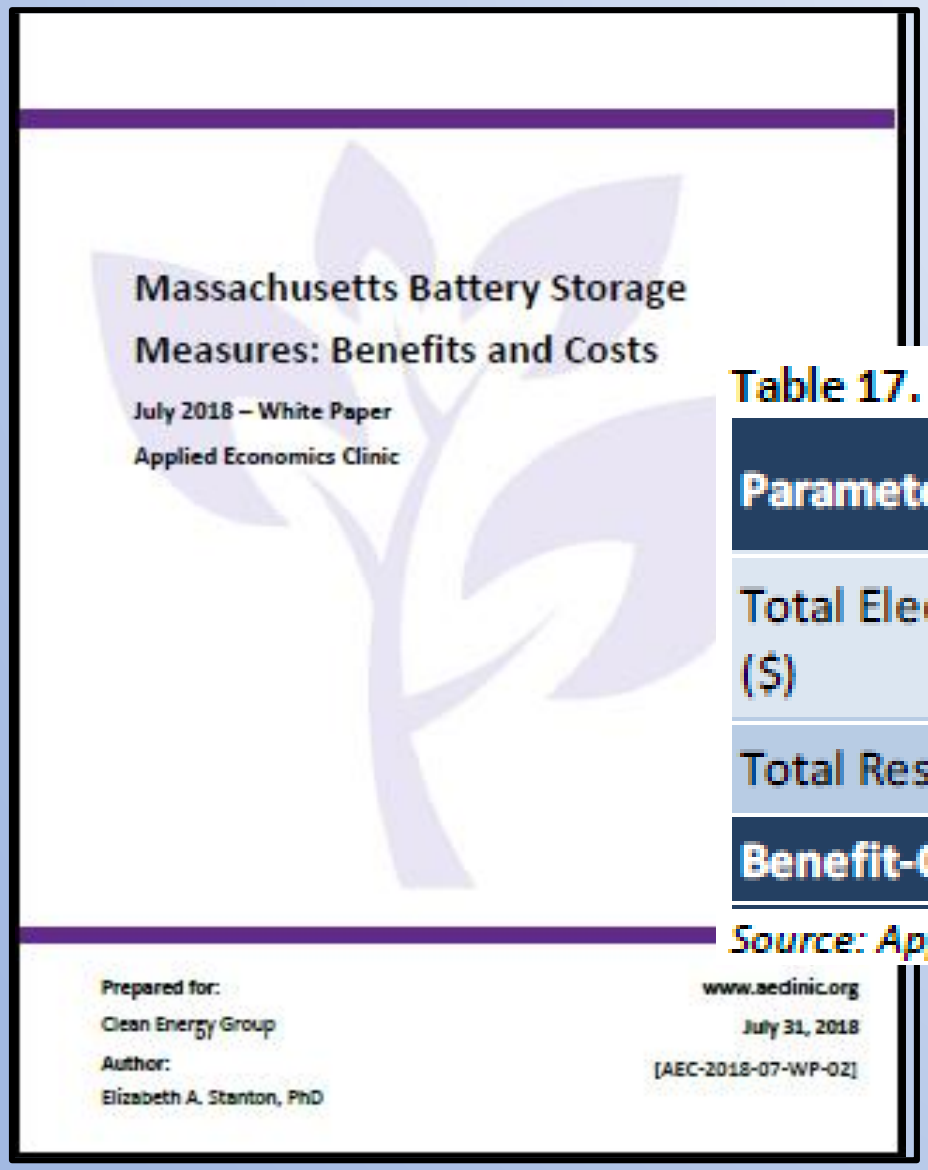
From Massachusetts *State of Charge* report

White space = inefficiency in the system

Redefining efficiency

- 2008: Massachusetts ***Green Communities Act*** requires that efficiency program administrators seek "…all available energy efficiency **and demand reduction resources** that are cost effective or less expensive than supply."
- 2016: Massachusetts ***State of Charge*** report notes that "**Storage and other measures that shift load are firmly covered by the intent of the [Green Communities] Act**" and adds, "The 2016-2018 Statewide **Energy Efficiency Investment Plan ("Three Year Plan") identifies peak demand reduction as an area of particular interest**…. **Energy storage, used to shift and manage load as part of peak demand reduction programs, can be deployed through this existing process."**
- 2018: Massachusetts **"Act to Advance Clean Energy"** specifically allows the use of energy efficiency funds to support the deployment of cost-effective energy storage "if the department determines that the **energy storage system installed at a customer's premises provides sustainable peak load reductions**."

2. Showing that storage is cost-effective



To qualify for state energy efficiency plans, *storage must pass a cost/benefit test*

Table 17. Total benefits and costs

Parameter for 2019	Low-Income	C&I
Total Electric Benefits ($)	$36,296	$155,782
Total Resource Cost ($)	$13,163	$46,322
Benefit-Cost Ratio	**2.8**	**3.4**

Source: Applied Economics Clinic calculations

CEG published independent economic analysis by AEC – July, 2018

Storage BCRs from Massachusetts EE plan PAs

NOTE: These numbers do not include non-energy benefits!

BCRs	Cape Light			Eversource			National Grid			Unitil		
	2019	2020	2021	2019	2020	2021	2019	2020	2021	2019	2020	2021
Residential Advanced Demand Management Program (A2e)												
Program BCRs	*1.6*	*2.4*	*2.4*	*1.0*	*1.4*	*1.6*	*1.5*	*2.4*	*2.5*	*0.7*	*1.1*	*1.2*
Direct Load Control	4.9	6.6	7.4	5.0	5.0	5.0	5.3	5.5	5.3	5.2	9.6	9.6
Behavioral DR												
Storage System and Performance		3.0	3.0									
Storage Daily Dispatch				1.5	1.5	1.5	4.9	4.9	5.0			
Storage Targeted Dispatch				0.0	0.0	0.0	0.1	0.1	0.1			
EV Load Management								0.8	0.8			
Income-Eligible Advanced Demand Management Program (B1b)												
Program BCRs		*2.3*	*2.4*					*2.4*	*2.4*			
Direct Load Control												
Behavioral DR												
Storage System and Performance		3.0	3.0									
Storage Daily Dispatch												
Storage Targeted Dispatch												
EV Load Management												
Commercial/Industrial Advanced Demand Management Program (C2c)												
Program BCRs	*7.5*	*4.6*	*4.7*	*2.9*	*2.9*	*2.8*	*7.9*	*4.8*	*4.9*	*2.7*	*2.9*	*3.1*
Interruptible Load	9.7	9.8	9.8	7.9	7.9	7.9	7.5	7.5	7.5	4.2	4.2	4.2
Winter Interruptible Load												
Storage System and Performance		3.0	3.0									
Storage Daily Dispatch				1.7	1.7	1.7	4.9	4.9	5.0	6.2	6.2	6.2
Storage Targeted Dispatch				3.2	3.2	3.2	0.1	0.1	0.1	0.1	0.1	0.1
Custom	8.3	8.3	8.3		2.0	2.0	1.3	1.3	1.3			

No LMI Program Offerings

RESULTS:

- Massachusetts 2019-2021 energy efficiency plan includes BTM storage as an Active Demand Reduction measure (for the first time)
- Incentive is actually a payment for performance based on peak demand reduction
- Performance payments = **~$13 million** over three years
- Expected results = **~34 MW** new behind-the-meter storage

Shortcomings:

- No enhanced incentive, financing or carve-out for **low-income customers**
- No up-front **rebate**
- Numerous omissions mean **storage BCRs are likely too low**

Compensation rates (from National Grid)

Three Options to Curtail

mass save

		Massachusetts	Rhode Island
Commercial	Daily Dispatch 	• 30 - 60 events per summer • 2 - 3 hours per event • Technology/Vendor Agnostic • **$200/kW-performed-summer** • **$ 25/kW-performed-winter** • **Plus SMART Battery Adder**	• 30 - 60 events per summer • 2 - 3 hours per event • Technology/Vendor Agnostic • **$300/kW-summer**
Residential	Residential Batteries 	• 30 - 60 events per summer • 2 - 3 hours per event • 4 Approved Battery Vendors • **$225/kW-performed-summer** • **$ 50/kW-performed-winter** • **Plus SMART Battery Adder**	• 30 - 60 events per summer • 2 - 3 hours per event • 4 Approved Battery Vendors • **$400/kW-summer**

Note: Customers can participate in the EE load reduction program while engaging in net metering and demand charge management, *and* could qualify for the SMART solar rebate with storage adder

Project Economics Example

A commercial customer participating in the targeted dispatch program installs a 60 kWh battery and signs up for a $200/kW summer daily dispatch program. Assuming perfect call response:

Performance payment calculation:

60 kWh battery = 20 kw/hr load reduction averaged over 3-hour calls.

20 kW average load reduction x $200 performance payment rate = $4,000 maximum seasonal payout

Duration of discharge matters!

The same 60 kWh battery could earn $6,000 if the duration of the discharge call were 2 hours instead of 3 (60/2 = 30 x $200 = $6,000)

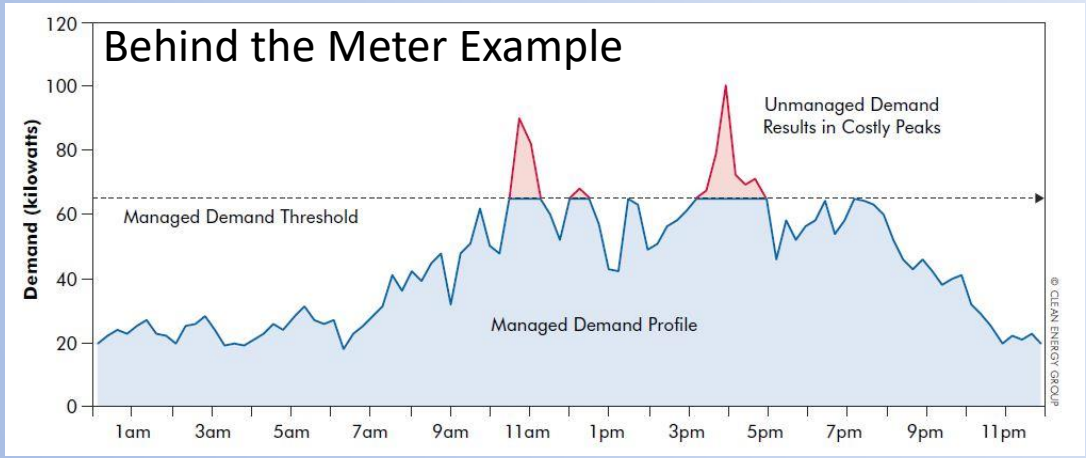
Comparison: Storage in MA SMART Solar Program vs. MA Energy Efficiency Plan

Behind-the-meter energy storage in MA may be eligible for both the SMART incentive and the energy efficiency incentive. The programs are different:

- SMART incentive:
  - Storage must be paired with solar
  - New systems only
  - Deployment incentive (rebate) with operational requirements, based on solar production
  - Incentive based on relative size and duration of storage system

- Energy Efficiency performance payment:
  - Storage can be stand-alone or paired with renewables
  - New systems only
  - Performance payment is seasonal (summer / winter) with five-year contract (pay for performance, not a rebate)
  - Payment based on average load reduction during dispatch calls

2E. Demand charge management



Peak reduced from 100 kW to 65kW = **35 kW reduction**

Savings depend on **cost of demand**

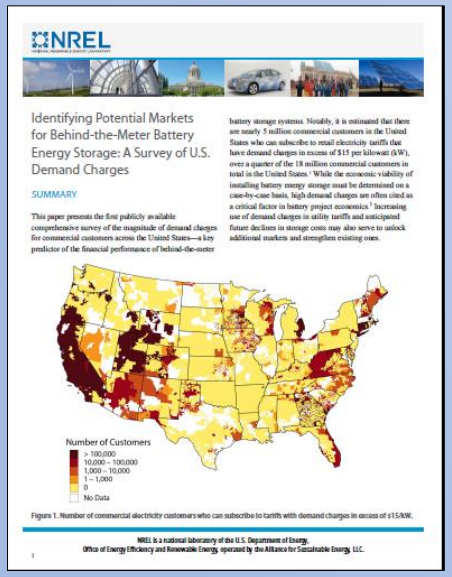
Demand charges @ $10/kW = **$4,200 annual savings**
Demand charges @ $20/kW = **$8,400 annual savings**

Generally, commercial customers paying **$15/kW or more** in demand charges may be able to install batteries economically for demand charge management (without subsidies).

(Energy storage can reduce costs by shaving peak loads on either side of the meter)

First National Survey of Demand Charge Rates

Based on a survey of more than 10,000 utility tariffs, ***Nearly 5 million commercial customers may be paying more than $15/kW in demand charges***


NREL

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

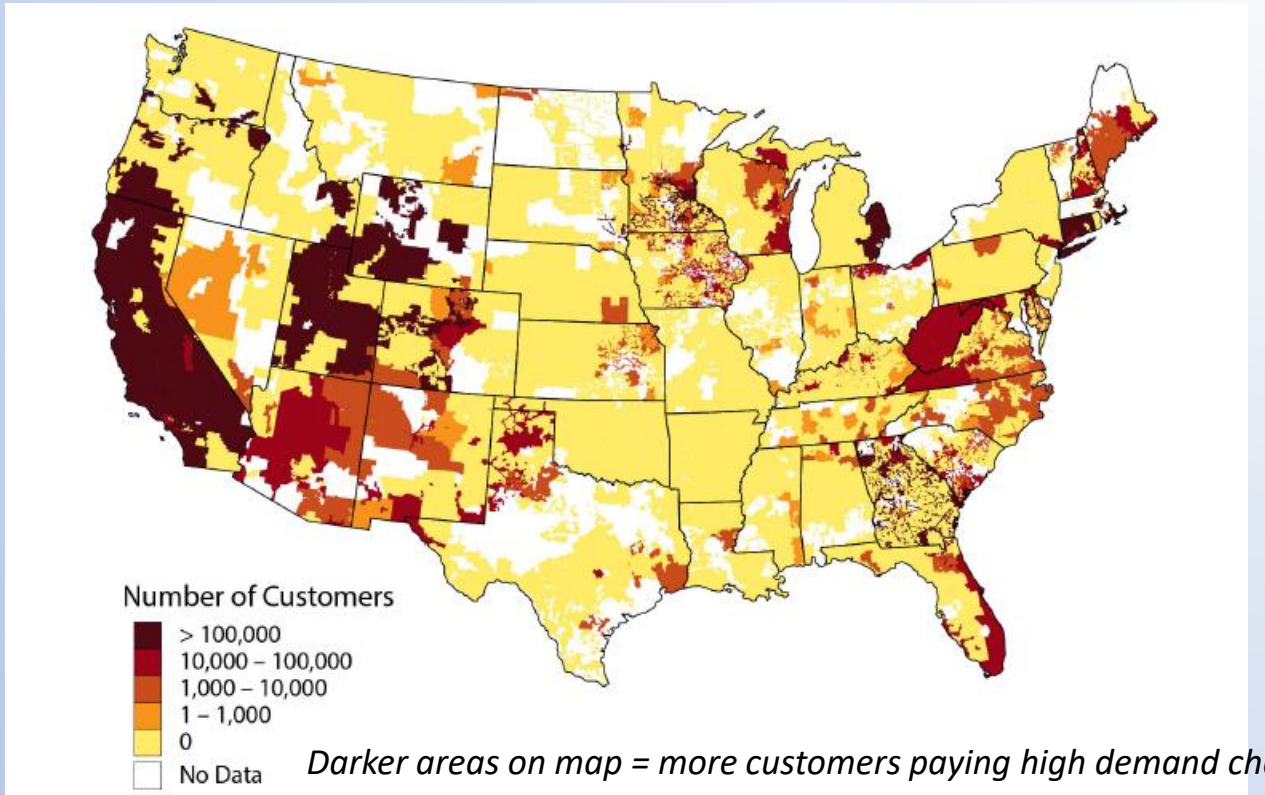
SUMMARY

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.



Darker areas on map = more customers paying high demand charges

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

What policies are needed?

1. Customer ***rebate programs*** for behind-the-meter storage
2. Inclusion of battery storage in state **energy efficiency programs**
3. Integration of storage into ***existing clean energy programs*** (energy efficiency plans, solar incentives, REC programs)

Demand Charges in New England

- Masssachusetts
  - $3.92 - $6.00/kW (National Grid)
  - $10.74 - $41.25/kW (Eversource)
- Connecticut (Eversource)
  - Small General Electric Service = $20.82/kW
  - Intermediate General Electric Service = $17.34/kW
  - Large Church and School = $18.17/kW
- New Hampshire (Eversource)
  - Small Commercial = $15.25/kW
  - Medium Commercial = $14.10/kW
- **Maine (Central Maine Power)**
  - **Small General Service = $12.18 - $13.57/kW**
  - **Intermediate General Service = $13.95/kW**
  - **Large General Service = $15.38 - $15.71/kW**
- Vermont (Green Mountain Power)
  - Small General Service = $14.30
  - Large General Service = $14.67
- Rhode Island (National Grid)
  - Small Commercial = $9.17/kW
  - Medium Commercial = $8.41/kW
  - Large Commercial = $7.03/kW

Generally, energy storage for demand charge management is economical (without subsidies) if the customer is paying <u>at least $15/kW for demand charges</u>.

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

- 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
- Analysis of solar vs solar+storage system for DCM and resiliency

System modeled:

- Solar: 150 kW DC (cost: $375,000)
- Storage: 30 kW/45 kWh L/I battery (cost: $88,604)
- Total capital cost: $463,604

Analysis by Geli

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**

Demand

Meter Charge, $/yr	**$2,000**
TOTAL, $/yr	**$220,188**

Hassan Apartments payback comparison

	Size	Capital cost	Federal ITC	Depreciation	Net cost	Year 1 savings: Energy charge	Year 1 savings: Demand charge	Estimated payback
Solar system	150 kW PV	$375,000	$112,500	$144,713	$117,787	$18,204	$5,374	5.7 years
Energy Storage system	30 kW/45 kWh battery	$88,604	$26,581	$34,192	$27,831	$0	$7,645	4.4 years
Combined system	150 kW PV + 30 kW/45 kWh battery	$463,604	$139,081	$178,905	$145,618	$18,204	$13,019	5.3 years

Storage payback = 4.4 years
Solar+Storage payback = 5.3 years
Solar alone payback = 5.7 years

What the analysis includes:

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

What it doesn't include:

- State solar incentives (and proposed storage adders)
- Income from Alternative Energy Certificates
- Other market programs (demand response)

2F. Other state energy storage strategies

State tax incentives: Maryland

Summary: In 2017, Maryland became the first state to offer an income tax credit for energy storage systems. Tax credits are capped at 30 percent of the total installed system cost, or up to $5,000 for residential systems and up to $75,000 for commercial systems. Storage can be stand-alone or PV connected.

Tax credit is funded at $750,000 annually through 2022, with $300,000 available for residential customers, $450,000 for commercial customers on a first-come, first-served basis.

Results: In the program's first year (2018), 61 residential customers and one commercial customer claimed a total $237,112 in tax credits.

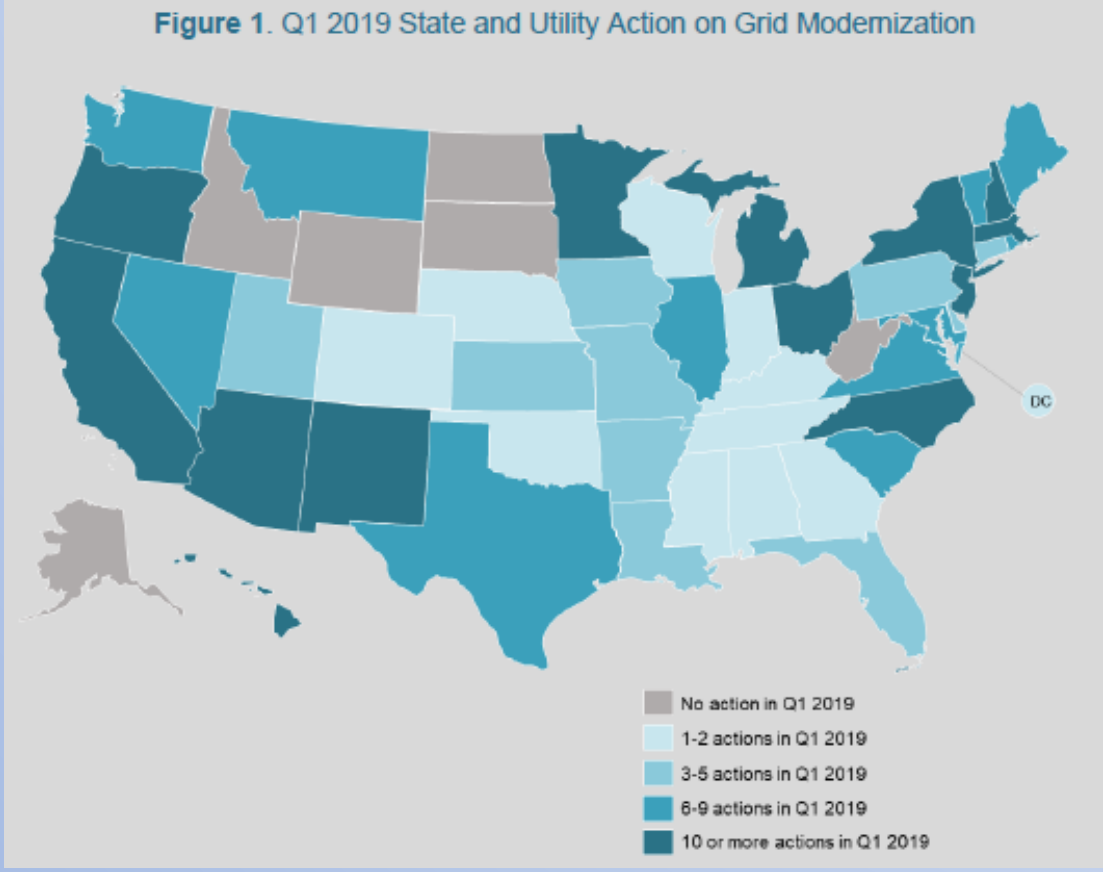
Conclusion: In the absence of other economic drivers, such as performance payments, rebates or demand charge management opportunities, tax incentives alone are unlikely to significantly move the market.

Lowering Soft Costs

- Financing/clean energy financial institutions
  - Green banks
  - Low/no interest loans
  - PACE programs
- Market and regulatory reform
  - Net metering
  - Capacity rules
  - Third party aggregation/virtual peakers
- Removal of barriers to deployment
  - Siting and permitting reforms
  - Interconnection rules
- Technical assistance, tools, and resources
  - Public technical assistance
  - Best practices guides
  - State vetted equipment and installer lists

Related programs and market reforms

- Clean peak standards (MA)
- Resiliency programs (MA, NY, CT, NJ)
- Grid modernization (NY, WA, NH, OH, MA, AZ, others)



Source: The 50 States of Grid Modernization: Q1 2019 Quarterly Report

Storage as a right

Colorado

- Storage as a consumer right
- Storage in utility IRPs

Senate Bill 18-009 gives Colorado consumers the right to:

- Install energy storage systems of up to 25 kW on their properties
- Streamlined interconnection process for solar-plus-storage installations
- Only one revenue meter is needed

House Bill 18-1270 requires Colorado utilities to:

- Include energy storage in their planning processes, including
  - modeling assumptions to assess the costs and benefits of energy storage
  - model contracts for the procurement of energy storage systems
- The law also stipulates that energy storage may be owned by an electric utility or any other person.

3. Storage policies and programs in New England

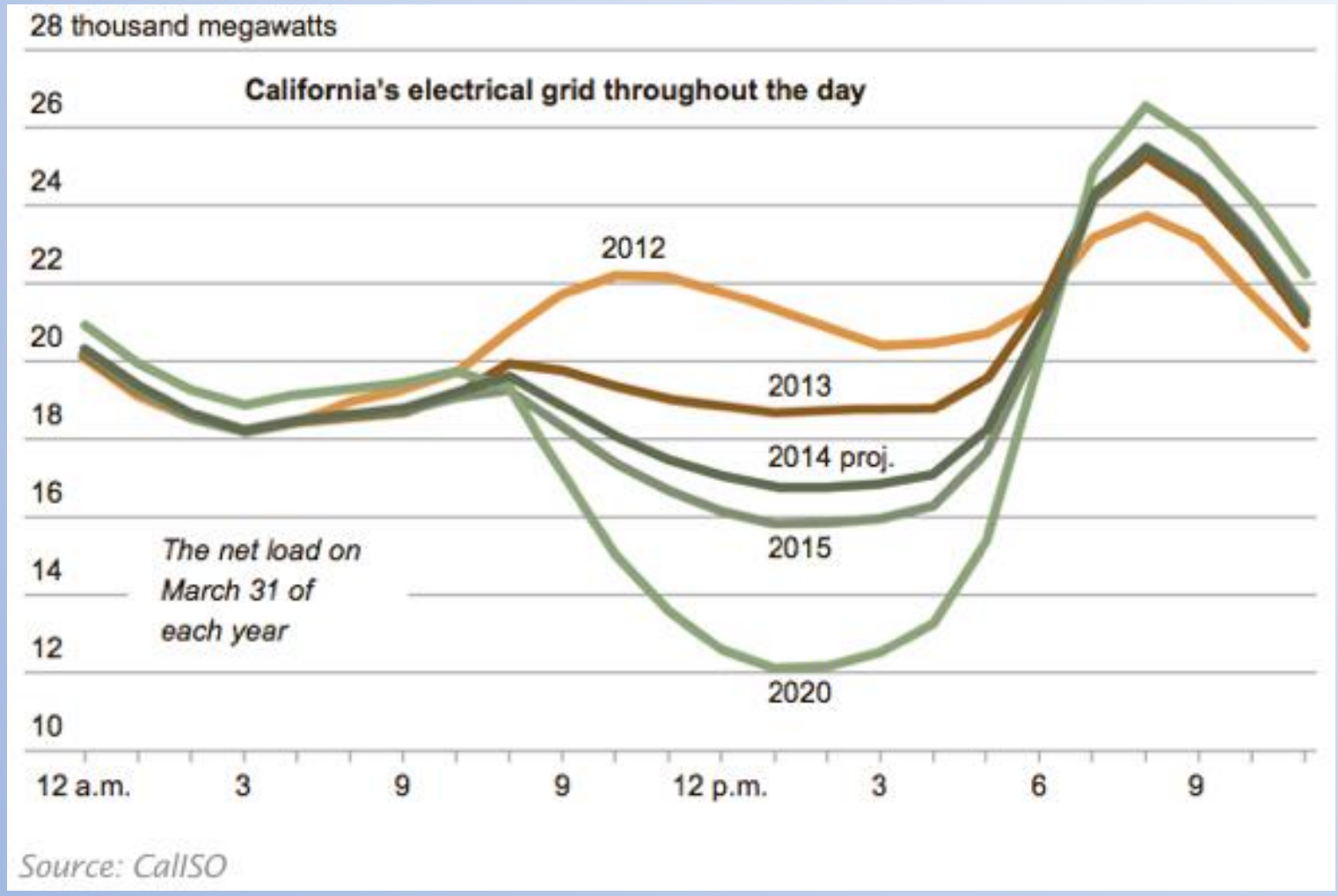
- **MA**
  - Landmark storage study (State of Charge)
  - 1 GW storage procurement target
  - Storage and resiliency grant programs
  - SMART solar program with storage adder
  - Storage added to state energy efficiency program
  - **Clean Peak Standard (in development)**
  - Microgrids program

- **VT**
  - Docket considering adding storage to the state's energy efficiency program
  - Vermont energy storage study
  - Several nation-leading utility-customer storage programs
  - Several utility scale storage installations

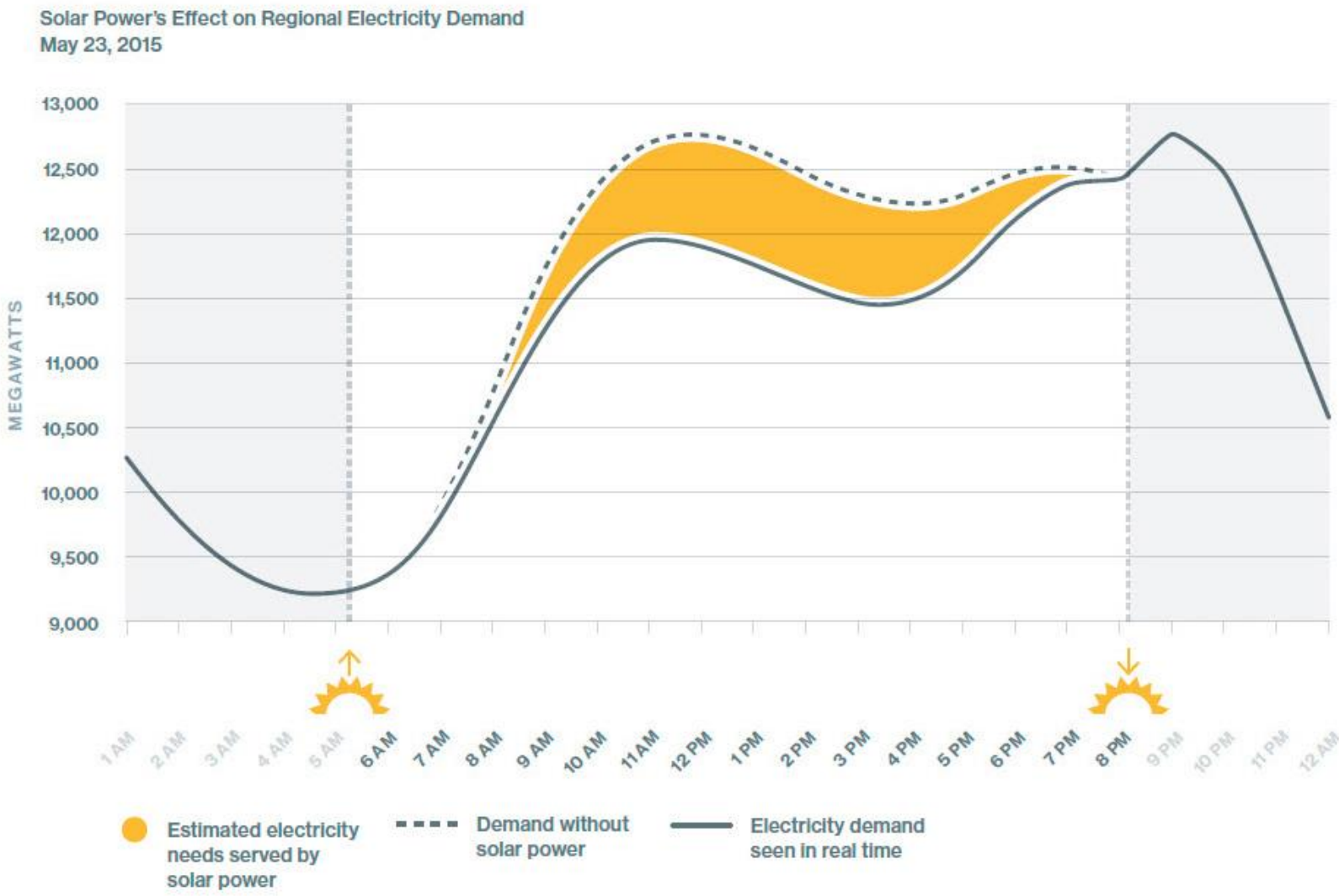
Storage policy and programs in New England (continued)

- **CT**
  - Microgrids grant program
  - Energy storage rebate proposal
  - Utility-proposed customer storage offering through the CT energy efficiency program (in development)
- **RI**
  - Microgrids initiative
  - Storage in the RI energy efficiency program
- **NH**
  - Customer storage pilot through Liberty Utilities
  - Utility-proposed customer storage offering through the NH energy efficiency program (in development)
- **ME**
  - Energy storage roadmap
  - Procurement target?

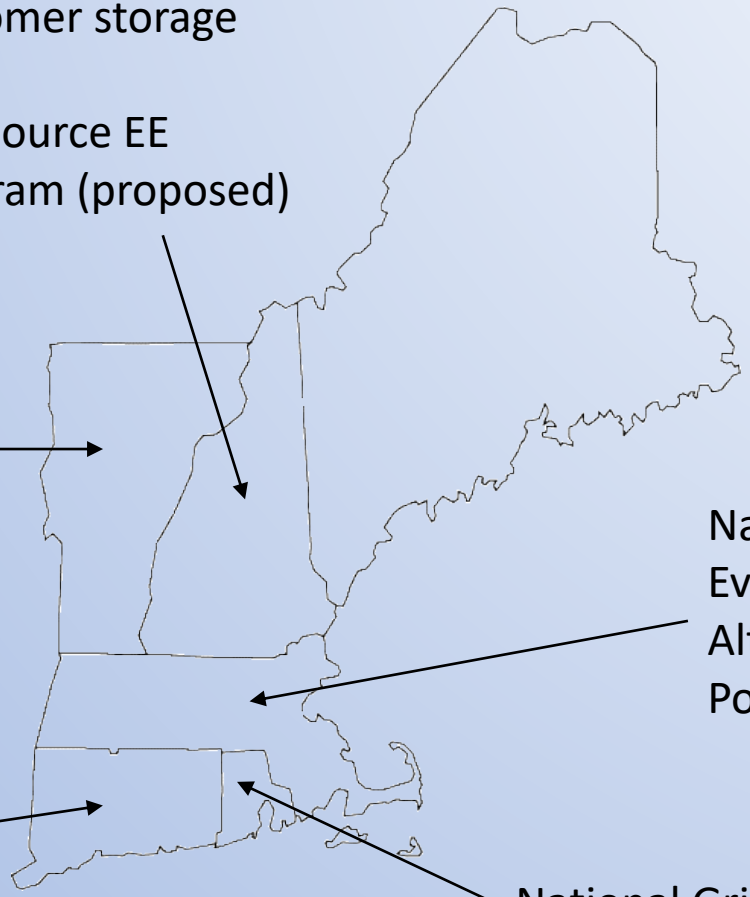
Basis for MA "Clean Peak Standard": The California "Duck" Curve



ISO-New England: Does this curve look familiar?



4. Utility customer battery programs in New England



Conclusions

- Storage markets are underdeveloped, and many valuable services are not yet monetizable; state policies and programs can help bridge funding gaps and jump-start markets.
- Incorporating storage into existing programs with dedicated funding, such as solar incentives, energy efficiency and procurement mandates, can be a fast and effective way to provide support.
- Issues of customer ownership and low-income access to storage need to be addressed when states draft energy storage policy and regulations.
- There is no silver bullet. States should consider a variety of policy approaches—customer incentives and performance payments, procurement targets, financing support, regulatory reform, and soft cost reductions.
- More demonstration projects are probably not needed for standard storage technologies. One-off grant programs are useful to demonstrate new technologies and applications, but do little to move the market.

Thank You

Todd Olinsky-Paul
Project Director
Clean Energy Group / Clean Energy States Alliance
Todd@cleanegroup.org