December 16, 2016

Commissioner Judith Judson
Massachusetts Department of Energy Resources
100 Cambridge St, Suite 1020
Boston, MA 02114

Re: Setting appropriate targets for viable and cost-effective energy storage systems

Dear Commissioner Judson:

Thank you for the opportunity to comment on the Department of Energy Resource's ("Department" or "DOER") determination about setting energy storage targets pursuant to Chapter 188 of the Acts of 2016, Section 15. The Northeast Clean Energy Council ("NECEC") and our member companies are appreciative of the significant effort put in by the Department to prepare the *State of Charge* report and consider the merits of setting energy storage targets for the Commonwealth. We also want to thank the Department and Baker Administration for their leadership in helping kick-start the burgeoning energy storage industry in Massachusetts with this report and other storage initiatives. NECEC looks forward to working with DOER to put Massachusetts on the map as a nation-leading state for energy storage innovation and deployment.

NECEC is the lead voice for hundreds of clean energy companies across the Northeast, helping to grow the clean energy economy. NECEC's mission is to create a world-class clean energy hub in the region delivering global impact with economic, energy and environmental solutions. NECEC is the only organization in the Northeast that covers all of the clean energy market segments, representing the business perspectives of investors and clean energy companies across every stage of development. NECEC members span the broad spectrum of the clean energy industry including advanced energy storage, as well as solar, energy efficiency, demand response, wind, CHP, fuel cells and advanced and "smart" technologies. Our members are already – or are very interested in – doing business in the Commonwealth and helping to grow our clean energy economy.

The Benefits of Energy Storage

Energy storage offers a myriad of benefits to customers, system owners, and the grid. By now, the magnitude of these benefits is well documented and understood by stakeholders in Massachusetts, and certainly by the Department through its development of the *State of Charge* report. While the focus of the Department's determination in this proceeding is on the particular question of whether to set energy storage targets, the immense benefits offered by energy storage are the underlying foundation for all of our collective considerations related to the storage target. As such, we felt it important to begin our comments with a brief synopsis of the many benefits obtainable through the adoption of energy storage.

Energy storage promises great value to Massachusetts through a combination of sizeable energy and monetary savings, high-priority energy and environmental policy impacts, and vitally important grid management and resiliency benefits. These and other positive impacts of

advanced energy storage are, of course, presented in great detail in the Department's *State of Charge* report[1] as well as in the presentation made at the September stakeholder listening session.[2]

In the first instance, well-deployed storage offers tremendous energy and monetary savings to the Massachusetts grid and its users. Not only are these savings reaped across the spectrum of reduced wholesale energy, capacity, and ancillary services costs, but also they emerge from more efficient utilization of transmission and distribution assets, which results in reduced, avoided, and deferred upgrade costs. Far and away the largest driver of cost savings that storage enables, however, is additional capacity during periods of peak demand, where storage has the potential to offer more than $1 billion in deferred peaker plant capital costs and reduced capacity market costs in the Massachusetts system.[3]

On top of these massive savings, energy storage also stands to play a catalytic role in helping the Commonwealth achieve several public policy priorities of paramount importance. Namely, energy storage will be an accelerant for both the integration of grid-scale and distributed clean energy resources, as well as reductions in greenhouse gas (GHG) emissions from the electricity sector. As a fast and flexible resource, energy storage is capable of balancing the variable output of intermittent resources such as solar and wind, and it can alleviate issues of congestion and hosting capacity on substations that would otherwise constrain distributed energy resource (DER) adoption. Moreover, as the Department is undoubtedly aware, energy storage also stands to be a substantial aid in helping the state meet its statutory GHG emission reduction targets under the Global Warming Solutions Act (GWSA).[4] Beyond enabling a higher penetration of zero-emission renewable generation, energy storage can avert reliance on and use of the dirtiest peaking units in the region and, when co-located with traditional generating units, allow the broader fleet of fossil fuel plants to run at an optimum heat rate more often.

Finally, the third major category of benefits tapped by energy storage includes a wide range of grid management and resiliency advantages. From increased reliability and flexibility to efficient usage and reduced congestion, storage assets – whether grid- or customer-facing – offer significant value to distribution companies and other entities engaged in grid operation and management. And, with extreme weather resiliency accruing more and more importance with each successive nor'easter and hurricane, energy storage provides the unique value of avoiding and mitigating prolonged power outages, especially for hospitals, emergency personnel facilities, and other critical infrastructure. As such, storage can be the key to unlocking the potential for microgrid deployment by municipalities and other large entities seeking all-important "island-able" capability.

All told, the bottom-line value proposition of storage in MA bears repeating: $3.4 billion in benefits to Massachusetts through $2.3b in system benefits and $1.1b in potential market revenue to developers. On top of this value, energy storage can also effectuate a 10% reduction in Massachusetts peak system demand and more than a million metric tons of carbon dioxide emissions reductions over a ten-year period.

These numbers speak for themselves, but they will not materialize by themselves. That is where

[1] Available online at http://www.mass.gov/eea/docs/doer/state-of-charge-report.pdf.
[2] Available online at http://www.mass.gov/eea/docs/doer/9-27-16-storage-presentation.pdf.
[3] Ibid., slide 30.
[4] See Chapter 298 of the Acts of 2008, *An Act Establishing the Global Warming Solutions Act*. Available online at https://malegislature.gov/Laws/SessionLaws/Acts/2008/Chapter298.

a procurement target for energy storage comes in. **To capture the tremendous benefits storage can provide for the Commonwealth and its citizens, businesses and industries, DOER should set an energy storage procurement target.**

The Efficacy of Procurement Targets

Setting targets for the adoption of a category of resource is a proven way to spur market development and technology deployment. Massachusetts need not look far for examples of how successful Renewable Portfolio Standards (RPS) and other similar targets have been in driving deployment up and costs down for burgeoning technologies like solar photovoltaics and wind. Drawing on its experience with and lessons learned from its RPS leadership, DOER currently has the ability to set in motion a new wave of deployment for energy storage. As a result, NECEC strongly urges the Department to make the affirmative decision to set an energy storage procurement target for the Commonwealth.

Procurement targets are unsurpassed in their ability to initiate uptake on the scale needed to drive significant change in the electric power sector. In other words, targets move megawatts. A procurement target can drive critical learning-by-doing, lower risk, and ensure that technologies are incorporated into regular business processes and operations. Electric distribution companies can learn how to incorporate a category of resource or technology into planning, procurement, and operations in a commercial setting with greater certainty. Furthermore, a target can offer them the latitude to leverage a resource or technology to meet any identified use-cases based on specific system needs. Regulators can learn how to evaluate the resource-type in question to realize ratepayer benefits and meet public policy goals. Developers and investors can learn about a new asset class in repeated implementations and gain certainty about performance and regulatory treatment, making them more inclined to undertake projects of that type. Together, these outcomes have the ability to spur the market, drive megawatts of resource deployment and substantially reduce any “soft costs” that may be particular to Massachusetts.

While demonstration projects and pilots are valuable and may offer some benefits and learning insights, they are not simply enough to jumpstart an industry at a level commensurate with the truly game-changing proposition offered by energy storage. Demonstrations and pilots are not pursued in the normal course of business, are not subject to the same cost-effectiveness discipline, and do not inform normal operations or processes. This limits the useful information they can supply to utilities and electricity sector stakeholders. Demonstrations also do not produce the track record critical for reducing cost of private financing, which only proceeds with “real world” performance and payback.

In the case of energy storage, one primary benefit of a reasonably ambitious procurement target is the experience and learning to be gained from pursuing a variety of use-cases and business models for storage. This learning-by-doing allows all stakeholders to find the best, most cost-effective uses of storage and drives down soft costs such as interconnection and permitting. This opportunity for early and rapid cost-reduction is arguably one of the largest benefits of a target, oft-overlooked for the potential impact that it can have in the long run. If stakeholders are able to learn and drive down the costs now with kilowatts and megawatts of deployment, the industry will be ideally situated to tackle power sector issues on the horizon that will demand gigawatts of storage capacity.

A procurement target also promises the Commonwealth a valuable ‘first-mover’ economic

development advantage. Jurisdictions with targets are not only able to attract new companies and businesses, but they also successfully encourage existing firms to double-down on their in-state investments and workforce. Massachusetts is already home to companies involved in energy storage at many parts of the value chain, including technology developers; storage and component manufacturers; engineering, procurement, & construction firms; project developers; software developers; and the scientific, legal, finance, and consulting services that support them. In fact, as it stands today, the only other state with a richer energy storage business cluster than Massachusetts is California - the first state to enact a storage procurement target. This is in part because the Commonwealth already boasts an impressive clean energy industry cluster that is responsible for nearly 100,000 jobs and $11 billion of economic activity annually, induced in large part by state policies and programs. While Massachusetts may not be able to be the true "first mover" in setting an energy storage mandate, acting quickly will allow it to be the first state mover in the northeast and on the east coast, putting it at a competitive advantage to other peer states like New York, Rhode Island, and Connecticut. That means jobs, investment, and megawatts – the trifecta of clean energy industry economic development.

As referenced previously, Massachusetts has the benefit of learning from the robust body of evidence attesting to the efficacy of targets and mandates for spurring emerging market development across the country. State RPSs have proven essential in driving initial renewable energy growth in the United States since the turn of the century. Today, RPS policies exist in 29 states and Washington D.C., collectively applying to 55% of total U.S. retail electricity sales.[5] As such, they offer more than just a case study for inferring the impact of procurement targets and mandates; they collectively offer a full-fledged testament to the worthiness of such targets and their ability to drive deployment up and costs down. RPSs have driven wind generation from less than 0.4% of U.S. generation in 2004 to more than 4.4% in 2014 while boosting solar above 1% of total electricity in the U.S. in 2015 for the first time ever. This has occurred as costs have gone down: declines in price of approximately 60% for onshore wind,[6] distributed-scale solar,[7] and utility-scale solar[8] since 2009. States with the strongest RPSs have indisputably benefitted from elevated clean energy, jobs, tax revenue, and economic development.

Early observations indicate that the same promise holds true for states adopting energy storage targets. California, of course, was the first to act in 2013 with a groundbreaking energy storage mandate for 1.325 GW of energy storage by 2024, and it has firmly cemented itself as a hotbed for storage activity and deployment. Since the adoption of its storage mandate, California's Public Utility Commission (PUC) has approved over 630 MW of energy storage, reflecting a 200% annual increase since the target's adoption.[9] Interestingly, sizeable portions of this storage capacity came out of solicitations that were not directly part of the storage target, suggesting that Massachusetts could similarly look to forthcoming RFPs for large-scale offshore wind, hydroelectric, and renewable generation as opportunities to leverage storage deployment. But development is proceeding rapidly on the customer side in California as well, with the state

[5] LBNL's U.S. Renewables Portfolio Standards: 2016 Annual Status Report.
[6] See Lawrence Berkeley National Laboratory's (LBNL) 2015 Wind Technologies Market Report, available online at http://newscenter.lbl.gov/2016/08/17/annual-wind-market-low-wind-energy-prices/.
[7] Price reductions for distributed-scale solar since 2009 range from 51%-65% depending on project size, according to LBNL's "Tracking the Sun IX" report, available online at: https://emp.lbl.gov/publications/tracking-sun-ix-installed-price?utm_source=newsletter29&utm_medium=email&utm_campaign=Constant Contact.
[8] See LBNL's 2015 Utility-Scale Solar report, available online at https://emp.lbl.gov/publications/utility-scale-solar-2015-empirical?utm_source=newsletter29&utm_medium=email&utm_campaign=Constant Contact.
[9] As cited by Commissioner Carla Peterman of the California Public Utility Commission during her presentation to the Restructuring Roundtable on December 9, 2016, slides from which are available online at http://www.raabassociates.org/Articles/Peterman Presentation 12.9.16.pdf.

expecting hundreds of megawatts of new customer-sited storage in the near future: approximately 250 MW aided by modifications made to the state's Self-Generation Incentive Program (SGIP), and 500 MW of distributed and customer storage capacity allowed under AB2868.[10] Without a doubt, California's storage mandate has succeeded in inciting market transformation and cultivating increased comfort for and familiarity with energy storage projects by utilities and the community at large.

The effectiveness of a state storage target in driving markets is such that the mere possibility of Massachusetts setting a target is already attracting investment in the Commonwealth. Companies new to Massachusetts are putting down roots here due to the prospect of a storage target in the Commonwealth, and many more companies are laying the groundwork for expansions to the Massachusetts market as well. The potency of the storage target is already manifesting itself, and this is merely a preview of the tide of interest and investment that will flow if and when the Department decides to set a target.

With Targets, Markets Can Work to Keep Costs Competitive

A procurement target will drive robust market competition among storage vendors and developers, and the cost-discipline that it brings will deliver customers maximum benefit. Cost impacts are, justifiably, a consideration for the Department to weigh in its decision, but the evidence provided by existing target programs – as well as *State of Charge*'s cost-benefit analyses for various energy storage use-cases – reveal that market forces work to keep costs competitive within the construct of a target.

By creating a stable, consistent long-term demand signal for storage, more companies will enter the market and compete to satisfy that demand than might otherwise occur. Additionally, that stable demand signal enables market participants to experiment more readily with use-cases, business models, deal structures, and other innovative means of delivering storage that may be best suited to the particular technical, regulatory, and economic features of the Massachusetts electricity system. Moreover, this market stability will better facilitate long-term contracts for storage assets and/or services, and such contracting will be critical for increasing the availability of project financing, as has been the case with the Commonwealth's RPS programs. More market entry, business model innovation, and financing availability will translate into greater competition and price revelation, which is the best means of assuring that customers benefit from storage at lowest cost.

For that reason, it is also clear that all ownership models and use-cases for energy storage should be eligible to benefit from and contribute to Massachusetts' storage target. A target will be critical in driving competition among third-party vendors and developers who seek to participate. The Commonwealth's utilities can and should own a certain amount of storage, but competitive procurement of storage types that utilities may own (e.g., for transmission and distribution purposes), as well as customer-connected (behind-the-meter) systems will drive down costs and allow a robust third-party industry to develop. In particular, NECEC views it as imperative that behind-the-meter storage owned by customers or third parties be allowed to benefit from and count for compliance towards a storage target, since it provides value as both a flexible, locational resource and as a unique enabler of customer choice and direct customer savings. All in all, driving competition among utilities, third-parties, and customers/end-users will reveal cost information and help guarantee the appropriate cost discipline, and it is therefore of

[10] Available online at https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB2868.

utmost importance to allow all project types, ownership models, and use-cases to count for compliance with the target.

Existing state RPSs again provide excellent examples for their track record of driving significant cost innovation in emerging technologies, namely in the wind and solar industries. Onshore wind, in particular, is a powerful exemplar of state renewable targets as the main policy driver of rapid and substantial cost reductions. The industry has seen 60% cost reductions in wind-generated electricity since 2009. In this period, wind has dominated RPS-related generation additions, accounting for around two-thirds of installed capacity to date. Recently, however, more and more wind additions are not being used for RPS compliance purposes, but are instead being increasingly procured by utilities, suppliers, and corporate purchasers on cost-competitiveness bases alone.[11] In this case, state renewable targets provided the initial compensation ramp needed to bring a technology/industry cost down to grid parity. While other factors like the federal production tax credit (PTC) undoubtedly played a role in wind's cost-decline, the demand signals created by state RPS targets provided the foundational underpinning for the market and drove competition. We envision and expect that an energy storage target will play an equally influential role in spurring storage adoption and driving down costs.

Preliminary Principles for Storage Target Design

NECEC recognizes that the focus of the Department in soliciting public comment at this time is on the threshold determination of whether or not to set storage targets for the state. Without delving too far into secondary questions about how a storage target could or should be structured, we wanted to offer some high-level principles for guiding DOER's considerations about the potential design of a target.

NECEC asserts to the Department that the storage target(s) should account for all electric load served in the state, whether the load is supplied by a distribution utility, a competitive supplier, municipal light plant, or other load-serving entity ("LSE"). In other words, if DOER is considering the potential for storage utilization by end-use customers, the Department should include all customers in the state in its future analyses and considerations about setting a target. Regardless of whether the targets are ultimately applicable to just distribution utilities or all LSEs, storage installed behind-the-meter by third parties should be able to be used to meet storage targets and be monetized and compensated accordingly. And importantly, this requires that targets eventually be designed in a way that does not create an uneven playing field between utilities and third-party providers.

DOER's statutory directive, of course, is to "determine whether to set appropriate targets for *electric companies*"[12] (emphasis added). The specific implication of "electric companies," as pertains to existing statutory definitions in M.G.L. Ch. 164, §1,[13] can and will be debated in a subsequent proceeding should the Department determine that setting a storage target is indeed appropriate. NECEC would simply argue at this early stage that a target must be structured to capture and spur deployment outside of (and in addition to) storage as an investor-owned utility

[11] According to 2016 North American Wind Power publication available online at http://nawindpower.com/online/issues/NAW1607/FEAT_03_RPS-Programs-Drive-Renewable-Energy-Deployment-National-Benefits.html.
[12] Chapter 188 of the Acts of 2016, Section 15(a), available online at https://malegislature.gov/Laws/SessionLaws/Acts/2016/Chapter188.
[13] Available online at https://malegislature.gov/Laws/GeneralLaws/PartI/TitleXXII/Chapter164/Section1.

(IOU), municipal light plant (MLP), or competitive supplier asset. According to the Department and consultants' analyses, the aggregate share of these three use-cases may only represent 60% or less of the total optimized storage deployment in the state.[14] As a result, the storage target should account for the sizeable expected share of behind-the-meter, merchant, and microgrid storage deployment accordingly.

We note that California's energy storage mandate is structured to set annual MW requirements for the state's three IOUs: Southern California Edison ("SCE"), Pacific Gas & Electric ("PG&E"), and San Diego Gas & Electric ("SDG&E"). Additionally, the mandate stipulates that these IOUs can own no more than 50% of the storage they procure. Notably, the storage target also includes a requirement for electric service providers ("ESPs")[15] and Community Choice Aggregations ("CCAs")[16] to procure 1% of their annual peak load in energy storage by 2020.[17] In this and future considerations by DOER, we would strongly encourage the Department to consider similar innovative compliance requirements to ensure that no single use-case or ownership model dominates and to capture and compensate behind the meter/customer-facing development. In addition, an accompanying interim target and long-term goal could be set to kick-start early deployments.

To take stock of the full spectrum of storage use-cases and project types, Massachusetts should take into account the balance/trade-offs that may exist between behind-the-meter deployments at small and medium scales and centralized, grid scale deployments. Embedded in this balance are the two important concepts of locational and temporal value. As the consultants' report and other studies, such as MIT's recently-released *Utility of the Future*[18] study, have shown, accounting for the locational value of distributed energy resources like storage is critical to optimizing their usefulness and identifying the particular circuits, feeders, and substations where the greatest benefit exists. Similarly, further unlocking the time-based element of DER valuation through time of use (TOU) rates and real time pricing (RTP) will help storage realize its full value to distribution utilities and the customer base. These questions are of course part of a much broader debate, but we would encourage the Department to remain cognizant of their importance as it makes its decision on an energy storage target.

The Danger of Falling Behind

With the discussion above in mind, Massachusetts should and must take action now to set a storage procurement target for the Commonwealth. While the state stands to reap tremendous benefit from the widespread adoption of storage, choosing *not* to set a storage target prior to December 31, 2016, poses great danger to the state in terms of falling behind other jurisdictions and incurring heavy opportunity costs. Without an enabling regulatory framework for energy storage to date, Massachusetts has not been the quickest adopter of energy storage: according to the consultants' listening session presentation in September, Massachusetts currently ranks 23rd amongst all other states in total installed storage capacity. Massachusetts may have an increasingly vibrant in-state energy storage cluster, but this has not yet translated to many

[14] See slide 45 of the Department's listening session presentation, available online at http://www.mass.gov/eea/docs/doer/9-27-16-storage-presentation.pdf.
[15] As defined by the California Public Utilities Commission (PUC) online here: https://ia.cpuc.ca.gov/esp_lists/esp_udc.htm.
[16] See http://www.cpuc.ca.gov/general.aspx?id=2567.
[17] See slide 5 of December 9, 2016, presentation from California PUC Commissioner Carla Peterman, available online at http://www.raabassociates.org/Articles/Peterman Presentation 12.9.16.pdf.
[18] Available online at http://energy.mit.edu/wp-content/uploads/2016/12/Utility-of-the-Future-Full-Report.pdf.

projects on the ground.

Clearly, DOER's recent efforts have been paving the way for more far-reaching storage deployment, beginning with the Baker administration's May 2015 announcement for a $10 million energy storage initiative, last summer's legislation and now culminating in the decision to set a storage procurement target. With this critical final push, the Department can inject the momentum needed for the in-state storage market to pass its inflection point and begin to truly flourish. Opting not to set a storage target would jeopardize the state's long-term prospects as a destination for energy storage deployment along with its ability to take advantage of the many aforementioned benefits.

Conclusion

NECEC greatly appreciates the opportunity to offer comments for the Department's consideration. We look forward to continuing to work with DOER to enable the state to set and meet targets for energy storage adoption, which we believe will propel Massachusetts to the forefront of energy storage leadership. We would be glad to discuss any of our recommendations with DOER and reiterate that we are available as a resource to you throughout this process. Please do not hesitate to contact us if you have any questions or we can provide any assistance.

Sincerely,

Peter Rothstein
President

Janet Gail Besser
Executive Vice President

Cc: Secretary Matt Beaton, EEA
Undersecretary Ned Bartlett, EEA
Will Lauwers, DOER
Jamie Dickerson, NECEC
Alistair Pim, NECEC