Energy Storage in State Energy Efficiency Plans: Lessons from Massachusetts

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Energy Storage: The New Efficiency

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

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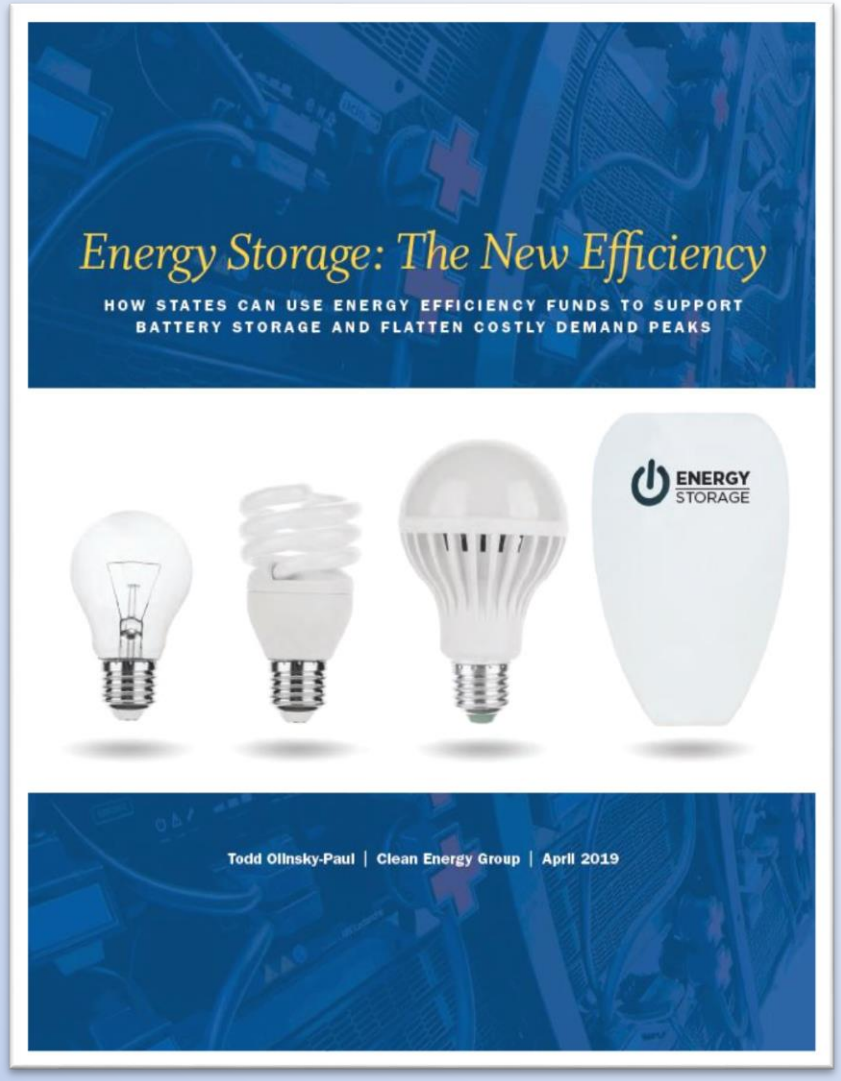
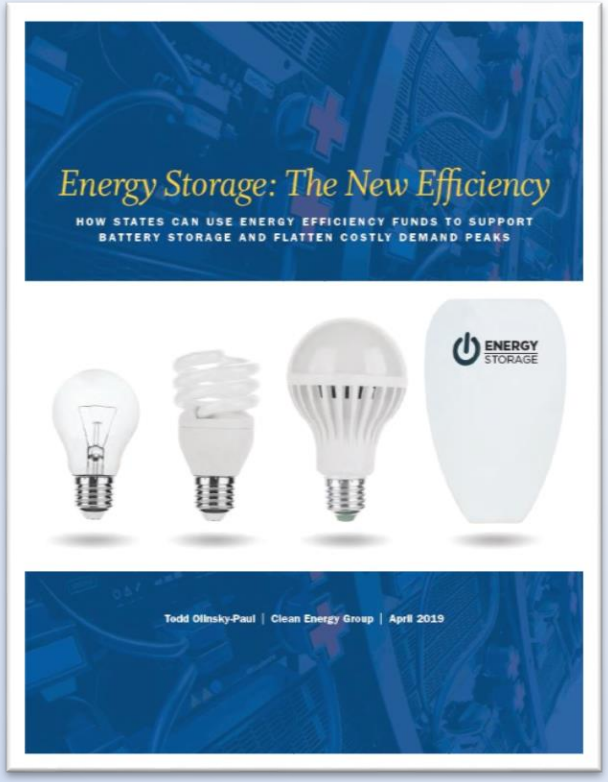


www.cleanegroup.org/ceg-resources/resource/energy-storage-the-new-efficiency

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** (not included in previous BCRs)
    1. Avoided power outages (combines value to customer and value to grid)
    2. Higher property values
    3. Avoided fines
    4. Avoided collections / terminations
    5. Avoided safety-related emergency calls
    6. Job creation
    7. Less land used for power plants (expressed in acres)

A Note on Vermont's Efficiency Program

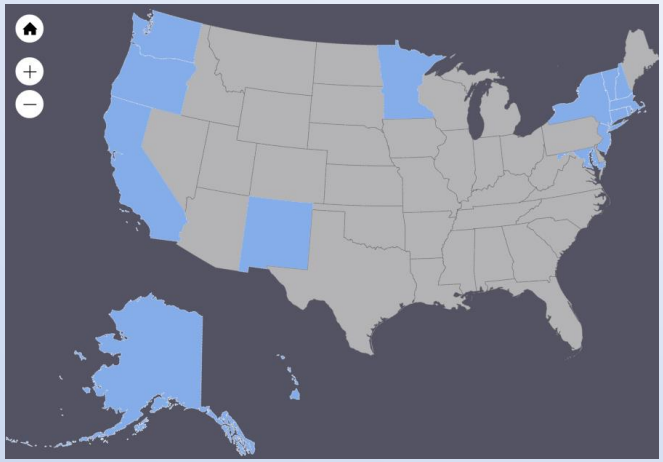
Unlike Massachusetts, Vermont has an efficiency utility that administers the state's efficiency program (Efficiency Vermont). Vermont is one of only a few states with this structure.

In Massachusetts, as in most states, the utilities administer the state's efficiency program. So when I refer to "program administrators" in Massachusetts, I'm talking about the electric utilities.

States Policy Landscape

MARKETS

1. **Studies/Roadmaps**
   - CA, NY, MA, NM, RI, OR, VT, NJ, MN, MD, others
2. **Grants/Demonstration projects**
   - NY, NJ, MA, CA, WA, OR, VT, CT, Others
3. **Longer-term programs**
   - Utility procurement targets
     - CA, OR, MA, NY, NJ
   - Rebates/Other incentives
     - Rebates (CA, NJ, NY)
     - State tax incentives (MD)
     - Storage adder in solar incentive program (MA)
     - IRP reform (NM, WA)
     - **Storage in EE plan (MA)**



In Massachusetts, two conditions needed to be met before storage could be included in the efficiency plan:

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

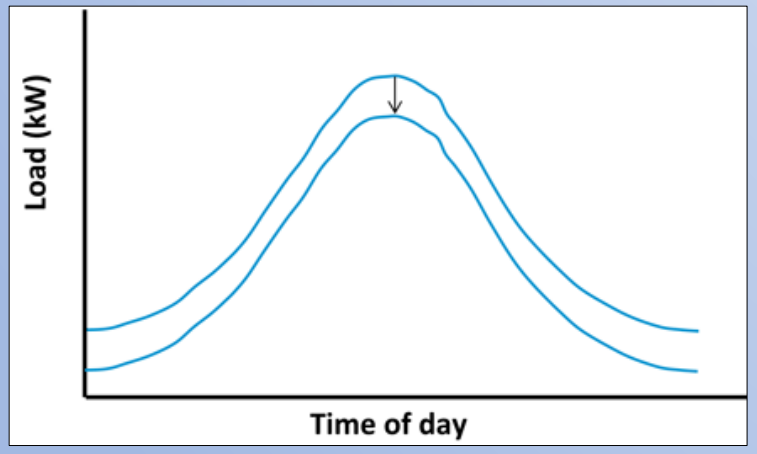
2. **Showing that storage is cost-effective.** In order for energy storage to qualify for the efficiency plan, it first had to be shown to be cost-effective. This meant that **storage had to be able to pass a Total Resource Cost** (TRC) test.

1. Redefining efficiency

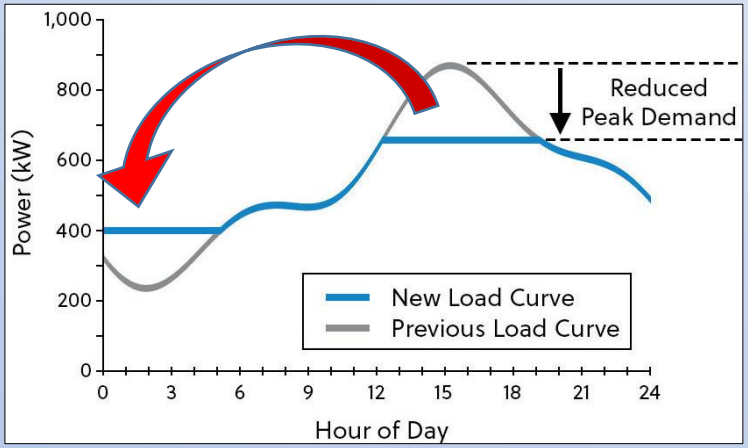
- **Traditionally, electrical efficiency is defined as "using fewer electrons"**
  - Storage does not normally qualify due to round trip losses
- **Massachusetts expanded the traditional definition of efficiency to include peak demand reduction**
  - Storage is well-suited to shifting peak demand, something 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

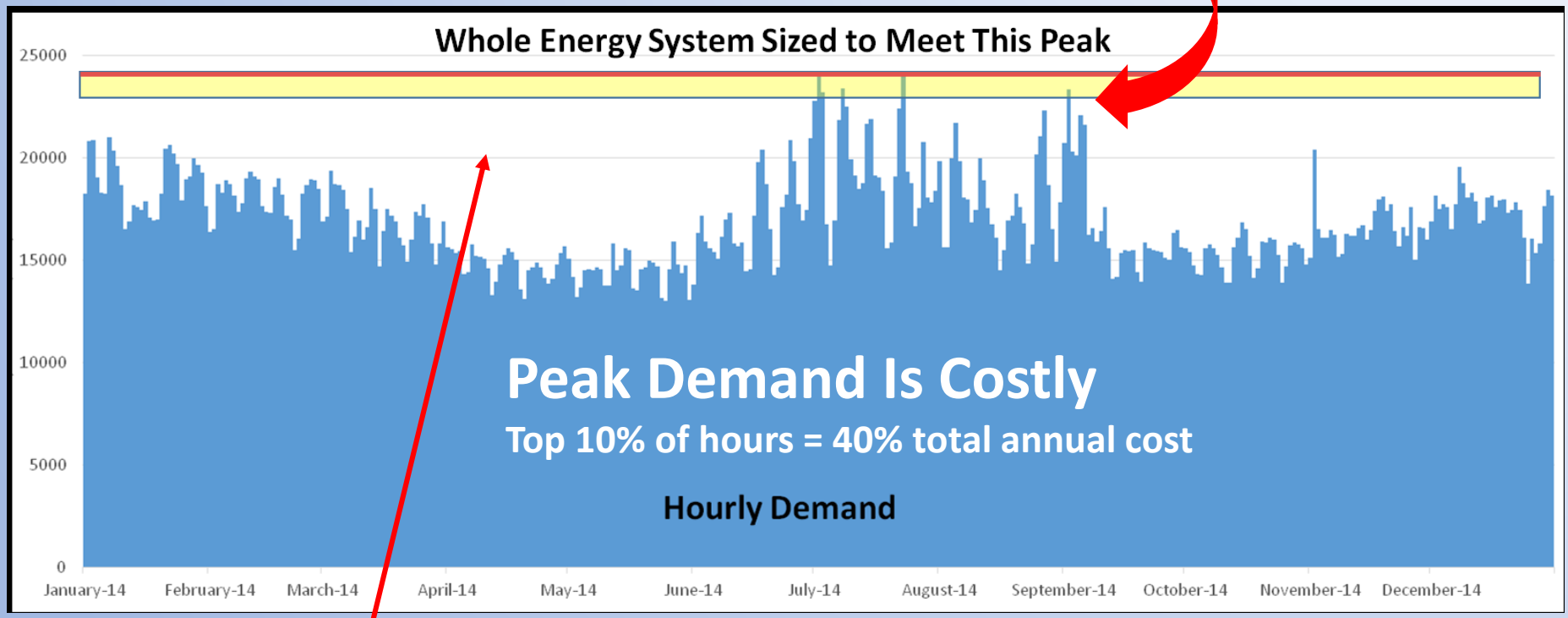


Peak demand reduction reduces peaks, but does not reduce net consumption



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

Note on Cost-Effectiveness Tests:

- Different states use different cost-effectiveness tests
- **Massachusetts** uses the Total Resource Cost test (TRC)
- **Vermont** uses the Societal Cost Test (SCT)
- The SCT adds in societal costs and benefits not captured by the TRC

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

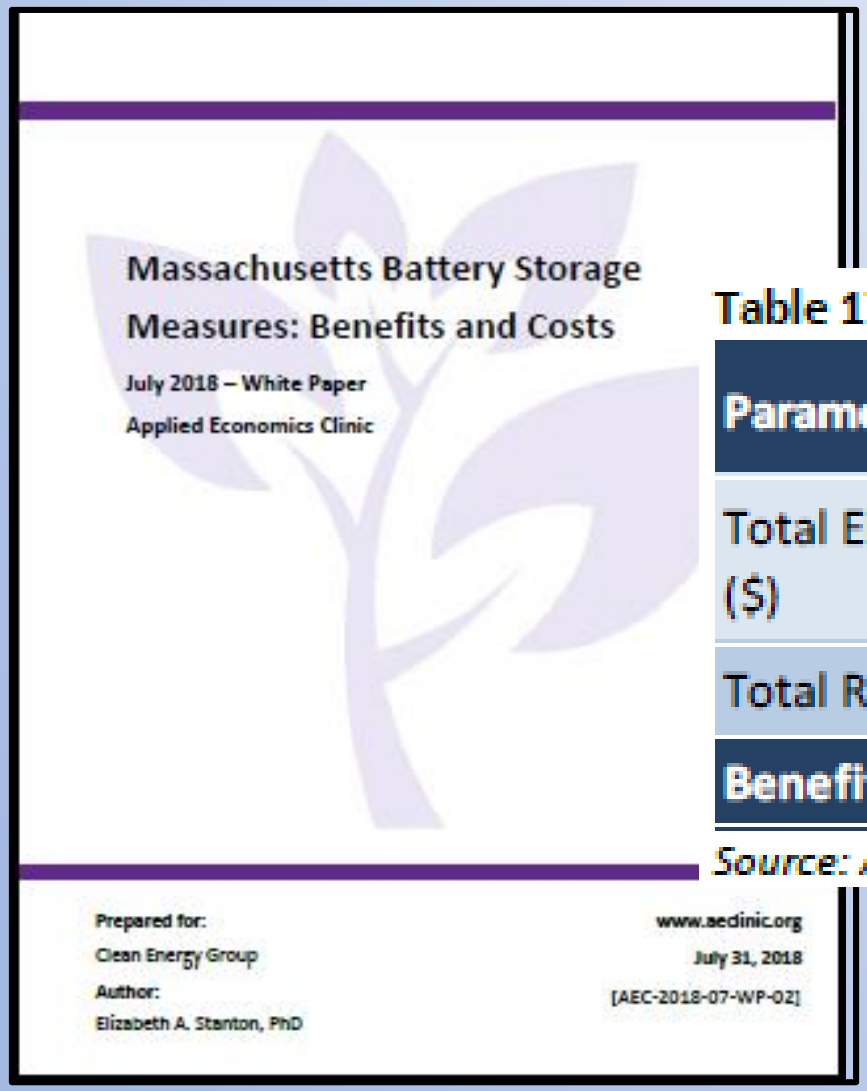


Table 17. Total benefits and costs

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			

Massachusetts Energy Efficiency Plan Incentive Structure

- Storage measures are in new Active Demand Reduction program
- **Incentive is for performance (load reduction), not installation**
- New BTM storage is eligible (with or without renewable generation)
- Residential and commercial customers may participate
- Two programs offered:
  - Daily discharge - $200/kWh (demonstration program)
  - Targeted discharge - $100/kWh summer, $25/kWh winter (full program offering)
- **Incentive payment based on *average load reduction*** during peak hours called by utility
- **Discharges will be called in *three hour blocks***
- Incentive paid at end of each year or season
- Utilities execute 5-year contract with customers
- HEAT loans available for storage

Project Economics Example

A commercial customer participating in the targeted dispatch program installs a 60 kW battery. Assuming perfect call response, 60 kW battery = 20 kw/hr load reduction averaged over 3-hour calls.

Incentive payment calculation: Assuming a 60 kW battery (maximum 20 kW load reduction average):

Summer payout = 20 kW x $100 = $2,000

Winter payout = 20 kW x $25 = $500

Annual revenue = $2,500

Note: a customer installing new solar+storage could qualify for energy efficiency performance incentive *and* the SMART solar rebate with storage adder

Customers can participate in these programs while engaging in net metering *and* demand charge management

Anticipated Results (Deployment)

- Massachusetts 2019-2021 Energy Efficiency Plan includes BTM storage as a demand reduction measure
- Incentive payments = **~$13 million** over three years
- Expected results = **~34 MW** new behind-the-meter storage

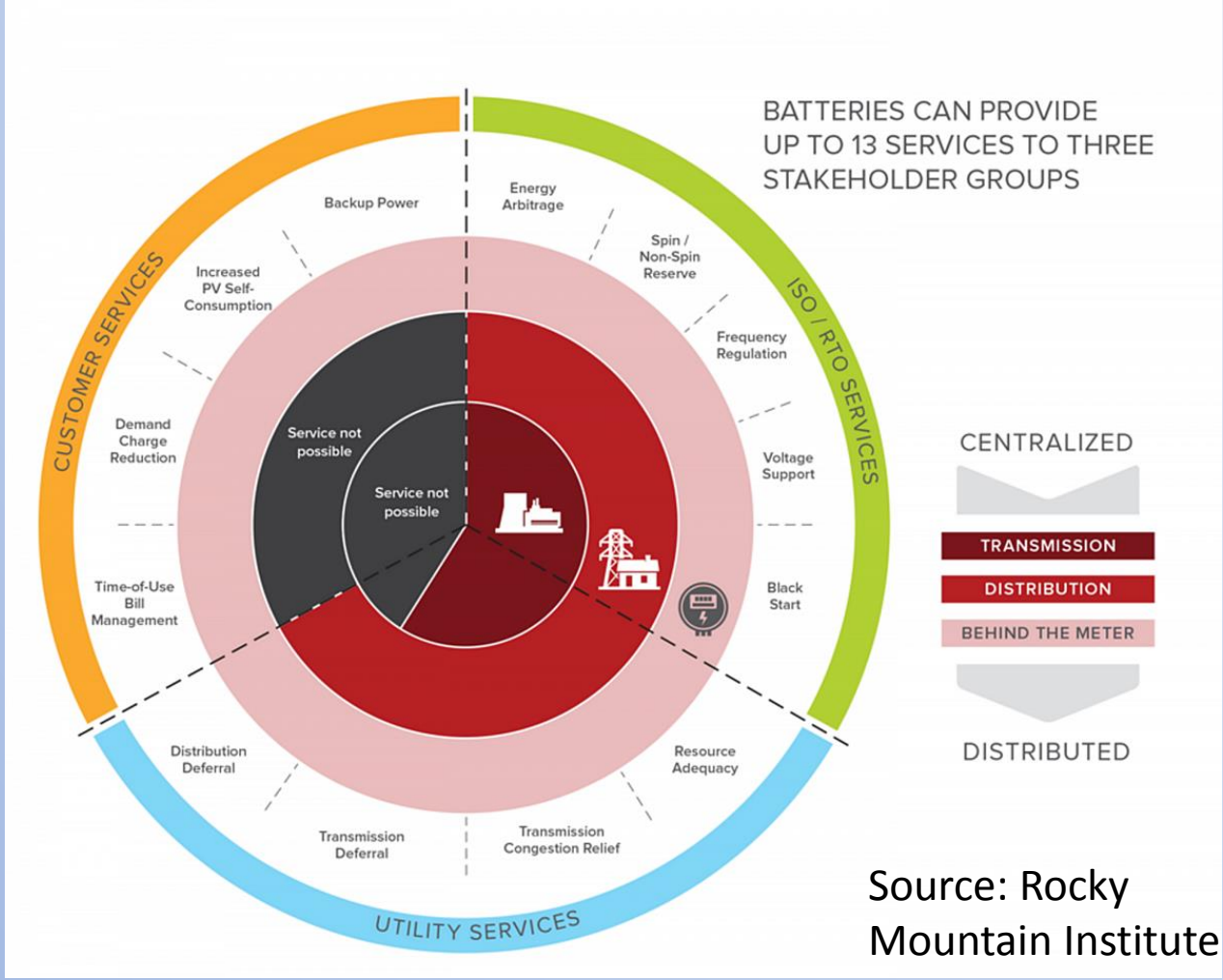
Shortcomings:

- No enhanced incentive, financing or carve-out for **low-income customers**
- No up-front **rebate**
- Numerous omissions mean **storage BCRs are likely too low**
- Daily discharge proposal downgraded to demonstration program
- Cape Light Compact proposal was NOT approved as proposed

What states should do

- **Expand the definition of energy efficiency to include peak demand reduction**
  - Energy efficiency program goals should include peak demand reduction goals
- **Fully integrate demand reduction measures, including battery storage, into state energy efficiency plans**
  - Battery storage becomes an eligible technology
- **Develop battery storage or demand reduction incentives within the energy efficiency program**
  - Incentives should include three basic elements:
    - Up-front rebate
    - Performance incentive
    - Access to financing
  - Incentives should include adders and/or carve-outs for low-income customers
  - Utility ownership should be limited
  - Third-party developers should be able to participate:
    - Market the program to customers
    - Provide private financing
    - Offer lease and PPA models
    - Aggregate capacity to meet program goals

- **Adopt, adapt and build on the economics analysis presented here**
  - Cost/benefit analyses of storage
  - Consider both the energy and the non-energy benefits of storage
  - Additional non-energy benefits of storage should be identified and valued



Source: Rocky Mountain Institute

Appendix B. Electric Efficiency Program Spending per Capita

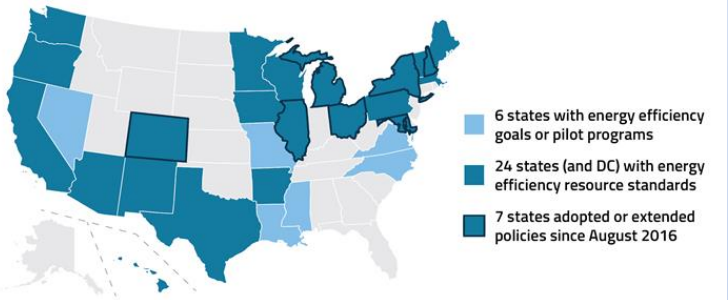
State	2017 electric efficiency spending ($ million)	$ per capita
Vermont	64.0	102.42
Massachusetts	620.8	91.11
Rhode Island	83.4	78.85
Connecticut	153.9	43.03
Oregon	158.8	38.75
Washington	281.8	38.67
Idaho	64.8	38.35
California	1,412.1	35.88
Iowa	112.3	35.82
Maryland	201.5	33.50
Minnesota	165.0	29.89
Illinois	348.1	27.27
Maine	31.1	23.38
Arkansas	68.8	22.88
New York	450.1	22.80
Michigan	220.4	22.20
District of Columbia	13.8	20.41
New Hampshire	26.1	18.55
Kentucky	84.7	18.09
Delaware	18.2	18.08
New Mexico	38.7	18.80
Wyoming	10.5	17.88
North Carolina	180.9	17.82
Colorado	98.2	17.38
Nevada	51.0	17.34
Utah	51.4	16.85
Oklahoma	66.0	16.82

State	2017 electric efficiency spending ($million)	$ per capita
Arizona	115.4	16.85
Missouri	100.0	16.41
Ohio	188.9	16.09
Hawaii	20.8	14.55
Indiana	87.0	13.12
Pennsylvania	164.1	12.84
New Jersey	113.5	12.69
Montana	13.0	12.43
Wisconsin	70.8	12.22
Texas	257.7	9.25
Florida	180.3	9.23
Mississippi	27.8	9.23
Tennessee	52.5	7.89
West Virginia	14.2	7.75
South Carolina	29.8	6.01
Georgia	55.5	5.38
Nebraska	10.2	5.34
South Dakota	4.4	5.08
Alabama	16.2	3.33
Louisiana	7.3	1.57
Virginia	0.1	0.02
Alaska	—	0.00
Kansas	—	0.00
North Dakota	—	0.00
US total	6,611.7	20.25
Median	88.2	23.38

Massachusetts Energy Efficiency Plan:
$2 Billion

All State Energy Efficiency Investment:
$9 Billion

Vermont Energy Efficiency Plan:
$150,436,604



The Vermont Context:

- **Unlike Massachusetts, Vermont's efficiency programs are mostly delivered by a third-party administrator (Efficiency Vermont).**
- **Vermont's efficiency program has a peak load reduction target, with incentives based on performance.**
- **Vermont's renewable energy standard has an "Energy Transformation" tier; the PUC has explicitly allowed distribution utilities to use energy storage to meet requirements.**

Vermont's 2018-2020 efficiency plan includes:

- Energy Savings Account Pilot Created in 2018 through Vermont legislative Act 150 "**Eligible measures will be expanded to include… demand reduction, and storage.**"
- "**Efficiency Vermont will continue to be eager to collaborate with distribution utilities and market actors to provide customers with optimally cost-effective approaches to energy-use management, including… energy storage, demand-response technologies**."
- **However: "Efficiency Vermont will not use EEC or TEPF funds to provide… incentives to customers with respect to… storage measures. Efficiency Vermont's role will be to provide general information about these technologies and to direct interested customers to the appropriate distribution utilities or market actors for further information regarding incentives and programs administered by such entities."**

Thank You

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