

MA DOER Energy Storage Target Annual Report – CY 2019

I. Introduction

Massachusetts law sets a target for 1,000 MWh of installed energy storage systems (“ESS”) be commissioned by December 31, 2025.

Unitil is strongly committed to serving as a clean energy catalyst for the region and views energy storage as a core component of the clean energy transformation required to achieve the Commonwealth’s goal of a 80% greenhouse gas emission reduction by 2050.

As of December 31, 2019, Unitil had approximately 19.1 MWh_{ac} and 8.9 MW_{ac} of ESS either installed or in the pipeline in its service territory, representing 1.9 % of the new statewide ESS target.

Unitil has been investigating how ESS can contribute in optimizing the operation of the electric system and enhance the integration of renewable distributed generation onto the system. In August 2019, Unitil received a grant to install a 2 MW/4 MWh ESS at a distribution substation. This system is presently being installed with real-time monitoring systems to enable precise control of the system.

What follows is Unitil’s detailed Energy Storage Target Annual Report (“Report”) to the DOER for the year ended December 31, 2019.

II. Reporting Requirements

An Act to Advance Clean Energy, Section 20 of Chapter 227 of the Acts of 2018, amended An Act Relative to Energy Diversity, Section 15 of Chapter 188 of the Acts of 2016, by striking out Section 15 in its entirety and replacing it with a new Section 15 containing a new statewide energy storage target of 1,000 MWh, to be achieved by December 31, 2025, and a new requirement for the electric distribution companies (EDCs) to report annually to the DOER on the new target by February 15, beginning in 2019, documenting the energy storage installations in their respective service territories.

As set forth in An Act to Advance Clean Energy, to achieve this new statewide energy storage target of 1,000 megawatt hours, DOER “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, inclusion in energy portfolio standards, the use of alternative compliance payments to develop pilot programs and the use of energy efficiency funds under section 19 of chapter 25 of the General Laws if the department determines that the energy storage system installed at a customer’s premises provides sustainable peak load reductions on either the electric or gas distribution systems and is otherwise consistent with section 11G of chapter 25A of the General Laws.”

This is Unitil's third annual Report to the DOER and covers the period January 1, 2019 through December 31, 2019.¹

A. Data Collection

Unitil obtains uniform data and information for EDC-owned and non-EDC-owned ESS projects through the distributed generation ("DG") interconnection process. For purposes of annual Reports to the DOER, the EDCs have been requesting data and information for ESS projects they do not own from customers and developers of existing ESS projects already connected to their distribution systems, and are requesting such data and information from customers and developers of new projects that have applied to interconnect to their respective distribution systems. As of December 3, 2019, the Department of Public Utilities ("DPU") issued an Interim Guidance regarding ESS requiring all applications for interconnection that include ESS to submit a completed ESS Questionnaire to provide technical and operational data about the proposed ESS.²

The collected data and information will be used to demonstrate measurable progress towards the achievement of the ESS 1,000 MWh target of installed ESS. These data and information include:

- ESS Installed, that is, Interconnected (MWh_{ac} and MW_{ac});
- ESS in the Pipeline to be installed (MWh_{ac} and MW_{ac});
- Policy Sources of ESS (e.g., SMART program);
- ESS Specifications (e.g., technology type, manufacturer);
- Operational Information (e.g., installation type, system configuration); and
- Applications/ Intended Use Cases (e.g., Peak Shaving/ Load Leveling).³

The EDCs are including the above-mentioned data and information on the ESS installed and pipeline projects in their annual reports to the DOER, to the extent such data and information has been provided to them. However, for non-EDC-owned projects, such data and information must be obtained from customers and developers, who were not required to provide such data and information until the Department's December 3, 2019 interim guidance noted above. Given that the Interim Guidance did not apply for much of the 2019 reporting year, the EDCs may have been unable to obtain some or all of this customer data and information and the level and type of data and information included for each such project may vary in this Report. Consistency of data collection and reporting should improve with the requirement for applicants to provide a completed ESS Questionnaire.

B. Attachment A

¹ Although more customer-owned ESS projects will be included in this report than in the EDCs' first ESS report to DOER, submitted on February 15, 2018, pursuant to An Act Relative to Energy Diversity, the data and information on each ESS projects in Massachusetts is still limited at this early stage of ESS installation in the Commonwealth as customers are not required to provide detailed ESS project data.

² See DG Interconnection, D.P.U. 19-55, Interim Guidance – Energy Storage Systems (December 3, 2019).

³ *State of Charge* report, issued on September 16, 2017. According to the report, a use case is defined as an integrated set of grid services performed by a technology at a distinct site or location on the grid.
<http://www.mass.gov/eea/docs/doer/state-of-charge-report.pdf>.

Attachment A to this Report includes installed ESS projects, and ESS projects in the pipeline as of December 31, 2019. For purposes of this Report, an “installed” ESS project means an ESS project that has been interconnected to an EDC’s electric distribution system.

C. Policy Sources of ESS

The EDCs have jointly identified several state policies, programs, and funding sources intended to drive the installation of ESS in the Commonwealth. Where the EDCs are aware of the state policy, program or funding source associated with an ESS project, the EDCs have identified that policy source in Attachment A. Some ESS projects may participate in multiple state policies, programs and funding sources. Policy sources of ESS projects include, but are not limited to:

- Utility-owned ESS for transmission and distribution operation and management for the benefit of customers (“Utility-Owned T&D”);
- Utility-owned ESS for research and development purposes, such as those projects supported by U.S. Department of Energy grants, or utility-scale solar plus storage projects developed to support research programs (“Utility-Owned R&D”);
- ESS to be paired with newly authorized large-scale energy procurements featuring 9,450,000 MWh of clean energy and 1,600 MW of offshore wind generation under Sections 83C and 83D of the Green Communities Act (“Section 83C or 83D”);
- Customer-owned ESS enrolled in an EDC’s energy efficiency/ demand response demonstration project or program (“Energy Efficiency/DR program”);
- Customer-owned ESS enrolled in the EDC’s Solar Massachusetts Renewable Target (“SMART”) program that qualify for the SMART storage adder (“SMART program”); and
- Customer-owned ESS funded by the DOER’s or Massachusetts Clean Energy Center’s (“MassCEC”) Advancing Commonwealth Energy Storage (“ACES”) and Peak Demand Reduction Grant programs, which include projects to which the EDC has provided in-kind and/or financial support (“DOER/ MassCEC Funded Projects”).⁴

D. Applications and Intended Use Cases

Based on the *State of Charge* report and the EDCs’ own expertise, the EDCs have identified the following primary applications and use cases for ESS. This list may be modified as the EDCs monitor relevant industry trends and gain further hands-on experience with energy storage.

- i. Wholesale Market (i.e., Energy, Capacity, Ancillary Services): ESS have the potential to participate in all major categories of the wholesale market.
 - a. In the wholesale energy market, ESS may be able to produce revenue by arbitraging hourly electricity prices, charging when the wholesale price is low and discharging when the wholesale price is high.

⁴ Any ACES or Peak Demand Reduction Grant project where the EDC is the award recipient or the EDC partner on the project.

- b. ESS may participate in the ISO-NE Forward Capacity Auction and earn revenue by contributing to ISO New England's installed capacity.
 - c. ESS may also be able to generate revenue by participating in the ancillary services market (e.g., black start and frequency regulation).
- ii. Peak Shaving / Load Leveling: ESS can store energy during hours of low demand and discharge energy when the system is peaking. This may reduce the entire system peak and result in lower utilization of inefficient and expensive gas and oil units. It may also reduce ISO-NE capacity and regional network service costs.
- iii. Generation Support (e.g., Peaker Replacement): ESS can discharge when the system is peaking, thus acting in place of peaking capacity. ESS have the potential to be cleaner and more reliable than a traditional combustion turbine unit.
- iv. T&D Asset Deferral: Strategic deployment of ESS has the potential to defer or eliminate transmission and distribution upgrades in specific locations. The potential for transmission and distribution deferrals need to be studied on an individual basis in consideration of local circumstances and system characteristics.
- v. Power Quality (e.g., Voltage/VAR Support): ESS can provide voltage/VAR support. Reactive power cannot be efficiently transmitted over long distances, which makes distributed ESS an attractive alternative to traditional voltage/VAR support supplied by generating units in some locations.
- vi. Customer Bill Savings (e.g., Demand Charge Management): Individual customers can utilize ESS to shave the peaks and fill the troughs of their load. By reducing peak load, customers may be able to mitigate their installed capacity tag. Commercial and industrial customers may also have the potential to realize bill savings by lowering their peak demand and avoiding a demand charge. Customers with time varying rates can also use ESS to perform arbitrage by charging the ESS during less expensive off-peak times and discharging for their own use during more expensive peak periods.
- vii. Renewable Energy Integration (e.g., Ramping, Smoothing): ESS can quickly follow the variable and unpredictable generation of an intermittent renewable resource making it smooth and dispatchable. ESS can thus support the further integration of renewable resources.
- viii. Renewable Energy Shifting: ESS have the potential to store energy generated by renewable resources when system demand is low and discharge when system demand is high.
- ix. Reliability and Resiliency: ESS can support reliability and resiliency by locally providing energy during an outage event.

- x. Microgrid: ESS can help promote a cost-effective and reliable microgrid. By storing energy produced by renewable resources or by combined heat and power (CHP) for use when those assets are not generating, ESS can support microgrid “islanding” and going off the main grid at times when there is an electric distribution system outage or when it would be otherwise advantageous to the microgrid operator.

E. Target Results

See Attachment A for data and information regarding installed (e.g., interconnected) ESS projects and ESS projects in the pipeline to be installed.

- i. Installed Projects

As of December 31, 2019, Unitil has 5 residential ESS, totalling 0.1 MWh_{ac} and 0.05 MWh_{ac} that is interconnected in its Massachusetts service territory..

- ii. Pipeline Projects

As of December 31, 2019, Unitil had approximately 19.0 MWh_{ac} and 8.3 MW_{ac} of ESS in the project pipeline.⁵

F. Cost-Effectiveness and Viability

Energy Efficiency/ Demand Response

In Massachusetts, the energy efficiency program administrators (“PAs”) use a Total Resource Cost (“TRC”) test to determine the cost-effectiveness of an offering or program. For the purposes of determining the cost-effectiveness of storage included as part of energy efficiency and demand response, the PAs would apply the TRC standard. The PAs look at the total cost of the project, regardless of funding source, and compare that against the total benefits of the project and determine if the benefits exceed the costs. In the 2019-2021 Three Year Energy Efficiency Plan, the PAs proposed a pay for performance program design for customer-owned and sited behind-the-meter storage assets, typically referred to as daily dispatch, which means a resource type that can participate daily during the summer peak hours without adverse impacts to personal comfort or facility productivity. For pay for performance specifically, the PAs are not incenting the equipment itself, only the performance of the equipment assuming it is already in a customer’s home or facility. Therefore, when assessing the cost effectiveness of the pay for performance storage offerings, the PAs will look only at the amount of the incentive they are proposing to offer and compare that against the level of benefits the kW reduction is expected to produce.

⁵ The exact amounts of energy and power of the proposed projects in AC and DC ratings could not be confirmed at the time of Report submittal, but will be known as the projects move from the pipeline to the installed list.

In the 2019-2021 Three Year Plan order, the DPU did not approve full scale statewide deployment of a daily dispatch because it was determined to be an untested form of dispatch but did support learning more through demonstration. The PAs, Unitil, Eversource, and Unitil, ran daily dispatch demonstrations in summer 2019 and plan to present the findings to the Massachusetts Energy Efficiency Advisory Council (“EEAC”), secure an EEAC resolution in support of daily dispatch becoming a full program offering, and submit a Compliance Filing to the DPU in Q1 2020.

The PAs made multiple presentations to the EEAC during 2019 and early 2020 to describe and support the inclusion of daily dispatch as a full program offering.⁶

G. Market Barriers and Solutions to the Adoption of Energy Storage

Market Barriers: Dual Participation

In 2019, the Federal Energy Regulatory Commission (“FERC”) conditionally approved several ISO-NE market rule changes filed in compliance with FERC Order 841, which required each Regional Transmission Organization (“RTO”) or Independent System Operator (“ISO”) to establish market participation models for ESS. Specifically, FERC required RTOs/ISOs to “account for the physical and operational characteristics of electric storage resources through bidding parameters or other means” and to ensure that ESS resources are “eligible to provide all capacity, energy, and ancillary services that [they are] technically capable of providing.”⁷

ISO-NE addressed Order 841 requirements primarily through the creation of the Continuous Storage Facility (“CSF”), a participation model that allows ESS resources to participate simultaneously as Generating Assets, Dispatchable Asset-Related Demand (“DARD”), and Alternative Technology Regulation Resources (“ATRRs”). For resources that do not wish to participate as CSFs, ISO-NE market rules also accommodate several other participation models, including combined models such as Settlement-Only Generator (“SOG”) and ATRR. Models other than the CSF model may limit an ESS’s ability to provide certain products (e.g., Reserves), but they may also afford ESS resources additional operational flexibility relative to the CSF model.

A key requirement for Order 841 compliance is the ability for ESS resources to serve both retail and wholesale markets (also called “dual participation”). In its conditional acceptance of ISO-NE’s tariff revisions issued in November 2019, FERC required ISO-NE

⁶ The PAs presented to the EEAC in March and November of 2019 and January 2020 on Active Demand Reduction and specifically the daily dispatch approach; <http://ma-eeac.org/march-20-eeac-meeting/>, <http://ma-eeac.org/november-20-eeac-meeting/>, <http://ma-eeac.org/january-22-eeac-meeting/>

⁷ Federal Energy Regulatory Commission Order 841, ¶320
<https://www.ferc.gov/whats-new/comm-meet/2018/021518/E-1.pdf>

to submit a further compliance filing “to explain how its Tariff allows for electric storage resources to participate in both wholesale and retail markets.”⁸ ISO-NE submitted a compliance filing to FERC on February 10, 2020 in which it proposed new tariff language to state that ESS will “not be precluded from providing retail services so long as it is able to fulfill its wholesale Energy Market and Forward Capacity Market obligations including, but not limited to, satisfying meter data reporting requirements and notifying the ISO of any changes to operational capabilities.”⁹

Previously, ISO-NE has suggested that ESS resources may achieve “dual participation” by appropriately shaping daily bids to “indicate a strong preference” to be dispatched at certain times.¹⁰ For example, an ESS may submit a bid at the ISO-NE floor price when it needs to discharge, or it may offer at the ISO-NE price cap when it does not want to discharge. By “indicating a strong preference,” resources may be able to meet most or all of their retail obligations through ISO-NE dispatch. However, this model does include some risk. For example, price spikes due to reserve constraints could exceed the offer price cap and result in a resource being called even when it does not wish to discharge. This may prevent the ESS resource from delivering energy later to meet its retail obligations or result in financial penalties if the resource does not answer ISO-NE dispatch.

For EDCs, the primary use case for utility-owned ESS devices is the deferral of a transmission or distribution investment through Non-Wires Alternative (“NWA”) projects. ESS installed as NWAs have certain reliability requirements that they must meet to properly defer or avoid system upgrades. These requirements may be limited or seasonal, leaving the ESS idle during the remaining parts of the year unless it is registered with ISO-NE. However, under ISO-NE’s current participation models, it is not possible for an asset to participate seasonally or to leave the market for portions of the year. Under the “strong preference” approach to dual participation, the ability to serve reliability requirements without incurring financial penalties is not guaranteed.¹¹

In some cases, an NWA project may be capable of managing market risk appropriately to achieve the T&D deferral goal while simultaneously participating in the ISO-NE markets. In these instances, the revenue earned through participation in the ISO-NE wholesale electricity markets could reduce the NWA cost to customers. In other cases, however, market risks may prevent resources from participating in ISO-NE markets,

⁸ FERC Order on ISO-NE Order 841 Compliance Filing, November 22, 2019

https://elibrary.ferc.gov/idmws/file_list.asp?document_id=14815902

⁹ Docket No. ER19-470-000, ISO-NE Revisions in Compliance with the Order No. 841 Order on Compliance, at 11 (Feb. 10, 2020), available at https://www.iso-ne.com/static-assets/documents/2020/02/compliance_filing_order_841.pdf

¹⁰ Chris Parent, former ISO-NE Market Development Director, used this phrase at DOER’s ISO-NE panel to describe a dual participation strategy during the “Energy Storage Stakeholder Series” on December 18, 2019.

¹¹ An NWA project participating in the ISO-NE markets may incur costs or penalties if providing non-wholesale services prevents it from meeting wholesale market requirements.

resulting in the underuse of a ratepayer-funded ESS asset throughout the year. The inability to participate in ISO-NE markets due to operational or financial risks may result in higher customer costs or prevent projects from going forward.

Unitil believes that ISO-NE's current approach to dual participation is an important step toward ensuring that ESS resources can achieve their full economic potential. However, Unitil believes that Massachusetts customers will be best served by a seasonal exemption for resources with reliability obligations. Such an obligation would allow NWA projects to temporarily suspend market participation during certain periods of the year in order to serve reliability requirements without incurring additional risk. This model will also lower NWA costs and make energy storage technologies more cost-competitive with traditional infrastructure upgrades in the future.

Market Barriers: DC Coupled Solar Facilities with Storage

Unitil is aware that many solar facility developers seek to pair their solar capacity with battery storage capacity to take advantage of the Commonwealth's SMART program storage adder and enhance the operational capabilities of the solar generation asset. Many of these are designed to be co-located and alternating current (AC)-connected, meaning that each component, the solar PV and battery storage system, has its own dedicated inverter(s) and the battery charges from AC-power flowing into its inverter. However, an increasingly popular design is to connect the battery storage to the solar PV output behind the inverter, or multiple inverters, as a direct current (DC) connection. Such systems have combined AC output for both resources through a single meter.

This type of connection is allowed by the EDCs' Standards for Interconnection of Distributed Generation, and DOER's regulations of the SMART program. DOER and industry participants have highlighted that the PV output that is used to charge the ESS directly is not fully compensated under the SMART program, due to roundtrip efficiency losses of the ESS. In addition, if the developer of such a DC-coupled solar and storage system wishes to participate in the ISO-NE markets, it is currently constrained from doing so, as all market settlement must occur in AC-metered energy, and the PV and ESS cannot be seen and settled separately when behind a single AC meter. As a result, ISO-NE will only recognize a single Settlement Only Generator asset, the PV array, behind the single meter.

In the proceedings of a DPU technical session held jointly for participants in D.P.U. 19-55 and D.P.U. 17-140, DOER agreed to convene a stakeholder group to primarily consider how the SMART-eligible solar output could be fully compensated and consider additional steps that might allow for participation of DC-coupled ESS more fully in the ISO-NE markets. As part of this stakeholder process, DOER convened the EDCs and solar/ESS industry members in numerous meetings from October 2019 to the present, which has resulted in agreement in principle on a methodology for annually

compensating DC-coupled ESS facility owners, participating in the SMART program, for roundtrip efficiency losses from the ESS. The details of this methodology are still in discussion at the time of this filing.

Additionally, the stakeholders, along with representatives of ISO-NE, agreed to work through the ISO-NE committee process to identify pathways to fuller market participation for DC-coupled ESS. This process is expected to include the reporting of DC-metered energy amounts from the solar and ESS assets for market settlement by the customer via a qualified meter reader, adjusted into AC-energy terms, and matched against the metered output of the utility owned AC meter. This process is expected to take 9-12 months at a minimum from the time of this filing, before a set of rules is adopted to allow such participation.

There are also ongoing efforts to develop national testing standards for DC electricity meters which, when promulgated, will further facilitate market participation of DC-coupled ESS.

H. Recommendations for Future Energy Storage Programs and Policies

Clean Peak Standard

In 2020, Until expects that DOER will conclude the process of developing and promulgating regulations to implement the Clean Peak Energy Standard, which was enacted on August 9, 2018, when Governor Baker signed into law An Act to Advance Clean Energy. Included in this statute was the addition of the Clean Peak Energy Standard. This section of the law requires DOER to establish a baseline minimum percentage of kWh sales to end use customers that shall be met with Clean Peak Certificates (“CPCs”).

DOER is in the process of finalizing the regulation in terms of: (i) establishment of seasonal peak periods; (ii) methodology by which CPC values shall be established, which may include a process by which the EDCs competitively procure CPCs from Clean Peak Resources (“CPRs”) and enter into Long Term Contracts, subject to approval from the DPU; (iii) establishment of minimum percentage of CPCs that must be derived from demand response resources; (iv) an alternative compliance mechanism for retail electricity suppliers; and (v) procedures by which each retail electricity supplier shall annual submit for DOER’s review and filing demonstrating its compliance with the requirement of this section.

Energy storage is a central element of the Clean Peak Energy Standard, as it is eligible to qualify as a CPR when it is “primarily charged by eligible renewable resources.” Until sees the development of the Clean Peak Standard as an opportunity for DOER to advance the Commonwealth’s energy storage goals while also mitigating greenhouse

gas and local pollutants, and the high costs of electricity supply associated with periods of peak demand.