SUBMITTED ELECTRONICALLY

January 27, 2017

Commissioner Judith Judson
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, Massachusetts 02114
Storage.DOER@massmail.state.ma.us

Re: Comments of Clean Energy Group, Union of Concerned Scientists, and Acadia Center Regarding Policies to Encourage the Cost-Effective Deployment of Energy Storage Systems

Dear Commissioner Judson:

Clean Energy Group (CEG) is pleased to submit the following comments to the Massachusetts Department of Energy Resources (DOER) in round 2 of stakeholder comments in support of its decision to adopt targets for energy storage utility procurement, as per *An Act to Promote Energy Diversity, Chapter 188 of the Acts of 2016 ("Energy Diversity Act").* These comments are also submitted on behalf of Union of Concerned Scientists (UCS) and Acadia Center (AC), who fully join in support of the positions taken here. CEG looks forward to continuing to provide comments throughout this process. CEG, UCS and AC also support the comments expected to be filed by Conservation Law Foundation, Northeast Clean Energy Council, and Boston LISC.

Clean Energy Group is a leading national, nonprofit advocacy organization working on innovative policy, technology, and finance programs in the areas of clean energy and climate change. CEG's Resilient Power Project has been working over the past three years to accelerate market development of clean energy resources paired with energy storage technologies for resilient power applications that serve low-income communities and vulnerable populations during disasters and power disruptions, and to address climate adaptation and mitigation goals through expansion of reliable renewable energy deployment.

The Union of Concerned Scientists, headquartered in Massachusetts, puts rigorous, independent science to work to solve our planet's most pressing problems. On behalf of its more than 500,000 supporters and network of approximately 17,000 scientists—including more than 16,000 supporters in Massachusetts—UCS combines technical analysis and effective advocacy to create practical solutions for a healthy, safe, and sustainable future. This includes working to develop and deploy clean energy policies that lower greenhouse gas emissions, mitigate the worst of climate impacts, and continue to fuel the growth of a renewable energy

industry that is already creating hundreds of thousands of jobs and driving other local economic benefits nationwide, including in Massachusetts.

Acadia Center is a non-profit, research and advocacy organization committed to advancing the clean energy future. Acadia Center is at the forefront of efforts to build clean, low carbon and consumer friendly economies. Acadia Center's approach is characterized by reliable information, comprehensive advocacy and problem solving through innovation and collaboration.

In order to avoid repetition, CEG summarizes our prior comments, submitted to DOER on December 16, 2016, in the following bullets:

- DOER should establish a utility procurement mandate for energy storage.
- Utility procurement targets should be in the 600 MW – 1.16 GW range (assuming the 600 MW to result from other policies and programs is not counted toward utility targets; if that 600 MW is to be counted, then utility procurement targets should add up to the 1,766 MW identified as optimal in State of Charge).
- Utility ownership should be limited, to encourage the development of a vibrant private sector storage market.
- Sub-targets for behind-the-meter and front-of-meter systems should be established.
- Social benefits should be required from utility-owned storage including LMI benefits, resilience, public health benefits, peaker and baseload displacement, and collocation with renewables.
- An ACP mechanism and fund should be established.
- Complimentary policy mechanisms to support storage deployment should be established.
- DOER should consider a consensus process rather than traditional rulemaking, including workshops to explore rulemaking provisions.

Our comments in this second round fall into the following seven broad categories:

1. Mandatory vs. voluntary target
2. DOER Authority
3. Utility ownership
4. Size and ramping of target
5. Cost-effectiveness of storage
6. Addressing specific utility comments from round 1
7. Process going forward

In addition to our comments below, we attach four other supporting documents, including two California Public Utilities Commission (CPUC) filings documenting issues and approaches used in California, and economic reports on two energy storage projects in Massachusetts (summarized below).

1. **Mandatory vs. voluntary target**

Now that DOER has decided to establish utility procurement targets for energy storage, the first and most important question to be decided is whether these targets will be mandatory or voluntary ("aspirational"). For a number of reasons, we believe it is important that these targets be mandatory; furthermore, we assert that the enabling legislation supports this view, and that a decision to set voluntary targets would be contrary to a plain reading of the legislation. Finally, we urge Massachusetts to follow the example of the California PUC, which imposed a schedule of mandatory procurement targets based on virtually identical legislative language. These arguments are set forth below.

Mandated utility procurement is necessary to meet Massachusetts' stated goals. Mandated procurement is needed in order to meet the optimized rate of energy storage deployment on the Massachusetts electric grid. The analysis conducted for *State of Charge* report identified this optimal amount of storage as 1,766 MW deployed on the Massachusetts grid by 2020 (resulting in up to $2.3 billion in benefits, plus $250 million in additional regional benefits, and a reduction in GHG gas emissions of more than 1 MMT CO2e over a 10-year time span). However, the suite of policies and programs recommended by the report will only result in 600 MW of new advanced storage by 2025 (providing over $800 million in cost savings to ratepayers and approximately 350,000 metric tons reduction in GHG emissions over a 10 year time span). *Failure to achieve the larger target would leave more than $1.5 billion in economic benefits and 650,000 metric tons of GHG emissions reductions on the table.* And, as noted in the *State of Charge* report, the markets for energy storage are not yet developed to the extent that they could support this target without mandatory utility procurement. Indeed, utility procurement is needed to achieve the maturation of these markets.

The California utility procurement mandate provides an example of how effective mandatory procurement targets are in meeting state energy storage deployment goals. Southern California Edison, for example, in its first round of procurement, contracted more than five times the amount of energy storage it is required to procure under the California mandate.[i] There is no comparable example or study showing that voluntary targets for utility procurement of energy storage would meet the state's goals, or come anywhere close to meeting them.

Without mandates, utilities will not deploy storage at a significant scale. As noted in *State of Charge*, the utilities have filed grid modernization plans identifying energy storage as a "key strategic asset for the future of grid modernization" that will enable numerous benefits including increased deployment of distributed energy resources (DER) with improved reliability and power quality, customer optimization of time varying rates (TVR), distribution system planning and operational improvement, and vehicle-to-grid (V2G) demonstrations. However, as is also noted in *State of Charge*, the actual energy storage deployment proposed by the IOUs in their GMPs is quite small.

For example, Eversource this month filed its Grid Modernization Base Commitment plan,[ii] which includes pilot energy storage projects in four Massachusetts communities, for a total capacity of 29 MW / 128 MWh over the next five years. Clearly, this level of "aspirational" investment will not result in the state meeting even a modest 600 MW goal by 2020 (and the Eversource GMBC plan is not a real commitment to deploy, only a commitment to conduct studies and consider deployment; the four pilots discussed in the plan are based on preliminary analysis and subject to change).

To date, advanced energy storage deployment in Massachusetts amounts to only about 3.5 MW in total (and most of this resulted from a DOER grant under the CCERI program). This points to a disconnect between the acknowledged value of storage, and the reality of investment in a new technology. Mandatory procurement targets would address this by ensuring that utility investment reflects and supports the analysis conducted in State of Charge, and supports the development of markets that will in turn support future private investment.

Without a mandate, private investors will not find a market for storage in MA. In *State of Charge*, DOER identified the central issue that prevents these benefits from being realized through private investment: "Private investors will simply not invest in building storage projects in Massachusetts without a means to be monetarily compensated for the value the storage resource provides to the system, even though doing so would result in cost benefits to ratepayers that substantially outweigh the cost of investment."[iii] In other words, until markets for services provided by storage mature, and market rules are revised to allow storage operators equal access, the many benefits of storage cannot be realized through private investment alone. Setting mandatory utility procurement targets would not only provide for immediate investment and deployment, but would also drive market development and regulatory reform.

The Energy Diversity Act calls for mandatory procurement targets, not voluntary goals. In *An Act to Promote Energy Diversity section 15 (c)*, the Massachusetts state legislature and executive used the following language: "Not later than January 1, 2020, each electric company entity shall submit a report to the department of energy resources demonstrating that it has complied with the energy storage system procurement targets and policies adopted by the department pursuant to this section." The requirement that utilities *demonstrate compliance* indicates that the procurement targets and policies are to be mandatory, not voluntary. If a voluntary goal were contemplated in the legislation, there would be no need to stipulate how utilities should demonstrate that they have complied with the law.

In allowing utility ownership of storage, the Energy Diversity Act implies utility procurement mandates. The *Act to Promote Energy Diversity* addresses energy storage in two important ways: 1) it allows utilities to own storage, which is unprecedented in

the recent history of the Commonwealth; and 2) it instructs DOER to assess, and if appropriate, to establish utility procurement targets for energy storage. Thus the Act assigns to utilities both rights and responsibilities with regard to energy storage – both the right of ownership, and the responsibility to procure. The alternative reading – that utilities now have the right to own storage, but no obligation to develop or deploy it – is an exercise in absurdity. In that case, the only outcome of the Act with regard to energy storage would be to grant utility ownership of the resource, with no attendant requirements or limitations. We do not believe this was the intent of the legislation, and urge DOER to adopt a "rights with responsibilities" reading of the Act.

The lessons of California. When considering whether to interpret the Massachusetts Energy Diversity Act as calling for mandatory energy storage procurement targets, DOER should look to interpretations of similar laws in other states. In particular, it appears that the language used by the Massachusetts legislature in crafting the section of the Energy Diversity Act that addresses energy storage is virtually identical to language used in the California law (AB 2514) [iv] that established a utility mandate to procure energy storage. As can be seen by a comparison of the italicized language in the two laws, the California mandate was obviously used as the basis for the Massachusetts law. In particular:

- Both laws require the energy agency to "*determine whether to set appropriate targets for electric companies to procure viable and cost effective energy storage systems*."
- In both cases, using identical language, the laws state that the energy agencies "*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*."
- Both laws require each utility to submit a report *"demonstrating that it has complied with the energy storage system procurement targets and policies"* adopted by the agency.

In other words, the California PUC, relying on language identical to that employed in Massachusetts, required utilities to achieve a series of specific MW procurement targets by specific dates, stating:

> *The procurement targets set for 2014, 2016, 2018, and 2020 represent the number of MW pending contract, under contract, or installed after the end of those procurement cycles…. By providing this flexibility, the requirements balance the need for energy storage developers to have sufficient lead time to become operational with the IOUs' need to have these systems on-line in a reasonable period of time. Thus, we are balancing flexibility in roughly the next decade with an absolute installation requirement no later than the end of 2024.* [v]

We note that in the California docket, utilities argued that it would be premature to mandate targets. CPUC rejected that argument and imposed mandatory utility targets by utility, stating: "Based on AB 2514, as well as our overall energy policy, we find that it is reasonable to establish procurement targets to encourage the development and deployment of new energy storage technologies." [vi]

To summarize: CPUC faced the same rulemaking question, whether to impose a storage procurement mandate, as is now faced by DOER. It also faced similar objections from utilities. Based on legislative language virtually identical to that used in the MA Energy Diversity Act, CPUC clearly and unequivocally imposed a utility mandate to procure energy storage. That is what the DOER should also do in this case.

For more information on the California energy storage docket, please see attached CPUC filings.

2. DOER Authority

The Energy Diversity Act explicitly empowers DOER not only to establish but to administer an energy storage procurement mandate. This reading is supported by the Act's language: "*the department of energy resources* shall determine whether to set appropriate targets…. *the department* may consider a variety of policies to encourage the cost-effective deployment of energy storage systems…. *The department* shall adopt the procurement targets…. *The department* shall reevaluate the procurement targets not less than once every 3 years…. each electric company entity shall submit a report *to the department of energy resources* demonstrating that it has complied with the energy storage system procurement targets and policies adopted by *the department* pursuant to this section."

In using this language, the Act clearly requires that DOER be the entity that not only adopts the targets, but reevaluates them on a regular basis, and accepts reports from utilities to confirm compliance. Nowhere does the Act contemplate a hand-off of these responsibilities to DPU or any other agency.

Establishment and administration of mandatory targets by DOER would mirror DOER's role in establishing and administration of the Massachusetts RPS and APS. DOER already exercises a regulatory role in administering the state RPS and APS, pursuant to 225 CMR 14.00, 15.00, and 16.00, and is thus well suited for a very similar role in administering a state energy storage portfolio standard.

We also note that the Energy Diversity Act explicitly delegates to DOER the authority to consider "a variety of policies" to fulfill the aims of the section. In so delegating, the legislature adopts an approach comparable to that of the original implementing statute for the state's renewable portfolio standard, under the 1997 restructuring law[vii]. Indeed, the legislature at that time was *less* explicit in some regards about DOER's authority, with no mention of alternative

compliance payments or other mechanisms to ensure the success of the RPS. In that case, DOER rightly exercised its authority in creating and adopting appropriate tools for what was then a nascent policy,[viii] creating a model that many of the states subsequently adopting RPSs (now totaling 29) have drawn from. In the Energy Diversity Act, the legislature clearly expects Massachusetts leadership—including in policy development—via its delegation to DOER.

Furthermore, the three portfolio standards (RPS, APS and energy storage portfolio standard) will be interconnected in practice, since utilities will be procuring both generation and storage, at times from the same resources (in the case of energy storage co-located with renewable or alternative generation behind a single meter). The agency administering the RPS will need to ensure that renewable or alternative energy credits are not double counted when energy generated by an eligible source is stored before being released to the grid. If energy storage is made eligible for the APS, as recommended in *State of Charge*, it may also be necessary to ensure that a single storage resource is not double counted toward both the APS and the energy storage targets. It is therefore both most appropriate and most efficient for DOER to administer utility procurement of all three resource pools – renewable generation, alternative energy resources, and energy storage.

We also note that the administration of programs and policy related to energy storage deployment should be closely coordinated with the administration of utility procurement within the same agency. Energy Diversity Act empowers DOER to use "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." The *State of Charge* report further suggests a suite of complementary policies to support energy storage deployment through grants, incentives, and the inclusion of storage in existing energy programs. These policies and programs should be administered in close coordination with a procurement mandate and targets; it makes no sense to hand off administration of an energy storage procurement mandate to the Massachusetts Department of Public Utilities (DPU) while DOER is administering related policies and programs. For example, state incentives for energy storage deployment need to be calibrated to work in concert with programs and incentives the utilities may develop in order to fulfill their procurement targets. And, the state needs to guard against double-dipping by resources that may qualify for a variety of incentives, including utility incentives under a procurement mandate.

These considerations suggest that the most sensible arrangement is for DOER to administer both policies and procurement mandates as they apply to renewable generation, alternative energy resources, and energy storage. DOER clearly has a legislative mandate to do so.

3. Utility Ownership

Once targets are established, DOER will need to adopt rules regarding the mechanisms for procurement. A key decision will be how much of the procured energy storage capacity may be

owned by utilities, and how much should be owned by third parties or customers. In this we urge DOER to look again to the example of California, which limited utility ownership to 50 percent of the overall procurement targets, and to our prior comments, in which we provided numerous arguments in favor of limiting utility ownership of storage procured under (and counted toward) mandatory targets. Not least of these is the fact that protecting private ownership by restricting utility ownership is necessary to support the development and maturation of the energy storage industry. This approach is also consistent with restructuring.

In this round of comments, we wish to respond in particular to prior utility comments urging DOER to enable "full ownership and/or operation of distributed storage as determined by the distribution company" including visibility and control of distributed storage by EDCs. This comment, and others like it, appear to indicate that utilities feel they must either fully own the energy storage resources (their first choice) or, if they cannot own them, fully control them.

There is no reason that utilities need to have full ownership OR full operational control over storage resources, any more than they need to fully own or control traditional demand response resources or providers of frequency regulation. These services can be provided contractually, with appropriate payment structures and penalties under contract.

In other words, utilities should be able to send a signal to storage operators, to which they respond; utilities do not need, and should not be allowed to demand, full operational control over energy storage resources they do not own. To allow utilities to require either complete ownership or complete control over these resources would have a chilling effect on the energy storage market, and limit the value and usefulness of third party- and customer-owned energy storage resources, which are capable of providing many different services at different times.

We urge DOER to instead require utilities to contractually procure some portion of a mandated target from private resources, and to develop and file standard-offer contracts for the procurement of customer- and third party-owned energy storage services. These contracts should be part of a larger procurement plan each utility should be required to file, outlining how it will reach its procurement targets by the prescribed dates. This will not only provide assurance that targets will be met, but will also send important market signals to storage providers.

4. Size of 2020 target, and ramp-up in out years

CEG supports DOER in its desire to achieve initial success in utility procurement of energy storage systems, and anticipates utility arguments that 2020 is too short a deadline to procure large amounts of energy storage. (Although we note that storage can be deployed and brought online very quickly, as shown by the example of Sterling Municipal Light Department, which bought its 2 MW energy storage system from groundbreaking to full operations in less than three months, and the fast-tracked storage being deployed in California to offset capacity losses

from the imminent retirement of the Diablo Canyon nuclear plant,[ix] and due to the gas shortage resulting from the Aliso Canyon leak.[x])

In order to support both early success and a meaningful target, we suggest a series of procurement targets over the coming years, increasing in non-linear fashion, so that utilities can start with an initial, more achievable (but still mandatory) target, and ramp up to larger mandatory targets in out years.

For an example of how this might look under several different scenarios, we provide the following table. We take as the optimal goal 1,766 MW of new, advanced energy storage on the state grid – the amount identified in State of Charge as providing optimal benefits to the state grid and ratepayers. Because DOER has not yet clarified whether the 600 MW of storage to be achieved through policy and program recommendations from State of Charge would count toward utility targets, we provide suggested numbers for both scenarios, with both shallow and steep ramping options:

Table 1

Proposed Massachusetts Energy Storage Utility Procurement Targets					**Comments**
Target Level	**2020**	**2023**	**2026**	**Total**	
Optimal, inclusive	200 MW	500 MW	1,066 MW	1,766 MW	Assumes 600 MW policy target will be counted toward utility targets
Optimal, inclusive, steeper ramp	125 MW	525 MW	1,116 MW	1,766 MW	Assumes 600 MW policy target will be counted toward utility targets; Provides lower 2020 target with steeper ramp to reach optimal total
Optimal, non-inclusive	150 MW	350 MW	660 MW	1,160 MW	Assumes 600 MW policy target will NOT be counted toward utility targets
Optimal, non-inclusive, steeper ramp	100 MW	375 MW	685 MW	1,160 MW	Assumes 600 MW policy target will NOT be counted toward utility targets; Provides lower 2020 target with steeper ramp to reach optimal total

This ramping approach is similar to the strategy employed in California, as shown in Table 2 below from CPUC:

Table 2

Energy Storage Procurement Targets (in MW)

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**

We note that the targets are all mandatory; that they are additive, not cumulative; that they ramp up progressively; and that they subdivide into transmission, distribution and customer-sited resources. This provides a model that DOER should adopt to meet its energy storage procurement goals.

In particular, we urge DOER to carve out minimum procurement sub-targets for behind-the-meter (BTM) systems, and to consider providing some sort of targeted incentive to help develop these systems in low- to moderate-income communities, which typically are last to benefit from new technologies, but which are most in need of the cost and resiliency benefits of energy storage (see our comments from round 1). We note that GTM Research, in its recent 2016 US Energy Storage Monitor quarterly report, predicts that more than 50 percent of energy storage deployment in the US will be located behind customer meters by 2021. BTM storage provides a wider range of services and is more beneficial to customers than storage placed on the transmission or distribution grid;[xi] Massachusetts should ensure that these benefits are captured through utility procurement targets, and that they are shared in by LMI communities.

5. Cost-effectiveness of storage

The Energy Diversity Act states that DOER should "set appropriate targets for electric companies to procure viable and cost-effective energy storage systems." CEG notes that in prior filed comments, some utilities have asserted that storage is not cost-effective, and that mandatory targets would displace more cost-effective traditional solutions.

We strongly disagree. In fact, energy storage has been shown to be cost-effective in Massachusetts, both behind the meter and on utility distribution systems. We provide here two

examples, and encourage DOER to contact us if more examples, or more economic analysis, is needed.

Two examples of cost-effective energy storage in Massachusetts

CEG believes that, contrary to some utility claims, energy storage can be cost-effectively deployed at various scales and for various applications in Massachusetts, not at some future date, but today. We have worked extensively with developers, utilities, engineering firms, national labs and others to develop rigorous economic analysis of a number of energy storage projects. In many cases we have been able to show how energy storage can pay for itself well within the lifespan of the system, saving money for the owners of these systems while providing benefits for ratepayers and communities.

Here we provide summaries of two such systems in Massachusetts, showing the value streams, costs and payback period for each. More detail is provided in the attached documents.

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.

Table 3 - 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

Sterling Municipal Light Department Example

Through CEG/CESA's work with the Massachusetts CCERI (resiliency) grantees, we have had the opportunity to assist Sterling Municipal Light Department in developing their 2 MW battery storage system in Sterling, MA. The system is deployed on the utility's distribution grid and will provide resilient (backup) power to the town's police station and emergency dispatch center while saving money for the municipal utility by enabling capacity and transmission cost savings along with other revenues.

The system's economics have been the subject of a soon-to-be-published Sandia National Laboratories report (the report is currently under review by IEEE). Value streams for this project, which can be replicated by any utility in New England, are:

Potential revenue for a 1 MW, 1 MWh system:

- Arbitrage savings $13,321.20/year
- Frequency regulation revenues $60,476.04/year
- RNS (transmission cost) savings $98,707.00/year
- FCM (capacity cost) savings $115,572/year (2017-2018 pricing)

Note that the price of transmission and capacity services are increasing, with capacity costs to triple over the next two years.

Given the above revenues and cost savings for a 1 MW project, Sterling's 2 MW project should create cost savings and revenues equivalent to $576,152/yr. Note that this does not include the value of resilient power services to the town's first responders, which is considerable. Nor does it include increases in capacity and transmission service costs over time. And, because the municipal utility is not able to capture federal Investment Tax Credit and accelerated depreciation, this analysis does not include the tax benefits, which would be quite significant if applied (approximately $1 million on a $2.7 million system).

Even without the benefit of federal tax incentives, and without considering the value of resiliency services or increases in capacity and transmission costs, the Sterling system, with a cost basis of $2.7 million, has a simple payback of less than 5 years (this assumes no grants or other subsidies). We expect the actual payback period to be even shorter.

Table 4 - Sterling Municipal Light Department example economics

Energy storage system	Capital cost	Value streams	Revenues/savings per year	Payback period
2 MW / 3.9 MWh lithium-ion battery	$2,700,000	Arbitrage	$26,642	4.68 years
		Frequency Regulation	$120,952	
		Transmission savings	$197,414	
		Capacity savings	$231,144	
		TOTAL	**$576,152**	

We submit these two economic cases to show that, contrary to utility claims, energy storage can be cost effective in Massachusetts today, both behind the customer meter and on the utility system. More detailed economic analysis for the BHA and Sterling cases can be found in the attached documents.

However, as noted in State of Charge, energy storage technologies do not yet have access to all markets in which they could provide services; cannot yet monetize many of their most valuable services; are still overcoming knowledge barriers; and are just beginning to establish a track record of performance.

In other words, there are serious market barriers that need to be overcome through policy measures such as a mandate. For all these reasons storage technologies are still associated with greater investment risk than competing traditional technologies. Therefore, mandates and incentives are important to ensure that utilities will procure storage at a scale that is meaningful within the context of the State of Charge optimization analysis.

6. Addressing utility comments

In our above comments, CEG has addressed a number of utility comments submitted in the previous round, including utility assertions that procurement targets should be "aspirational" and not subject to a compliance mechanism; that storage is not cost effective; and that utilities should have full ownership of energy storage resources or, failing that, full control over them.

In this section we wish to address several additional comments made by utilities in the prior round of stakeholder input:

Retail ratemaking
Utilities have suggested that DOER should allow "retail ratemaking that avoids undue cost-shifting to consumers that do not own storage devices" and adopt "an efficient rate design that compensates solar customers for self-generation and known system benefits, as opposed to maximum energy exports and potential system benefits."

CEG is opposed to setting new fees and tariffs for behind-the-meter solar+storage customers as part of the rulemaking for utility procurement. Such efforts erode the value of solar and storage resources, penalize customers for investing in clean, distributed energy resources, and do not recognize the added value such BTM systems provide to the utility grid.

Instead, DOER should encourage utilities to find ways to capture the added value of these customer-sited systems, for example, through the "virtual power plant" model that has been pioneered by Green Mountain Power in Vermont. This model allows the utility to contract with storage customers to discharge at peak demand hours in response to a signal, much like a demand response program. This aggregated discharge from distributed storage systems can reduce utility capacity and transmission costs that are based on monthly and annual peaks. The resulting savings can be shared with customers. For more information on this system, see http://www.cleanegroup.org/mcknight-lane/.

MW vs MWh
Utilities have suggested that targets should be stated in MW (megawatts). CEG asserts that targets should be stated in MWh (megawatt hours). The use of MW to measure storage capacity is problematic because the MW rating alone is only a power rating; it does not tell you how much energy capacity the battery has, or what applications it is appropriate for. There is a huge difference between a 1 MW battery that discharges over five minutes, and a 1 MW battery that discharges over five hours.

Setting targets in terms of MW alone would allow utilities to comply with the targets by installing systems capable only of brief, intense bursts of power. However, this would not provide most of the system benefits identified in State of Charge, since most of

these benefits require longer, more sustained discharge times. Requiring energy storage capacity to be measured and reported in MWh will provide a much more accurate measure of how much energy storage is actually being provided to the state grid and will allow accurate accounting of utility efforts to meet capacity targets.

Existing assets

Utilities have suggested that existing assets should be counted toward procurement targets. CEG would prefer that only new assets be counted; however, we also recognize that there may be some value to recognizing the efforts of forward-looking utilities that are early adopters of energy storage.

If existing assets are to be counted, we suggest that only relatively recent assets, for example, those installed since 2014, should be eligible (and only if these assets are still in use). This will avoid counting older storage assets that may be approaching end of life, may no longer be in use, or may have declined significantly in operational efficiency. This was the strategy used in California, where storage resources under contract by 2010 were counted toward targets established in 2013.

We also urge that, following the example of California's energy storage mandate, large pumped storage facilities (existing or new) not be counted toward targets for Massachusetts, as their inclusion would crowd out new advanced storage technologies such as batteries and flywheels (and we note that the State of Charge analysis and modeling was based on new advanced energy storage technologies, not pumped hydro, which the reports notes is unlikely to be built in Massachusetts due to geographic and environmental limitations).

APS targets

We note that utilities have suggested that energy storage should count toward APS targets, but that new requirements for storage should not be adopted within the APS. While we are not sure this is the right forum for this debate, we would argue that allowing storage to be eligible within existing procurement programs without setting new targets for storage may detract from procurement of other resources within those programs; alternately, it could result in no storage being procured within those programs. Energy storage and other alternative energy technologies should not be an "either/or" proposition; instead, the state should set out targets for the procurement of storage in tandem with complimentary technologies in these programs.

7. Process going forward

In addition to the above comments, CEG would like to address the process for stakeholder input and rulemaking over the next five months. In particular, we feel that a more structured process for stakeholder input would result in more useful comments and a better forum for sharing information. We suggest that DOER consider something like the following process:

- Divide desired stakeholder input into major topics, such as target size/timing/subdivisions, compliance mechanisms, complimentary policies and mechanisms, utility ownership requirements, and similar issues.
- For each topic area, develop a set of questions and subtopics to be addressed, noting specific issues where technical or analytical input is needed.
- Set a series of dates for the submission of comments in these categories.
- For each category, set a second date for submission of responses to the first round comments.
- Publish comments and responses on the state's website as they are received.

We hope these comments are helpful, and encourage DOER to contact us with any questions.

Sincerely,

Lewis Milford
Clean Energy Group

Todd Olinsky-Paul
Clean Energy Group

John Rogers
UCS

Mike Jacobs
UCS

Paula Garcia
UCS

Peter Shattuck
Acadia

---

[i] https://www.greentechmedia.com/articles/read/breaking-sce-announces-winners-of-energy-storage-contracts, http://www.utilitydive.com/news/socal-edison-signs-contracts-for-250-mw-of-energy-storage/329870/

[ii] http://web1.env.state.ma.us/DPU/FileRoomAPI/api/Attachments/Get/?path=17-05%2fESGMBC1.pdf

[iii] State of Charge, xiii

[iv] AB 2514 Section 2836.

(a) (1) *On or before March 1, 2012, the commission shall open a proceeding to determine appropriate targets, if any, for each load-serving entity to procure viable and cost-effective energy storage systems to be achieved by December 31, 2015, and December 31, 2020. As part of this proceeding, the commission may consider a variety of possible policies to encourage the cost-effective deployment of energy storage systems, including refinement of existing procurement methods to properly value energy storage systems.*

(2) The commission shall adopt the procurement targets, if determined to be appropriate pursuant to paragraph (1), by October 1, 2013.

(3) The commission shall reevaluate the determinations made pursuant to this subdivision not less than once every three years.

(4) Nothing in this section prohibits the commission's evaluation and approval of any application for funding or recovery of costs of any ongoing or new development, trialing, and testing of energy storage projects or technologies outside of the proceeding required by this chapter.

(b) (1) On or before March 1, 2012, the governing board of each local publicly owned electric utility shall initiate a process to determine appropriate targets, if any, for the utility to procure viable and cost-effective energy storage systems to be achieved by December 31, 2016, and December 31, 2021. As part of this proceeding, the governing board may consider a variety of possible policies to encourage the cost-effective deployment of energy storage systems, including refinement of existing procurement methods to properly value energy storage systems.

(2) The governing board shall adopt the procurement targets, if determined to be appropriate pursuant to paragraph (1), by October 1, 2014.

(3) The governing board shall reevaluate the determinations made pursuant to this subdivision not less than once every three years.
(4) A local publicly owned electric utility shall report to the Energy Commission regarding the energy storage system procurement targets and policies adopted by the governing board pursuant to paragraph (2), and report any modifications made to those targets as a result of a reevaluation undertaken pursuant to paragraph (3).

[v] Id. At p 26.

[vi] Id at pp. 22-23.

[vii] https://malegislature.gov/Laws/SessionLaws/Acts/2016/Chapter188

[viii] Massachusetts was the first state in the nation to adopt a state-wide renewable portfolio standard.

[ix] https://www.greentechmedia.com/articles/read/pge-to-replace-diablo-canyon-nuclear-plant-with-100-carbon-free-resources

[x] http://www.utilitydive.com/news/inside-construction-of-the-worlds-largest-lithium-ion-battery-storage-faci/431765/, https://www.greentechmedia.com/articles/read/california-utilities-are-fast-tracking-battery-projects-to-manage-aliso-can

[xi] Garrett Fitzgerald, James Mandel, Jesse Morris, Hervé Touati. 2015. The Economics of Battery Energy Storage, Rocky Mountain Institute. http://www.rmi.org/Content/Files/RMI-TheEconomicsOfBatteryEnergyStorage-FullReport-FINAL.pdf