Innovation in Finance, Technology & Policy

SUBMITTED ELECTRONICALLY

May 31, 2017

Mr. William Lauwers
Massachusetts Department of Energy Resources
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Storage.DOER@massmail.state.ms.us

Re: Comments of Clean Energy Group on MA DOER Energy Storage Target Docket

Dear Mr. Lauwers:

Clean Energy Group (CEG) has developed some new information indicating that the size of the behind-the-meter (BTM) energy storage market in Massachusetts may be much larger than previously assumed. We provide that information to the agency as part of the pending DOER rulemaking docket regarding whether to set a utility energy storage mandate or target, and at what size; please consider this a filing in that matter.[1] However, this information might also be relevant to the larger set of state storage incentive strategies under consideration.

The attached memo lays out this new information and analysis.

In part, the information we present comes from the state's own *State of Charge* report. Over the last month we have had reason to go back and review the report, especially the part that analyzed the behind-the-meter "demand charge" market. On a close rereading, what we found was that the economic analysis presented is based on the lowest demand charges in the state, which occur in National Grid's territory. These low demand charges do not reflect the real costs of service paid by thousands of commercial customers in Massachusetts, especially in Boston and the surrounding municipalities, parts of Cape Cod, and the large areas of Western Massachusetts that are in Eversource's service territory.

[1] As there is no established process for receiving comments on the proposed agency action since comments were last submitted in January, 2017, we decided to submit this information to you in advance of the expected decision in late June. We apologize for the lateness of the submission, but this analysis was just completed in the last week, based in part on new information filed in the pending Eversource rate case. We leave it to the agency to decide whether to post this memorandum on the filed comments in that matter, thus sharing it with the other commenters.

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In addition to our ongoing work, an additional source of our information in this memo comes from new information filed in Eversource's current rate case (Docket 17-05). If we are reading these filings correctly, it appears to us that Eversource is proposing to put even more customers on rates with significant demand charges – meaning that if the proposed new rates are approved, the appetite among commercial customers in Massachusetts for demand charge management could be even larger.

Based on this new analysis and information, these are the key new findings of relevance to the pending DOER utility procurement decision, and associated policy making:

- In its BTM economic analysis, the State of Charge report drew from among the lowest, demand charge rates in the state (those in the NGrid service territory). If the State of Charge analysis had assumed a demand charge rate more representational of what Eversource customers are paying – say, $23/kW – *annual savings would be four times higher than the assumed savings in the report*, resulting in a very different conclusion regarding the existing economic opportunities for BTM storage in Massachusetts.

- Our research and that of other organizations indicates that $15/kW is the demand charge threshold above which BTM storage becomes economic for demand charge management. Based on information disclosed in Eversource's pending rate case, *tens of thousands of commercial customers in Eversource's Boston and Cape Cod service territories are subject to demand charges greater than $15/KW, meaning that these customers may be able to economically install BTM energy storage for demand charge management* – not in some distant future, but today.

- Furthermore, it is likely that many of these Eversource customers pay demand charges significantly higher than $15/KW. *Current Eversource demand rates in Boston are comparable to those in the highest demand charge utility territories in the country,* such as in San Diego Gas & Electric territory in California; in both cases, it appears that some commercial customers pay demand charges of more than $30/kW, twice the threshold for economic use of energy storage. For these customers, BTM energy storage could be not merely economically viable, but a money-maker.

- If Eversource's proposed changes to current demand charges in its pending rate case are accepted, we believe that many more commercial customers – *up to 90,000 in total, according to the Eversource filed materials* – will soon pay combined distribution and transmission demand charge rates that make energy storage a potential economic option for demand charge management.

- If even half of these Eversource customers installed BTM energy storage, savings would be enormous. Extrapolating from the State of Charge analysis and Eversource rate case filings, if 45,000 Eversource customers saved about $16,000 dollars a year each in demand charge reduction using energy storage, *that amounts to a total savings of $720 million per year. Over a 10-year period (the current standard for lithium-ion battery warranties), this amounts to a total of $7.2 billion.*

- These savings, if true, are not being captured in the state, *a significant market failure that warrants policy intervention.*

In summary, we think there is a large and growing market for behind-the-meter energy storage in Massachusetts, based on demand charge management alone, which was significantly understated in the *State of Charge* report.

Our concern now is that DOER and other state agencies may be proceeding with the development of energy storage policy based on the notion that energy storage for behind-the-meter commercial customers is not yet economically viable in Massachusetts, when the reality is otherwise.

Our hope is that the new information contained in this filing might encourage the agency to be more aggressive in setting mandates and targets in the current docket. *In particular, a BTM storage carve-out in utility procurement targets is both needed and warranted, and this should be combined with more robust and developer-friendly incentives.* The need for this is indicated by the fact that BTM projects are already economic for many C/I customers in Massachusetts, but are not being pursued with any vigor in the absence of utility targets and significant, developer-friendly incentives.

Further, we believe that this information should inform renewed discussion, between policy makers and stakeholders, of the potential energy storage market in Massachusetts. This discussion should include not only a reevaluation of the BTM economic picture for storage, but also the appropriate scope, type and level of storage incentives and other policies that should be implemented in the state, to capture this nascent market.

We hope the information presented below is helpful, and will be happy to discuss at your convenience.

The analysis of the behind-the-meter demand charge management market opportunity presented in *State of Charge* is so conservative that it misses the actual market.

The most important market driver for behind-the-meter energy storage across the nation is demand charge management. Batteries installed behind a commercial/industrial customer's

meter can be used to shave peak demand, and thereby reduce utility demand charges, which are typically based on the customer's 15-minute peak demand each month.

Demand charges vary by utility territory; the higher the demand charge, the more the customer can potentially save through demand charge management. In many areas of the country, demand charges are high enough to make energy storage a sound economic proposition even without subsidies; with modest subsidies, they make energy storage an extremely favorable investment.

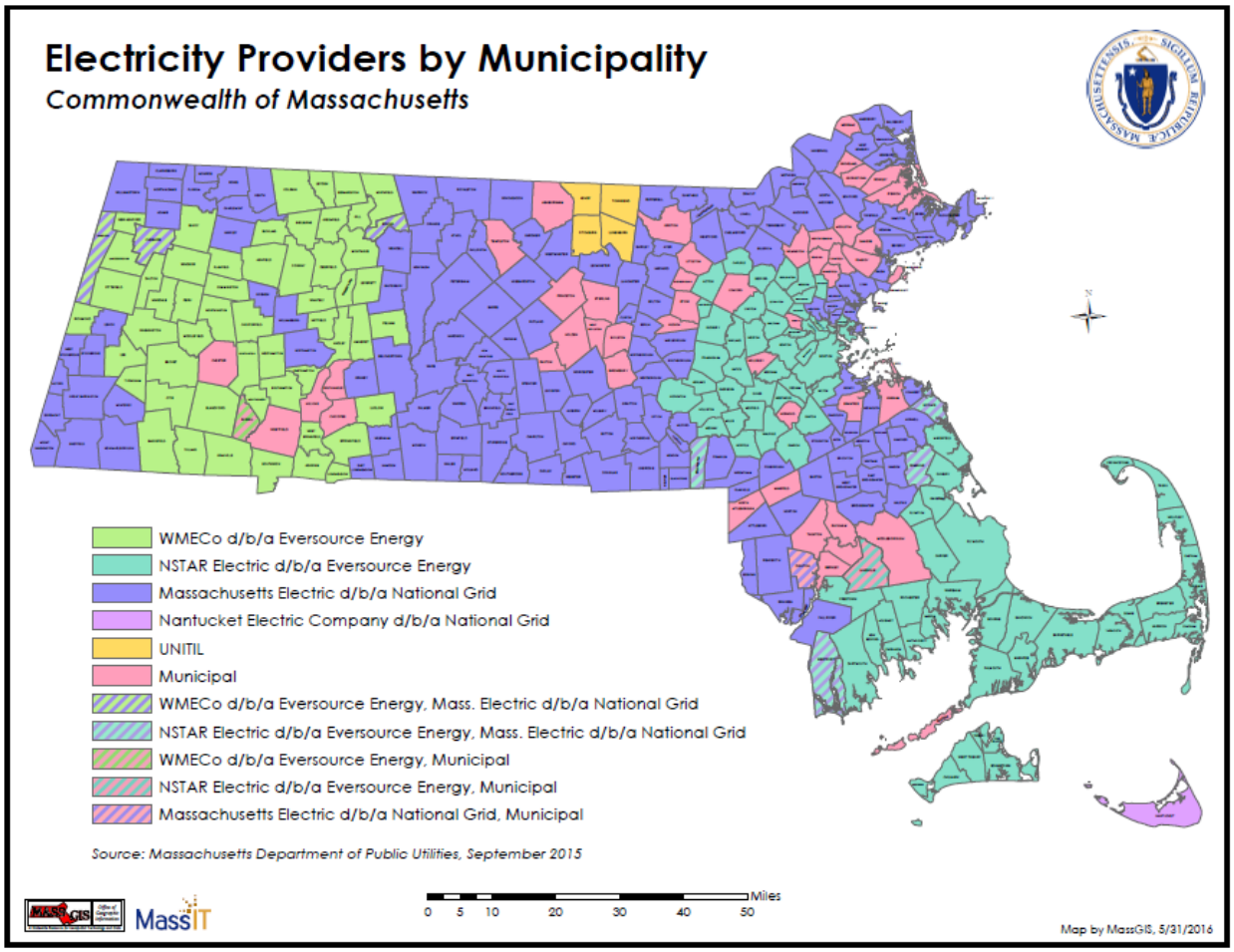
In Massachusetts, demand charge rates vary greatly between the two main utilities, National Grid and Eversource, as shown in the *State of Charge* report at Table 2-1 (SOC, p53):

Utility / Demand $/KW	Commercial (non-summer / summer)	Industrial (non-summer / summer)
National Grid	$6.00	$3.92
Eversource NStar	$17.37 / $41.25	$19.15 / $25.12
Eversource WMECO	$13.36	$10.74
Unitil	$9.58	$7.88

Table 2-1: Demand charges by utilities in Massachusetts as of July 2016[94]

As can be seen in Table 2-1, National Grid's C/I demand charge rates range from $3.92 - $6.00/kW. These rates are quite low and do not provide a favorable market for storage.

By contrast, Eversource's rates, according to the report, range from $10.74 - $41.25/kW, with the higher end of the range located in the NStar territories (Boston area and Cape Cod). Eversource's territory is shown in the light green and light blue areas on the map below, with the highest demand charge areas being light blue:



As shown above, Eversource serves Boston and its densely-populated suburbs, meaning many of the state's commercial/industrial customers pay Eversource's highest demand charge rates. Despite this fact, the initial *State of Charge* demand charge management analysis (SOC, p53-54) assumes the typical customer is billed under the National Grid G-3 rate plan.[2] This is a time-of-use plan with very low demand charges and thus, very little opportunity to use energy storage to reduce demand charges:

[2] National Grid's G-3 rate is only applicable to larger commercial customers with a peak demand of at least 200 kW. It is worth noting that smaller commercial customers are also subject to demand charges. For instance, Eversource's NStar B2 General Service (G-2) rate tariff is designed for any customer with monthly peak demand of 10 kW or greater, and has very high demand charge rates.

National Grid G-3 Rates for Delivery Service

Customer Charge	$223.00/month
Distribution Demand Charge	$5.76/kW
Distribution Charge Peak Hours* Off-Peak Hours*	 1.617¢/kWh 0.864¢/kWh
Transmission Charge	2.059¢/kWh
Transition Energy Charge	0.058¢/kWh
Energy Efficiency Charge	0.957¢/kWh
Renewables Charge	0.050¢/kWh

By choosing one of the lowest rates in the state for analysis, the report produced a finding that minimized the current, existing market opportunity for demand charge management. In fact, the analysis (SOC, p54) found that a 200 kW lithium ion battery located behind a commercial customer meter could save only $4,085/year by reducing demand charges. That is not a market worth pursuing at current storage prices.

But this low savings result is accurate only if one assumes that most customers in the state are paying those low demand charge rates. The *State of Charge* report itself notes that "on other utility rate structures such as Eversource and Unitil, industrial and commercial customers can achieve far greater demand charge reductions since the $/kW demand charges are higher in those utility rate structures." Unfortunately, this "far greater" market opportunity is never analyzed in the report.

We assume that the report's authors used a worst-case scenario for assessing the state's demand charge market to produce a defensibly conservative result. This cautious approach unfortunately resulted in analysis that does not begin to fully capture the actual, representative scale of the storage market as it exists today in Massachusetts.

If the State of Charge analysis had assumed a more reasonable demand charge rate – say, $23/kW, which would make sense for Eversource territories – annual savings would be around $16,000 and payback of installed costs would be reached four times faster.

The same ultra-conservative approach influenced the *State of Charge* value-stacking analysis for C&I behind-the-meter systems (SOC, p125):

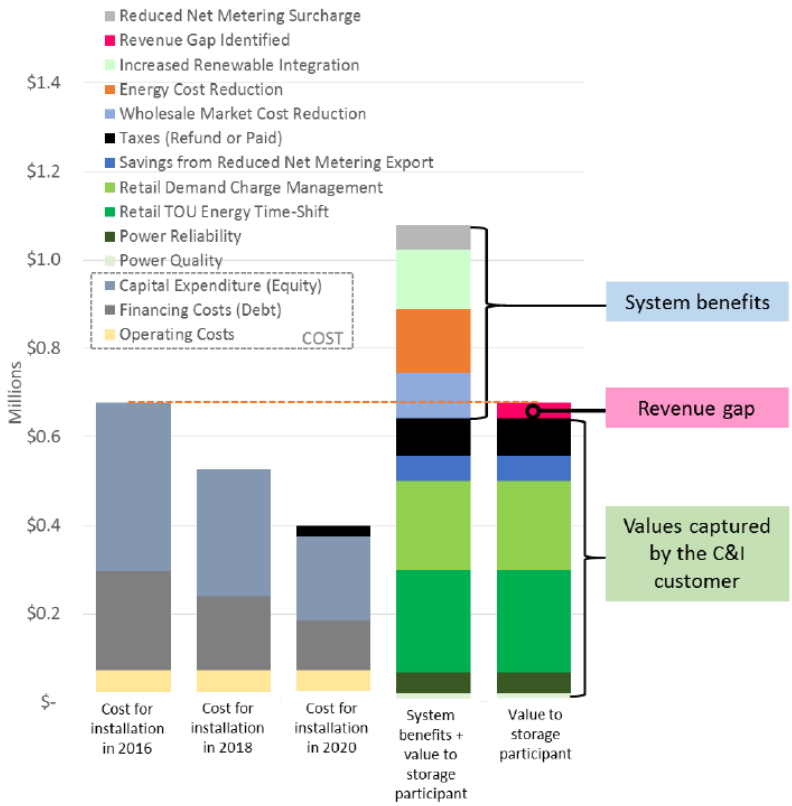


Figure 5-9: Illustrative Example of Cost-Benefit Analysis for Behind-the-Meter C&I Customer, Pairing 1MW/1MWh Energy Storage with On-Site Solar Generation[161]

In this analysis, the value the customer realizes from demand charge management (light green bar) is based on a "blended" demand charge rate of $7.84/kW.[3]

But even the lowest Eversource rate is significantly higher than the rate used in this analysis. Again, using a more reasonable rate of $23/kW would result in nearly three times the savings from demand charge management, easily overwhelming the small revenue gap identified in the analysis. But the study fails to present any analysis using a higher demand charge rate, instead concluding that "benefits captured by the C&I customer can only readily justify the cost of energy storage currently when in utilities with high demand charges." The study does not reveal how many commercial customers in the state fall into this "high demand charge" group. Based on information included in Eversource's pending rate case, it appears that tens of thousands of customers fall into this group.

But there is a second problem here: in addition to minimizing the economics of demand charge management, the report's value stack analysis also fails to adequately flag the beneficial effects

[3] There is some confusion here as the footnote on SOC p124 notes that the blended rate is based on NGrid rate of $3.92 and Eversource rates of $8.59 and $14.56, depending on season; but the rate summary table on p53 doesn't show any Eversource rate lower than $10.74.

of rapidly declining installed costs for energy storage. Based on the chart above, declining costs alone (the three bars on the left) should result in monetizable benefits outweighing costs by 2017, even using the unrealistically low demand charge rate of $7.84/kW. This means that, by the time the ink was dry on the report, positive economics for commercial behind-the-meter solar+storage systems existed not only in Eversource and Unitil territories, but across the state.

The bottom line: when the *State of Charge* report was written a year ago, it did not address an enormous untapped Massachusetts market for behind-the-meter energy storage that existed even then. This market is likely even more lucrative and widespread today, and will grow more so by the time state policy, which was to be based on this report, will be crafted and implemented.

There is already a large Massachusetts market for economical demand charge management using behind-the-meter energy storage

That there is such a large untapped storage market based on demand charge rates is not just speculation. CEG has conducted several analyses identifying economic opportunities for BTM energy storage demand charge management. Eversource's disclosure of the number of customer on several high demand charge rate tariffs in their pending rate case reinforces the large market potential in MA for BTM storage.

Based on the pending rate case, it appears that*:*

- *Tens of thousands of commercial customers in Eversource's Boston and Cape Cod service territories likely pay demand charges greater than $15/KW, a level that supports economically installed energy storage for demand charge management – not in some distant future, but today.*

- *What this means is that at today's installed costs, these customers could potentially save more money through demand charge management alone than they would pay for an energy storage system.*

- *Furthermore, it is likely that many of these customers pay demand charges significantly higher than $15/KW; for these customers, energy storage could be not merely economically viable, but a money-maker.*

The $15/KW threshold is based on findings from several recent reports,[4] including *The Economics of Commercial Energy Storage in the U.S.* by GreenTech Media. GTM Research

[4] See also *The New Economics of Energy Storage* by McKinsey & Company, http://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/the-new-economics-of-energy-storage

analyzed rate structures across 51 utilities to determine the opportunity for demand charge management for commercial energy storage customers. It found that demand-charge rates of at least $15 per kilowatt per month are necessary to achieve favorable economics for energy storage today, although that threshold falls to $11/KW by 2021 due to declines in the cost of storage.

It appears that customers and other interested parties possibly are not aware of this market potential beyond the passing reference to Eversource rates in the *State of Charge* report. If this is so, we think that something should be done to ensure that utility procurement targets and developer incentives *recognize and are based on representative rate analysis that reflects actual economic reality and market potential in Massachusetts*.

Energy Storage for Demand Charge Management in Boston: An Example

Our analysis that higher demand charges can drive real economic projects in Massachusetts is not theoretical. We have worked extensively with developers, utilities, engineering firms, national labs and others to develop rigorous economic analysis of several behind-the-meter energy storage projects, including the following case in Eversource territory.

Boston Housing Authority Example

Through our Resilient Power Project, Clean Energy Group has been working with the Boston Housing Authority (BHA) to assess the feasibility of deploying a combined solar PV and battery storage system at one of their multifamily affordable housing properties. BHA is interested in exploring the combination of solar and storage technologies as both cost-saving measures and as a way to improve the resiliency and safety of the building for its tenants. By designing the system with the ability to island during grid outages, BHA can ensure that critical loads, such as lighting, mobility, communications, and refrigeration, continue to be powered during an emergency.

The storage component of the system is essential to BHA not only due to the resiliency benefits that a solar-only system cannot provide, but also to manage high demand charges. Under its current Eversource electric rate tariff, the affordable housing property faces a summer peak demand charge of nearly $30 per kilowatt. Overall, demand charges account for 36 percent of the building's annual electricity expenditures.

Using an estimated solar array size of 150 kilowatts, the energy software company Geli analyzed 33 months of 15-minute interval electricity usage data to determine economically optimal battery storage system sizing. **The analysis found that a 30 kilowatt/45 kilowatt-hour battery system could save BHA around $8,000 per year in demand charges. This size storage system was determined to have an impressive payback period of 4.4 years, more than a year sooner than the estimated payback of the solar system alone.**

While a combined solar and storage system appears to be very promising investment opportunity for the public housing authority, the storage portion of the project may be difficult to develop due to a series of existing market failures, such as difficulty in securing project financing due to lack of an extensive track record for storage system technology performance and return on investment. It is also worth noting that a battery system of this size may be limited in its potential to meet critical power needs during an emergency. The addition of a utility procurement contract for storage capacity would both strengthen the financeability of the project and allow for the economic deployment of a larger storage system, allowing for increased building resiliency and greater safety for affordable housing residents during disasters.

BHA example economics:

						Year 1 savings		
	Size	Capital cost	Federal ITC	Depreciation	Net cost	Energy charge	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

Eversource filings in the current rate case indicate that the number of customers on demand charges in both Eastern and Western Massachusetts may increase.

We are aware that Eversource is proposing to consolidate 55 current rate classes into 10 new rate classes, and to change its method of assessing demand charges from a system of higher summer and lower winter charges, to a stepped increase system under which customers will pay more per kW as their demand increases. Our preliminary analysis is that these changes will expand the number of customers paying demand charges in Massachusetts, and will spread those charges more broadly across both the customer base, and the state.

The outcome, we think, if these rate changes are adopted, is that while one or two classes of customers may pay lower demand charges under the proposed new rates, many more customers – *up to 90,000 in total according to the Eversource tables below* – will pay combined distribution and transmission demand charge rates that make energy storage an economic option for demand charge management.

In these tables, the proposed rates G-1.DMD, G-2, G-3 and G-4 all pay demand charges. As an example of the significant cost of these proposed charges, more than 85,500 general service

customers in the G-1 demand rate class would face combined distribution and transmission demand charges ranging from $12.52/kW to $22.12/kW. Any customer in this class exceeding

10kW demand would pay the highest rate. Larger customers, who fall into the G-2, G-3 and G-4 rate classes, would pay even high per-kilowatt rates, with the largest customers paying $29.70/kW.

NSTAR Electric Company
d/b/a Eversource Energy
Number of General Service Customers Mapped to New Rate Classes
July 2015 through June 2016

Line No.	Service Area (A)	Current Rate Classes (B)	G-1.NDMD (C)	G-1.DMD (D)	G-2 (E)	G-3 (F)	G-4 (G)	Total (H)
1	Boston	G-1 Non Dmd	55,529	20				55,549
2	Boston	G-1 Dmd		17,021				17,021
3	Boston	G-2	2	28,510	1,114	17		29,643
4	Boston	G-3		52	101	258	66	477
5	Boston	T-1	27	13				39
6	Boston	T-2		854	1,443	707	22	3,026
7	Cambridge	G-0	4,353	1,021				5,375
8	Cambridge	G-1		1,986	68	2		2,056
9	Cambridge	G-2		123	193	122		437
10	Cambridge	G-3		4	9	51	8	72
11	Cambridge	G-4		34				34
12	Cambridge	G-5	16	34	6	3		59
13	Cambridge	G-6	9					9
14	South	G-1 Annual	27,576	13,421	346	5		41,348
15	South	G-1 Seasonal	2,696	698	10			3,404
16	South	G-2		71	299	106		476
17	South	G-3		7	6	63	9	85
18	South	G-4		26	2			28
19	South	G-5	679	113	6			798
20	South	G-6		1	4	1		7
21	South	G-7 Annual		422	9	2		432
22	South	G-7 Seasonal		82	2			84
23	South	CON 13.2kV			1			1
24	South	CON 115kV				1		1
25	Total		90,887	64,512	3,618	1,337	106	160,460
26	Boston	Total	55,557	46,470	2,658	982	88	105,756
27	Cambridge	Total	4,378	3,202	276	178	8	8,042
28	South	Total	30,951	14,841	684	177	9	46,663

Western Massachusetts Electric Company
d/b/a Eversource Energy
Number of General Service Customers Mapped to New Rate Classes
July 2015 through June 2016

Line No.	Current Rate Classes	G-1.NDMD	G-1.DMD	G-2	G-3	G-4	Total
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
1	23 (Commercial)	17	-	-	-	-	17
2	24	-	200	1	-	-	201
3	G-0	404	20,232	181	1	-	20,818
4	G-2	-	641	424	4	-	1,069
5	T-0	-	9	-	-	-	9
6	T-2	-	7	42	206	-	255
7	T-4	-	9	6	-	-	15
8	T-5	-	-	-	2	18	20
11	Total	421	21,098	654	213	18	22,404

Based on these proposed rates, many Eversource C/I customers on both sides of the state will soon have the potential to save an enormous amount of money by using energy storage to control demand charges – if the proper policies are adopted to support the underlying market economics. Conversely, if these customers are not aware of the opportunity, or cannot install storage due to regulatory barriers or high first costs, a significant savings opportunity will have been lost. Other clean, behind-the-meter technologies, such as energy efficiency and solar, cannot be effectively used to reduce demand charges, unless combined with energy storage.

The economic implications of this are huge. If even half of the Eversource customers who could economically do so installed BTM energy storage, savings would be enormous. Extrapolating from the State of Charge analysis, 45,000 Eversource customers (half the 90,000 customers shown in the tables above) saving about $16,000 dollars a year each in demand charge reduction (four times the savings amount indicated in *SOC*, based on demand charges four times higher) amounts to a total savings of $720 million per year. Over a 10 year period (the current standard for lithium-ion battery warranties), this amounts to a total of $7.2 billion.

These levels of savings are not fanciful – in fact, they are quite conservative. Based on our work with actual commercial customers in Massachusetts, we have found potential savings from the installation of energy storage for demand charge management alone ranging from $7,600/year for a multifamily housing facility, to $63,500/year for a hospital.

The Massachusetts market mirrors the California market; what is lacking in Massachusetts is the right policies.

This picture of a robust and growing Massachusetts market for energy storage strikingly parallels the value-driven, behind-the-meter markets in California.

Current Eversource demand rates in Boston are comparable to those in the highest demand charge utility territories in California (such as San Diego Gas & Electric); in both cases, it appears that some commercial customers pay demand charges of more than $30/kW, twice the threshold for economic use of energy storage. In fact, Boston and some areas in California have the highest demand charges in the nation. [5]

To capitalize on underlying economics and support the development of new markets, California has put in place two significant policies: A large utility procurement mandate of 1.325 GW of energy storage by 2020, which includes carve-outs for behind-the-meter (customer sited) systems in each utility territory; and the Self-Generation Incentive Program (SGIP), which was recently recapitalized and focused almost entirely on providing support for behind the meter energy storage projects.

Since Massachusetts is currently engaged in developing a utility procurement target and incentive programs for energy storage, it's worth looking at some details of California's successful policies. It's particularly worth noting that the larger California utility mandate also includes requirements for behind the meter project investment – a detail that could be critical given current and projected behind-the-meter storage economics in Massachusetts. In fact, we believe that with proper targets and incentives, the behind-the-meter storage market in Massachusetts could grow much faster than assumed in the *State of Charge* report.

The California utility mandate for behind-the-meter systems has been clarified and expanded several times by the California PUC. Notably, in February of this year, CPUC directed the utilities to incorporate up to 166.66 MW of distributed energy storage systems into their 2018 energy storage procurement plans. CPUC has also issued a recent order requiring the state's three investor-owned utilities to procure an additional 500 MW of behind-the-meter storage.

As shown in the table below, the California utilities have made great strides towards fulfilling their mandatory energy storage targets, and are integrating storage procurement into their ongoing procurement activities rather than solely relying on results from energy storage specific procurements. Southern California Edison, in particular, has already exceeded its 2016 procurement target, including its customer-side grid domain target, but continues to solicit additional energy storage resources.

The data in the table below does not include all California utility procurement through the completion of 2016; according to the CPUC, accounting for anticipated additional projects would result in a total remaining storage obligation closer to 620 MWs.

[5] CEG has done several reports on demand charge rates and energy storage in California. See, e.g., http://www.cleanegroup.org/ceg-resources/resource/closing-the-california-clean-energy-divide/

Table 2: Energy Storage Procurement to Date (MWs) - Data as of February 2017

Service Territory	Procurement Approved by Commission Customer/Distribution/Transmission			TOTAL BY UTILITY	Remaining Obligation
PG&E	9.63[13]	16[14]	50[15]	*75.63*	504.37
SCE	190.14[16]	52.22[17]	100[18]	*342.36*	257.78[19]
SDG&E	13[20]	43.65[21]	40[22]	*96.65*	68.35
TOTAL BY DOMAIN	192.63[23]	95.87	190	*478.5*	846.5

The CPUC also stated in its February order that "proposed programs and investments should prioritize distributed energy storage systems to public sector and low-income customers, and should demonstrate ratepayer benefits, seek to minimize overall costs and maximize overall benefits, reduce dependence on petroleum, meet air quality standards, and reduce greenhouse gas emissions while not unreasonably limiting or impairing the ability of nonutility enterprises to market and deploy energy storage systems." This provides some sense of the scope of additional, non-monetizable benefits expected from behind-the-meter energy storage systems, in addition to demand charge management, and it also shows the CPUC's intent to include public sector and low-income customers in the benefits of energy storage deployment.

In addition to utility mandates, California's SGIP incentive program has also been highly successful in stimulating customer-sited storage deployment. In this regard, it is worth noting the immense scale of the California energy storage incentives. The SGIP budget through 2019 is approximately $566,692,308. Of this amount, 79% is reserved for energy storage projects, with the balance going to support renewable generation. Recently, an initial $50 million offering (SGIP Step 1) was almost fully subscribed within 24 hours; the California Solar Energy Industries Association estimates that SGIP Step 1 will support 340 large-scale battery systems and 1,400 residential systems. This is in addition to approximately 380 non-residential behind-the-meter storage systems already installed in CA through SGIP.

We don't know the economics of why each of these systems was installed, but it's likely that the vast majority are being used for demand charge management. It is worth noting that both Stem and Advanced Microgrid Solutions have secured energy storage capacity contracts with California utilities for behind-the-meter systems that also deliver demand charge savings to host commercial facilities. This shows the productive interplay between utility procurement mandates and the economics of demand charge management.

Behind-the-meter storage can move fast, once appropriate targets and incentives are in place

Note that in the above table, overall customer-sited procurement achieved to date under the California utility procurement mandate exceeds distribution- and transmission-based procurement on a MW basis – even though far greater MW targets are set for utility systems on

the transmission and distribution grids. In fulfilling their mandatory targets, California utilities have incentivized nearly 193 MW of storage behind customer meters; apparently, these utilities found it easier and faster to work with customers and developers to install small-scale, BTM storage, than to site larger-scale storage on their own systems.

By contrast, the Massachusetts *State of Charge* analysis expects behind-the-meter C&I systems to account for only 6% of its recommended 1,766MW of deployed energy storage (SOC, p110). This may indicate a significant underestimation of the potential of the behind-the-meter energy storage market by the report's analysts.

We are aware that in some cases, the potential economic benefit to be gained by installing BTM storage are limited by relatively flat customer load curves; and for this reason, we take a conservative approach in calculating the number of customers that might economically install storage in Massachusetts. However, we are aware of no reason for customer load curves to be fundamentally flatter in Massachusetts than in California, where BTM storage is doing very well and has a very positive economic outlook, with demand charge rates very similar to large portions of eastern Massachusetts.

Implications for energy storage policy in MA

We understand that a conservative approach was taken in the *State of Charge* report. But we believe the policy making process should be based on more representative and current information.

Our concern is the degree to which the *State of Charge* analysis may form the basis for a position that, in implementing new policy, caution is warranted because the market for economic energy storage in the state is small, and margins are thin. In fact, the opposite seems to be true – there is a large, untapped, lucrative energy storage market today in the state based on existing utility rate demand charges – a market that can only be accelerated and captured by smart storage policy.

Through our work with both commercial customers and utilities in Massachusetts, we have developed an understanding of the kinds of incentives and policy that would support project development given current economic realities in the state, including demand charges for small- and medium-sized commercial customers, ICAP tags for large commercial customers, and capacity and transmission charges for utilities.

All these charges point to the major conclusion of *State of Charge:* the grid is overbuilt in Massachusetts to meet peak demand, with large portions of the state's cost of electricity going to pay for relatively small amounts of power delivered at peak demand times. To address this problem, demand management must be achieved at all levels of the system, including by commercial customers. Energy storage provides an efficient, economic, and non-polluting method to achieve these state goals.

Given the information we have presented here, we think the following policy steps would be both prudent and timely:

- The information in this memo should be reviewed and vetted by DOER and other parties
- A discussion should be staged for stakeholders and policy makers to consider potential impacts on state policymaking
    - Size of state utility procurement target
    - Potential carve-out for BTM systems in state utility procurement target
    - Potential for developing more developer-friendly BTM storage incentives, such as rebates, tax incentives and storage RECs/adders – is the SMART solar program sufficient to move this very large market?
- A process should be initiated to review and assess this information for future regulatory reform, including addressing interconnection restrictions, opening new markets for BTM systems, overcoming regulatory barriers etc.
- Given the frequent and beneficial pairing of solar and storage, the implications for solar programs and customers should be addressed. National Grid is already telling customers they can't net meter if they install energy storage, and Eversource has proposed to assess demand charges on all residential net metering customers. This Eversource rate proposal has obvious serious implications for residential solar customers and for the state's commitment to clean energy, as well as for the energy storage market.

We hope this discussion has been helpful to DOER. We will continue to forward new information and analysis, and as always we are available to discuss or answer questions if any arise.

Sincerely,

Lewis Milford	Seth Mullendore	Todd Olinsky-Paul
President	Project Director	Project Director