I. Introduction

The Commission to Study the Economic, Environmental and Energy Benefits of Energy Storage to the Maine Electricity Industry was established during the First Regular Session of the 129th Legislature by Resolve 2019, chapter 83. A copy of the enabling legislation is provided in Appendix A. The enabling legislation establishes the membership of the commission to include members with various expertise and interests in energy storage matters. Specifically, the 14-member commission includes:

- Two members of the Senate appointed by the President of the Senate;
- Three members of the House of Representatives appointed by the Speaker of the House;
- Four public members appointed by the President of the Senate including: a representative of the energy storage industry, a representative of the hydroelectric energy storage industry, a representative of an electric utility in the State and an academic in the field of energy storage;
- Four public members appointed by the Speaker of the House including: a representative of a conservation organization, a representative of a business that uses significant electric power in the State, a representative of a large-scale energy storage owner and a representative of a small-scale energy storage owner; and
- The Public Advocate.

A list of commission members is provided in Appendix B.

Resolve 2019, chapter 83, outlines seven duties to guide the commission in its study of energy storage, as follows:

1. Review and evaluate the economic, environmental and energy benefits of energy storage to the State's electricity industry, as well as public policy and economic proposals to create and maintain a sustainable future for energy storage in the State;

2. Consider the challenges of the broad electricity market in the State, including challenges with transmission and stranded renewable energy generation in the northern part of the State, and analyze whether energy storage is part of the transmission solution;

3. Consider whether the environmental, economic, resiliency and energy benefits of energy storage support updating the State's energy policy to strengthen and increase the role of energy storage throughout the State;

4. Consider the economic benefits of energy storage systems procurement targets, including: benefits of cost savings to ratepayers from the provision of services, including energy price arbitrage, capacity, ancillary services and transmission and distribution asset deferral or substitution; direct cost savings to ratepayers that deploy energy storage systems; an improved ability to integrate renewable resources; improved reliability and power quality; the effect on retail electric rates over the life of a given energy storage system compared to the effect on retail electric rates using a nonenergy storage system alternative over the life of the nonenergy storage system alternative; reduced greenhouse

gas emissions; and any other value reasonably related to the application of energy storage system technology and compare those economic benefits to the effects of leaving current policies in place;

5. Review economically efficient and effective implementation approaches to energy storage targets;

6. Consider bring-your-own-device programs that offer credits for sharing stored energy with electric utilities and storm outage and response management programs for behind-the-meter energy storage to reduce peak reduction and increase resiliency; and

7. Examine any other issues to further the purposes of the study.

In carrying out its work, the commission was required to seek public input and consult and collaborate with stakeholders and relevant experts.

The enabling legislation charges the commission with submitting a report of its findings and recommendations, including any suggested legislation, to the Joint Standing Committee on Energy, Utilities and Technology by December 4, 2019. Under the Joint Rules of the Legislature, the Joint Standing Committee on Energy, Utilities and Technology, after review of the commission's report, may submit a bill to the Second Regular Session of the 129th Legislature based on the report (Joint Rule 353).

II. Commission Process

The commission held a total of four meetings to conduct its work. These meetings were held on October 22, November 6, November 19 and December 2, 2019, respectively. All meetings were open to the public and live audio of each meeting was made available over the Internet through the Legislature's webpage.

The balance of the first two meetings centered on information gathering. To inform its work, the commission sought input from: individuals with expertise in the energy storage policy arena at the national and regional level; state agencies engaged directly or indirectly in energy storage issues; and industry stakeholders engaged in energy storage project development and operation on the ground in Maine. The commission also reviewed several key published reports on state and national energy storage policy issues.

The first meeting focused on providing commission members with necessary background information to lay the foundation for the commission's work. The meeting included a review of the enabling legislation (see Appendix A), covering the duties, process and timeline for the commission's work, as described above; a presentation from a regional expert on energy storage policy, programs and activities; and a discussion of individual commission members goals and priorities for the study.

At this meeting, Todd Olinsky-Paul of the Clean Energy Group and Clean Energy States Alliance made a presentation on "Energy Storage Landscape in New England: Policies, Programs and Activities." Mr. Olinsky-Paul provided an overview of current federal and state policies that are shaping the landscape for energy storage and discussed energy storage development activity, with particular focus on Massachusetts and other New England states. His presentation reviewed different types of state policies and incentives for energy storage, including procurement targets, renewable portfolio standards, rebate programs and tax incentives. He also discussed the use of energy efficiency funds to provide incentives for energy storage, with reference to his recent publication: "Energy Storage: The New Efficiency."[1]

At its second meeting, the commission focused on learning more about the state and national energy storage landscape. The meeting included: two presentations from state agency officials; a presentation by a national expert from the United States Department of Energy (DOE) Pacific Northwest National Laboratory (PNNL); and a discussion of several key energy storage study reports.

To begin the meeting, the Public Utilities Commission (PUC) and the Efficiency Maine Trust (EMT) provided presentations on the regulatory and programmatic landscape for energy storage in Maine. PUC Chairman Philip Bartlett focused his presentation on opportunities for energy storage development under recent legislation relating to renewable portfolio standards, solar and other distributed generation resources, non-wires alternatives to grid investments and beneficial electrification. He also touched on regulatory barriers and cost trends for energy storage technology. The commission then heard from Michael Stoddard and Ian Burnes of EMT regarding the EMT Innovation Program and how that program can encourage the development of energy storage opportunities through pilot projects. Mr. Burnes described several innovation pilot projects relevant to energy storage.

At this meeting, the commission received an in-depth presentation on energy storage issues from Jeremy Twitchell from the PNNL of U.S. DOE. Offering a national perspective, Mr. Twitchell reviewed:

- The U.S. DOE Energy Storage Program;
- Different energy storage technologies, their advantages, challenges and applications and cost trends;
- The range of services energy storage can deliver and how these relate to energy resource planning; and
- Current state energy storage policies.[2]

The final component of the second meeting was commission review and discussion of two reports that members had read in preparation for the meeting. These reports are as follows:

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[1] Olinsky-Paul, Todd, "Energy Storage: The New Efficiency," April 2019, https://www.cleanegroup.org/wp-content/uploads/energy-storage-the-new-efficiency.pdf
[2] Twitchell, Jeremy, "A Review of State-Level Policies on Electrical Energy Storage," April 2019, https://doi.org/10.1007/s40518-019-00128-1

- The "State of Charge, Massachusetts Energy Storage Initiative Study"[3] report provides a detailed look at national and state energy storage industry landscape, economic development and market opportunities for energy storage and potential policies and programs to better support energy storage deployment in Massachusetts. This study was completed by a team of consultants in conjunction with the Massachusetts Department of Energy Resources and the Massachusetts Clean Energy Center as part of the state's Energy Storage Initiative. The study was based on an in-depth quantitative modeling and analysis of detailed costs, benefits and feasibility of specific energy storage use cases for Massachusetts.

- The "Economics of Battery Energy Storage"[4] report examines the range of services that battery energy storage can provide to the electrical grid and the economic values associated with those services. The report considers the different types of value batteries can generate at different locations on and levels of the grid and for different sectors (for example, end-use customers, transmission and distribution, wholesale markets), the barriers that exist for the utilization of batteries and the implications for stakeholders.

Commission staff provided several handouts to members that synthesized key information from these two reports. Copies of these handouts are included as Appendix C.

At both the second and third meetings, the commission heard presentations from stakeholders engaged in energy storage development and/or operations with a connection to Maine or other New England states. The commission received brief informational presentations from the following individuals:

- Eben Perkins, Competitive Energy Services, LLC
- Brett Cullen, ENGIE
- Matt Doubleday, SunRaise
- Benjamin Lavoie, Ameresco
- Kurt Adams, Summit Natural Gas
- Brad Bradshaw, Velerity
- Michael Connelly, LS Power
- Jason Houck, Form Energy, Inc.
- Greg Geller, Enel X
- Tom Murley, Two Lights Energy Advisors

Additional information regarding the energy storage activities of each presenter is provided as Appendix D.

The balance of the third meeting was dedicated to discussion of findings and recommendations. In preparation for this discussion, the commission chairs had asked each member to submit, in

[3] "State of Charge, Massachusetts Energy Storage Initiative Study," September 2016, https://www.mass.gov/media/6441/download
[4] "The Economics of Battery Energy Storage," Rocky Mountain Institute, September 2015, https://rmi.org/wp-content/uploads/2017/03/RMI-TheEconomicsOfBatteryEnergyStorage-FullReport-FINAL.pdf

advance, a list of up to three key findings, or takeaways, and up to three key recommendations they would like considered by the commission. Of the 14 commission members, 10 supplied input in response to this request. Based on these submissions, commission staff prepared summary documents organizing the input received for use at the third meeting; copies of these summary documents are provided in Appendix E. At the meeting, the commission members worked through the summary documents to identify priorities, clarify information, refine key points and develop a consensus on draft findings and recommendations to be included in the report.

At its fourth and final meeting on December 2, 2019, the commission reviewed and finalized its draft report.

III. Commission Findings

To develop its findings, the commission solicited input from individual members on their key findings, or takeaways, from material presented to and reviewed by the commission. As noted above, members were each asked to submit up to three key findings for consideration which were then compiled by staff and organized by common elements. In this process six overarching findings emerged, each with multiple specific supporting findings submitted by members (see Appendix E). After careful review and discussion of the individual submissions and the overarching findings identified, the commission unanimously agreed on the following four findings:

1. Energy storage has the potential to reduce costs and improve reliability.
2. Energy storage complements and supports renewable energy.
3. Energy storage technology is dynamic and evolving and presents cost-effective options.
4. Energy storage development may be inhibited by market barriers or a lack of clear regulatory signals.

1. Energy storage has the potential to reduce costs and improve reliability.

The commission finds that energy storage offers potential to reduce electricity costs and to improve reliability of the electric transmission and distribution system.

The commission identified and discussed several key ways in which energy storage has the potential to reduce costs for electric ratepayers. Energy storage can shave demand peaks, which has the potential to reduce costs for individual customers and for all ratepayers. At the customer level, energy storage provides cost saving opportunities particularly for commercial and industrial (C&I) customers who pay demand charges. For these customers, behind-the-meter energy storage offers the opportunity to manage peak demand by using stored energy during peak periods thereby reducing their need to purchase energy. Energy storage allows a customer to use electricity from the grid with less variation, reducing any dramatic peaks in load from the grid that a C&I customer may have depending on the nature of their business's energy needs. In a scenario with time-differentiated rates for energy supply, energy storage also allows C&I customers to store energy during time periods with lower rates and use that energy during periods when rates are higher, which could also result in a reduction of charges paid for that energy.

Energy storage also provides the opportunity to reduce system peak demand. This is important because the overall system of generation, transmission and distribution infrastructure needs to be sized to serve the highest peak usage. A system sized to meet these short peak periods results in inefficiencies and the underutilization of assets at the expense of ratepayers. Energy storage can be used to meet system requirements at times of peak electricity consumption by discharging energy stored during non-peak periods, instead of using generation assets. This can eliminate the need to use "peaker" generation plants (often natural gas plants) to meet peak demand, which usually occurs during periods of high electric and fuel prices and which results in greenhouse gas emissions. The usage of storage during these peak usage periods also could delay or defer the need to invest in new capacity, as well as delay, defer or reduce the need for upgrades to transmission and distribution systems. A well-planned electrical system that incorporates energy storage in an effective manner has the potential to reduce costs to ratepayers as it shifts away from the need to build expensive facilities to meet these peak periods.

In addition to the potential for cost savings, the commission also finds that energy storage can improve grid reliability, which is measured by the percent of time the grid is "available and functional".[5] Well-placed and planned deployment of energy storage can both increase the efficiency of the electrical grid and make it less susceptible to disruptions.[6] Energy storage can provide several distinct services that directly impact grid reliability, including: frequency regulation, voltage regulation, spinning and non-spinning reserves and black start asset services (see Appendix C). As discussed in conjunction with the commission's review of "State of Charge, Massachusetts Energy Storage Initiative Study"[7] energy storage can help in the management of power flows and alleviate reliability issues caused by reverse power flows[8] when located at substations. In California, where over 1.3 gigawatts of energy storage will be deployed by 2020, it has been found that energy storage is a "key reliability tool that is used to support a changing and more dynamic grid. In many cases, it is faster to implement than generation facilities and it can be more cost effective than alternative reliability solutions." On numerous occasions, the commission noted that it is important for Maine to look to the lessons learned from other states as it moves forward on energy storage policy.

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[5] Susser, Jonathan. "Understanding and Managing Grid Reliability and Resiliency," July 25, 2018. https://www.advancedenergy.org/2018/07/25/gridreliabilityandresiliency/

[6] Electricity Advisory Committee. "Securing the 21st–Century Grid: The Potential Role of Storage in Providing Resilience, Reliability, and Security Services, Recommendations for the U.S. Department of Energy." June 25, 2018. https://www.energy.gov/sites/prod/files/2018/06/f53/EAC_Role%20of%20Storage%20in%20Providing%20Resilience%20Reliability%20Security%20Services%20%28June%202018%29_0.pdf

[7] "State of Charge, Massachusetts Energy Storage Initiative Study," September 2016, https://www.mass.gov/media/6441/download

[8] Reverse power flow or backfeeding is a flow of electrical energy in the reverse direction from its normal flow. For example, reverse power flow may occur when there is an excess of solar power flowing from a solar generator into the grid.

2. Energy storage complements and supports renewable energy.

The commission finds that the deployment of energy storage complements and supports renewable energy generation resources. Maine law makes a clear commitment to encouraging renewable energy as a source of electricity:

> **1. Policy.** In order to ensure an adequate and reliable supply of electricity for Maine residents and to encourage the use of renewable, efficient and indigenous resources, it is the policy of this State to encourage the generation of electricity from renewable and efficient sources and to diversify electricity production on which residents of this State rely in a manner consistent with this section.
> (35-A MRSA, section 3210, subsection 1)

During the First Session of the 129th Legislation, the state's commitment to renewable energy was strengthened through several laws. Under Public Law 2019, chapter 477, the following goals were enacted:

> **1-A. State goals for consumption of electricity from renewable resources.** The State's goals for increasing consumption of electricity in the State that comes from renewable resources are as follows:
>
> A. By January 1, 2030, 80% of retail sales electricity in the State will come from renewable resources; and
> B. By January 1, 2050, 100% of retail sales electricity in the State will come from renewable resources.
> (35-A MRSA, section 3210, subsection 1-A)

In addition, Public Law 2019, chapter 477 requires the procurement of new renewable generation resources and Public Law 2019, chapter 478 requires the procurement of distributed generation resources defined as generation facilities with a nameplate capacity of less than five megawatts that uses renewable fuel or technology. With these additional commitments to renewable energy, there is a key opportunity for energy storage.

Energy storage can play an important supporting role for renewable resources and address certain limitations of these resources. In particular, while renewable energy has many benefits, certain renewable resources have intermittent production and this is where storage can be of great value. For example, renewable energy generated from solar or wind is only produced when there is sun shining or wind blowing, respectively. Energy storage can be used to store excess power generated during periods with sun and wind availability. During periods of time when the sun or wind is not available, energy storage can be used to address that gap by discharging stored energy. Longer duration energy storage, as it becomes available, offers the potential to increase deployment of certain types of renewable energy such as wind. For example, in times of consistent wind and low-electricity demand, that excess energy produced from wind is lost. If there is longer duration energy storage available, that excess energy can be captured, making the renewable energy more valuable and efficient. As the penetration of intermittent renewable generation resources increases in the state, the need to address intermittency through system flexibility increases.

3. Energy storage technology is dynamic and evolving and presents cost-effective options.

During the study process, the commission reviewed the classification of energy storage technologies (See Appendix C) and discussed how the advantages and applications of energy storage can vary by technology type, size and location. For example, long-duration storage such as pumped hydropower may be complementary to short-duration advanced storage technologies given differing capabilities and grid requirements. Over the course of its discussions, the commission expressed numerous times that Maine needs remain technology neutral when developing energy storage policy. Any policy developed related to energy storage should not just focus on a singular technology, but rather should be flexible to realize the benefits that differing technologies can provide to address differing needs.

From the presentations made by energy storage stakeholders (see Appendix D), it became clear that energy storage options and technologies are ever evolving and what may seem ideal today may be replaced any time by an option that addresses a need in a more effective and efficient manner in the future. Commission members expressed that they do not want to miss out on opportunities to maximize storage benefits because policy was too narrowly crafted. Members also discussed the importance of considering behind-the-meter storage solutions as these solutions also generate socialized benefits.

The commission also learned through its study, especially from the presentation provided by Jeremy Twitchell of the Pacific Northwest National Laboratory, that storage technology costs are declining and that storage is cost-effective in many applications. As more entities deploy storage technology the experiences learned can provide a greater understanding of storage technology benefits and inform opportunities for cost-effective storage technology solutions in Maine.

4. Energy storage development may be inhibited by market barriers or a lack of clear regulatory signals.

The commission identified that there may still be some barriers to the deployment of energy storage in Maine. While some of these challenges can be addressed at the state level, others will require coordinating with other states in the region to try to affect change.

At the state level, the commission discussed whether Maine law provides clear direction regarding whether an investor-owned transmission and distribution utility (IOU) could own, or have a financial interest in an energy storage facility. In current law, 35-A MRSA section 3204, subsection 6 "allows an investor-owned transmission and distribution utility to own, have a financial interest in or otherwise control generation and generation-related assets "only "to the extent that the commission finds that ownership, interest or control is necessary for the utility to perform its obligations as a transmission and distribution utility in an efficient manner." This provision does not provide clarity on the instances in which an IOU could have any interest in energy storage. While IOU's understand they can earn revenue from traditional transmission and distribution projects, it is not at all clear when they can earn revenue on energy storage projects and this lack of clarity provides a disincentive for the IOU to look at alternatives to transmission and distribution projects.

At the regional level, the commission discussed the current role for energy storage in the markets operated by ISO-NE. As stated in the "State of Charge" report for energy storage development to grow clear rules need to be in place at ISO-NE to enable full participation of energy storage projects in the wholesale markets.[9] The commission noted that ISO-NE markets accommodate energy storage but do not fully value energy storage capabilities. Furthermore, the markets that energy storage can participate in are not large enough to incent significant new energy storage deployment and ISO-NE system planning and modeling cannot currently accommodate all market functions. Whether behind-the-meter or on a larger scale, in order for people to invest in storage that will provide system benefits to all ratepayers, an investor needs to be monetarily compensated for the value the storage project is providing to the system since they are bearing all of the costs.

In moving forward, Maine does not need to reinvent the wheel. There are many other states Maine can look to, especially those in the New England region, for ways in which to encourage storage in a manner that will benefit all ratepayers. The important thing is that the state needs to start to act quickly so we do not lose pace and fall behind in the New England market.

IV. Recommendations

As highlighted in section III of this report, the commission observed that energy storage has the potential to play an important and valuable role in Maine's energy future through it's potential to increase grid reliability, reduce inefficiencies, complement renewable energy generation especially as its deployment grows, and create cost savings for electric ratepayers. Based on available research and information presented by experts in the field, the commission has identified several initial steps the State can take without delay to advance energy storage in the state. The commission also recognizes that to move beyond these first steps to create and implement a longer-term plan for state energy storage policy requires additional investigation. The remainder of this section outlines the commission's recommendations, including specific short-term actions as well as targeted research and analysis to map out the long-term path forward for energy storage development and policy in the State. The recommendations are as follows:

1. Establish state targets for energy storage development
2. Encourage energy storage paired with renewable and distributed generation resources
3. Advance energy storage as an energy efficiency resource
4. Clarify utility ownership of energy storage
5. Address electricity rate design issues relating to time-of-use
6. Advocate for energy storage consideration in regional wholesale markets
7. Conduct an in-depth Maine-specific analysis of energy storage costs, benefits and opportunities

[9] "State of Charge, Massachusetts Energy Storage Initiative Study," September 2016, https://www.mass.gov/media/6441/download

The commission recommends that all energy storage policy efforts, as well as analysis conducted to inform future policy, include careful consideration of the needs of low-income populations and strategies to ensure low-income households and communities in the State have access to the benefits of energy storage.

1. Establish Targets for Energy Storage Development

The commission recommends that the State set a short-term target for the development of energy storage capacity and develop longer term goals based on further research and analysis. In the short-term, the commission recommends establishing a State goal of reaching 100 megawatts (MW) of energy storage capacity available in the State by the end of 2025. This is specified as a goal not a mandate; it does not require any particular action or procurement activity by the State. By creating a goal of 100 MW of available storage capacity by 2025, the commission's intent is to signal the State's recognition of the value and benefits that strategic investment in energy storage can provide to energy consumers and the electrical grid. The commission selected 100 MW by 2025 as a modest initial target to encourage investment and development activity. In developing this target, the commission considered energy storage targets established by other states, which are summarized in Table 1. The commission recommends that the Governor's Energy Office developed and propose future targets as part of the in-depth energy storage study outlined in recommendation 7.

Table 1 – Statewide Energy Storage Targets[10]

State	Target Level	Target Date	Type
Arizona	3,000 MW	2030	Goal
Massachusetts	200 MWh 1,000 MWh	2020 2025	Goal
New York	1,500 MW 3,000 MW	2025 2030	Goal
New Jersey	600 MW 2,000 MW	2021 2030	Goal
California	1,325 MW	2024	Requirement

2. Encourage Energy Storage in Renewable Energy Procurement

To realize the benefits energy storage can provide in conjunction with renewable energy generation, the commission recommends that the State enhance opportunities for energy storage under the long-term contracts (procurements) for renewable resources and distributed generation (DG) resources required by recent legislation. In 2019, the State enacted two laws which explicitly allow for energy storage paired with generation to participate in certain resource procurements administered by the PUC. First, "An Act to Reform Maine's Renewable Portfolio Standard" (Public Law 2019, chapter 477) includes requirements for procurements of new renewable generation resources and specifically allows grid-connected energy storage systems paired as a complementary resource with a renewable generation resource to participate in the

[10] Source: https://www.eesi.org/papers/view/energy-storage-2019

procurement under certain conditions.[11] Second, "An Act to Promote Solar Energy Projects and Distributed Generation Resources" (Public Law 2019, chapter 478), requires procurements of shared DG resources (output owned by or allocated to subscribers) and commercial/institutional DG resources. This law authorizes, but does not require, the PUC to establish incentives in the DG procurements which may include incentives to support DG resources paired with energy storage.

The commission recommends the State take the next step beyond allowing storage paired with renewable generation in these procurements and create an incentive for energy storage paired with renewables. Specifically, the commission recommends:

- Providing an adder for energy storage in procurements of new renewable generation resources under 35-A MRSA section 3210-G and of DG resources under 35-A MRSA, chapter 34-C in the contract price when: (a) the generation resource is paired with energy storage and (b) the bidder demonstrates that the paired storage alleviates congestion on the transmission or distribution system or provides some other demonstrated benefit to grid reliability, grid resiliency or electricity ratepayers.

- Requiring the PUC to determine the specific value (or formula) along with eligibility criteria for this "adder" through a rulemaking or other appropriate PUC proceeding conducted for this purpose.

3. Advance Energy Storage as an Energy Efficiency Resource

The role of energy storage in peak demand reduction provides a direct link between energy storage and the work of the Efficiency Maine Trust. Current law specifically directs EMT to advance the goal of reducing peak demand (35-A MRSA section 10104) and to consider programs that reduce electricity costs for all consumers through peak demand reduction (35-A MRSA section 10110, subsection 2 paragraph A, subparagraph 4). Energy storage provides a mechanism to reduce peak demand by storing energy during off-peak periods and discharging stored energy during peak periods thereby reducing demand on the grid during the peak period; this is often referred to as peak shaving or peak shifting.

To ensure that EMT is empowered to pursue energy storage initiatives, the commission recommends that the Legislature provide additional clarity in law and specific policy directives to EMT regarding energy storage. In particular, to solidify and clarify the role of EMT with respect to energy storage and energy efficiency, the commission recommends:

- Amending the laws governing the Efficiency Maine Trust (Title 35-A chapter 97) to ensure that the Trust's authority explicitly and affirmatively includes energy storage, by adding direct references to energy storage in relevant sections of statute, including definitions; and

[11] To participate storage must be co-located with the generation or located separately from the generation provided that the PUC finds the inclusion of the energy storage system would result in a reduction in greenhouse gas emissions

- Directing the Efficiency Maine Trust to develop opportunities through its programs and initiatives to use energy storage to reduce peak electricity demand. In developing storage programs, the commission recommends that the Trust consider:
  - Bring-your-own-device (BYOD) programs in which customer-owned and customer-sited battery storage is aggregated and performance incentives are provided for reducing load at times of system peak;
  - Rebate programs for residential storage paired with renewable energy;
  - Customer education initiatives regarding demand management and energy storage, including education targeted to low-income and rural areas; and
  - Enhancing the existing Innovation Pilot Program to advance innovation in storage applications.

4. Clarify Utility Ownership of Energy Storage

The commission has identified a need for increased clarity regarding ownership and dispatch of energy storage resources by investor-owned transmission and distribution utilities. Current law provides that the PUC may allow an investor-owned transmission and distribution utility to own generation-related assets to the extent that the commission finds it is necessary for the utility to perform its obligations in an efficient manner (35-A MRSA section 3204, subsection 6). From the perspective of utilities, this language and its interpretation by the PUC results in a degree of uncertainty that creates a barrier to investment. The commission is interested in having the PUC carefully examine and evaluate whether and how transmission and distribution utilities could participate in energy storage with appropriate "guardrails" to ensure that private developers as well as electricity consumers are not disadvantaged.

Specifically, the commission recommends directing the PUC to open a docket to examine issues related to the ownership and operation of energy storage by transmission and distribution utilities including consideration of:

- Cost implications for electricity ratepayers;
- Implications for the private market for storage development, construction and operation; and
- Potential benefits of utilities installing energy storage at or near utility substations to address transmission congestion issues

5. Address Rate Design and Energy Storage

To harness the value offered by energy storage and concurrently address limitations in current electricity rate structures, the commission recommends the PUC investigate and, where appropriate, implement rate designs that account for variation in the cost components of electricity as the load (or demand) on the electricity system fluctuates. Even in the absence of energy storage, time differentiated electricity rates can provide valuable signals to energy consumers about the cost of energy at different times and encourage consumer to adjust consumption to periods of lower demand, providing benefits to the overall system. Time differentiated rates also create incentives for energy storage to shift demand away from high cost

peak periods. Energy storage increases the value of time differentiated rates by creating the opportunity to bank excess generation (supply) during non-peak periods when prices are lower and discharge that energy for consumption during peak periods when prices are high.
The commission recommends that the PUC take the following specific steps to address rate design:

- Open a docket to investigate opportunities to modernize electricity rate design through time-of-use, or other time-differentiated rates, that send appropriate price signals and incentives to consumers to reduce demand during peak periods.
- Develop and implement a pilot program to test and evaluate time-of-use rates in conjunction with energy storage; and
- Develop and implement a schedule for regular review and update of electricity rate designs and ensure that the review include consideration of time differentiated rates.

6. Advocate for Energy Storage in the Regional Energy Markets

Given the potential value and range of services that energy storage can provide at the wholesale market level, the commission recommends that the State take steps to ensure that ISO-NE continues to address and integrate energy storage in wholesale markets. The commission recognizes that the ISO-NE wholesale markets and associated market rules provide some avenues for energy storage to participate. As these markets continue to evolve, the commission wants to ensure that ISO-NE considers, and values, the full range of energy storage in regional system planning and market development. As the regional transmission operator, ISO-NE is uniquely positioned to create wholesale market opportunities to realize the potential of energy storage, particularly with respect to certain aspects of grid operation and performance, including but not limited to frequency and voltage regulation, spinning and non-spinning reserves and restoring generation during grid outages (known as black start assets).

While Maine alone cannot change the ISO-NE rules, it can provide the ISO-NE with signals that change needs to occur. The commission recommends that the PUC, Governor's Energy Office (GEO) and other state agencies as appropriate seek opportunities to advocate for consideration of energy storage opportunities by ISO-New England in regional market planning and design. These opportunities may include direct intervention as well as engagement with ISO-NE through regional organizations, such as the New England States Council on Energy (NESCOE) and the New England Conference of Public Utility Commissioners (NECPUC). The commission highlights the following issues for the PUC and GEO to raise in efforts to advance energy storage issues at the regional level:

- Addressing variation in locational value of new grid-scale energy storage, for example in relation to transmission-constrained areas and renewable energy generation; and

- Creating market opportunities for the full range of energy and reliability services that can be delivered by grid-scale energy storage. Examples could include establishing new market products for fast ramping and long-duration load following capabilities and expanding existing ancillary service markets including the Frequency Regulation market.

7. Conduct In-depth Analysis of Energy Storage Costs, Benefits and Opportunities

As an important complement to the preceding recommendations, the commission strongly recommends that the State, under the direction of the Governor's Energy Office, concurrently conduct a comprehensive analysis to evaluate and quantify the costs, benefits and opportunities for energy storage in the State and develop specific recommendations for future policy and program development. The preceding six recommendations offered by the commission outline critical first steps Maine can take in the energy storage arena based on existing research and analysis and experience of other states. To move beyond these first steps, the commission recognizes the need for Maine to conduct an in-depth, data driven study that includes quantitative modeling and analysis.

The commission recommends that the GEO be directed to conduct this study over a period of time that is determined to be sufficient to allow for the meaningful evaluation of data and information and deliver a report to the Legislature upon the conclusion of the study. To maximize the value and efficiency of this study initiative, the commission recommend that the study include:

- A review of existing state-specific energy storage studies, including but not limited to the Massachusetts State of Charge report (2016) and the Vermont Act 53 Report (2017)[12], and consultation with relevant staff and organizations in those States. This will ensure that Maine does not reinvent the wheel and capitalizes on lessons from similar efforts completed to date.

- Input from and involvement of the relevant state agencies including the PUC, the EMT, and the newly formed Climate Council and relevant subcommittees of that Council.

- Quantitative data analysis modeling of energy storage needs, opportunities and cost-benefit analysis based on Maine-specific data, using existing energy storage modeling software available from reputable sources when possible and appropriate.[13]

- Comprehensive consideration of relevant issues including, but not limited to:
    - Emerging storage technologies and technological developments;
    - Access to energy storage for low-income households and communities;
    - Impacts of energy storage on carbon emissions;
    - Energy storage permitting and interconnection requirements;

[12] "Act 53 Report: A Report to the Vermont General Assembly on the Issue of Deploying Storage on the Vermont Electric Transmission and Distribution System" Vermont Department of Public Service (November 2017) https://legislature.vermont.gov/assets/Legislative-Reports/Storage-Report-Final.pdf

[13] The commission recommends consideration of: Battery Storage Evaluation Tool available from the U.S. Department of Energy, Pacific Northwest National Laboratory and the Storage Value Estimation Tool (Storage VET) available from the Electric Power Research Institute.

  - Safety and performance codes and standards; and
  - Decommissioning and end-of-life remediation of storage technology

- Recommendations for future energy storage targets beyond the 100 MW by 2025 target outlined in Recommendation 1. The commission recommends that the GEO carefully consider how to set targets optimally to support achievement of the state's renewable energy goals of 80% by 2030 and 100% by 2050 (35-A section 3210, subsection 1-A).

- Comprehensive recommendations that include a prioritized list and timeline of Maine-specific goals and needs for energy storage and associated policy and statutory changes necessary to achieve those goals.

The commission recognizes this study will require technical and analytical expertise and resources and therefore recommends that the Governors' Energy Office be provided the necessary resources to carry out this work effectively.

Finally, the commission recommends that the GEO address energy storage in all future updates to the comprehensive State Energy Plan, which GEO is required to provide the Governor and the Legislature every 2 years in January (2 MRSA section 9, subsection 3, paragraph C). To provide clarity and specificity, the commission recommends amending the State Energy Plan statute to require the plan, and biennial updates to the plan, specifically address energy storage development.[14]

Appendices – To be added

A. Authorizing Legislation
B. Membership List
C. Work Session Handouts, November 6, 2019
D. List of Stakeholder Presentations
E. Member Takeaways and Findings; Member Suggested Recommendations

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[14] This could be modeled on the current statutory requirement that the plan include a section on wind energy development (see 2 MRSA section 9, subsection 3, paragraph C, subparagraph (1), sub-subparagraph (c)).