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January 9, 2020

Members of the Vermont General Assembly
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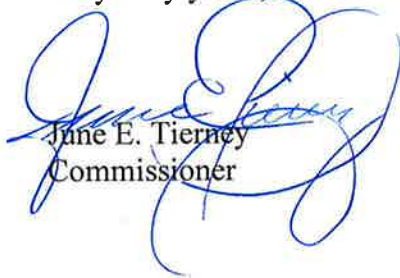
Re: Energy Storage Report Pursuant to Act 31 of 2019

Dear Senators and Representatives:

I am pleased to submit recommendations for the regulatory treatment of energy storage facilities, conducted pursuant to Sec. 26 of Act 31. These recommendations include proposed statutory language, both within the body of the report as well as consolidated into a separate bill template.

If you have any questions or concerns upon reading these recommendations, please do not hesitate to contact me or Deputy Planning Director Anne Margolis.

Very truly yours,



June E. Tierney
Commissioner





ACT 31 STORAGE REGULATION - FINAL RECOMMENDATIONS

January 9, 2020

Introduction

With the passage of [Act 31 of 2019](#), Vermont took its first steps in clarifying the regulatory treatment of energy storage by (1) defining an energy storage facility as, “a system that uses mechanical, chemical, or thermal processes to store energy for export to the grid”; and (2) requiring energy storage facilities 500 kW and larger to obtain a Certificate of Public Good under 30 V.S.A. § 248.

Act 31 also asked the Department of Public Service (“Department”) to “make recommendations for the regulatory treatment of energy storage facilities with a capacity of less than 500 kW and energy storage facilities of any size with grid-exporting capabilities not subject to direct or indirect control by a Vermont distribution utility.”

The Department issued draft recommendation options for review and consideration by energy storage stakeholders in November 2019. Written comments were received from the Public Utility Commission, Agency of Natural Resources, Department of Public Safety, Vermont Electric Power Company (VELCO), and Bram Towbin (a private individual); all comments are posted at <https://publicservice.vermont.gov/content/2019-energy-storage-regulatory-recommendations-2017-energy-storage-study>.

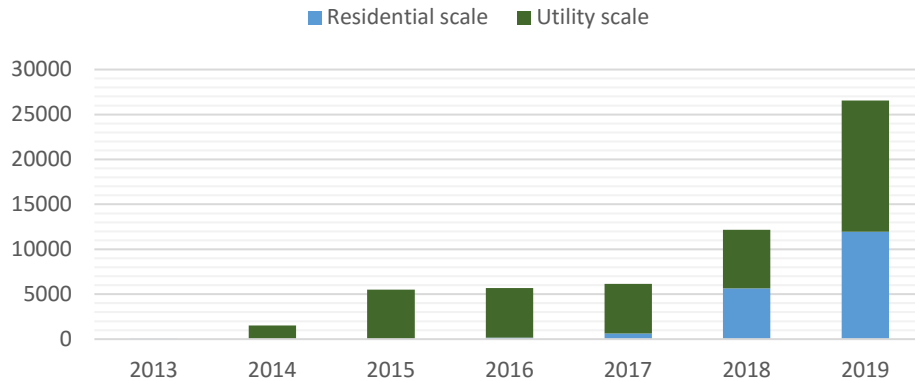
Based on the Department’s research and feedback received from stakeholders, the Department now issues these final recommendations, in which it seeks to:

- Provide a clear path to permitting storage projects
- Ensure storage projects and their operations do not adversely impact the grid or ratepayers; and
- Provide public and environmental safety

The case for regulatory reform

With the deployment of any technology, including storage, comes questions of whether and how to enact regulations that protect the public and the environment without imposing unnecessary hurdles on deployment. Jurisdictions around the country, including Vermont, are seeing rapid growth in energy storage deployment. In 2014, Vermont had 1.5 megawatts (MW) of interconnected battery storage. Through November 2019, that number had grown to over 26.5 MW, with at least another 5 MW permitted or in development:

Total kilowatts (kW) of installed battery storage in VT



For a sense of scale, Green Mountain Power’s (“GMP’s”) 2018 Integrated Resource Plan, approved by the Public Utility Commission (“PUC”) in September 2019, includes an illustrative future portfolio (a conceptual future portfolio based on what we know today about costs, values, and use cases) that discusses the potential for up to 100 MW of storage and other flexible loads ramping up over a 10-year period starting in 2022.¹

Storage growth regionally and nationally is similarly expected to rapidly accelerate in the next decade. The regional transmission organization for New England (“ISO-NE”) reported in early 2019 that 20 MW of grid-scale battery projects had come online since 2015, and there were proposals to interconnect more than 1,300 MW of energy storage projects by 2022 (these are *only* projects connected to the transmission system or actively participating in wholesale markets).² Meanwhile, Wood Mackenzie Power & Renewables anticipates tenfold growth in the storage market between 2019 and 2024:

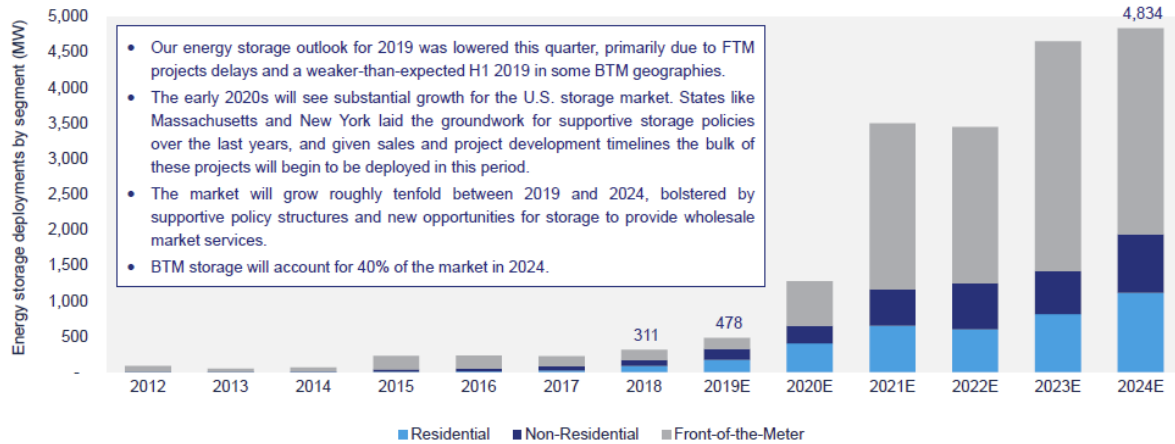
¹ <https://greenmountainpower.com/wp-content/uploads/2019/03/IRP-Portfolio-Evaluation.pdf> at 8-37

² https://www.iso-ne.com/static-assets/documents/2019/02/20190220_pr_state-of-the-grid_presentation_final.pdf at 19

U.S. energy storage annual deployments will exceed 4.8 GW by 2024

Utility procurements, changing tariffs and grid service opportunities are all driving the market forward

U.S. energy storage annual deployment forecast, 2012-2024E (MW)



Source: Wood Mackenzie Power & Renewables/ESA U.S. energy storage monitor

As discussed in the Department's 2017 [Report to the Vermont General Assembly on the Issue of Deploying Storage on the Vermont Electric Transmission and Distribution System](#), storage can provide the *functionality* of load as well as generation.³ The Department's report recognized the rapidly expanding deployment of storage and the need to reform existing – or create new – regulatory mechanisms to ensure deployment is safe, beneficial, and accountable. These regulation recommendations include regulating both grid-exporting and, potentially, some *non-grid-exporting* storage, as both pose potential impacts to the grid (e.g., fault current and inadvertent export).⁴ In addition, the recommendations recognize both the unique characteristics of storage as well as the potential for growth of other distributed energy resources with similar characteristics and the need to modernize – rather than piecemeal modify existing – regulatory mechanisms.

The Department's 2017 report touched briefly on needed reforms to regulatory review and interconnection processes to accommodate storage. It recommended:

- 30 V.S.A. § 248 be used as the vehicle for review of larger projects, with appropriate modifications;
- Revisions to 30 V.S.A. § 8010 (or design of a similar process) as a vehicle for the review of smaller storage projects;
- Commission rules, such as Rule 5.900 (which addresses decommissioning) be modified to incorporate storage; and
- Interconnection of storage continue to be governed by Rule 5.500 and pending revisions thereof.

³ Storage does not, however, *create* generation and is in fact a net load, given round-trip losses.

⁴ Non-exporting storage is likely to pose lesser impacts than exporting storage and should be treated commensurately. Several states, e.g. California and Colorado, have adopted specific, expedited procedures for non-exporting storage or even waived it from interconnection rules if certain requirements are met. See <https://www.nrel.gov/docs/fy18osti/71232.pdf>.

This paper reinforces and expands upon those recommendations based on technology developments, lessons learned, and best practices that have emerged since 2017. In developing these regulatory recommendations, the Department seeks to address several areas of concern, while simultaneously instituting a clear path to permitting for storage implementers.

Impacts to the electric grid

As the storage industry grows, national standards, codes, and guidelines as well as industry best practices are emerging to address the technology and its applications while providing a level playing field for industry growth.⁵

Potential impacts to the grid from other inverter-based resources, such as solar photovoltaics, are generally reviewed by Vermont utilities in accordance with statewide interconnection procedures promulgated by the PUC.⁶ According to the National Renewable Energy Laboratory (“NREL”), the factors a utility must assess to evaluate potential impacts on their system from energy storage facilities include:

- Planned operational capacity and behavior (i.e., dispatch strategy);
- Exporting versus non-exporting systems and associated control systems testing;
- Engineering reviews and technical screening procedures;
- Impact on load; and
- Co-location with on-site generation (e.g., solar plus storage).⁷

In many cases, a storage facility can be reviewed for system impacts in a similar fashion to a comparably sized inverter-based generation resource, such as solar. There are, however, significant differences between a solar photovoltaic facility and a storage facility in terms of the storage facility’s individual behavior and also its range of possible behaviors when physically or virtually aggregated with other resources. An individual storage facility can import and store energy from a source, such as a solar facility or the grid, on a schedule or in response to a signal. It can export that stored energy to the grid, again in a controlled manner. It can perform both functions in rapid succession and change intended operations at any time.

A grid operator or intermediary can also orchestrate the activities of many individual units to act in the aggregate, which, in essence, creates a much larger, virtual resource that combines many small, distributed resources to either add to or (as is the case today) reduce bulk system load. As NREL writes:

Further complicating the issue, these dispatch strategies may not be fixed over time as market conditions and incentives shift and optimal dispatch strategies change. In the case of non-exporting or limited-export storage systems, the nameplate capacity may be a poor indicator of the system's potential impact on the grid and lead to an unnecessarily time-consuming and costly review. The

⁵ These include UL 9540, UL 9540A, NFPA 855, IEC 62933, and UL 1741

⁶ Not all energy storage is inverter-based, but most of the installed and planned storage in Vermont is inverter-based.

⁷ Peterson, Zachary. Emerging Practices for Energy Storage Interconnection: NREL, 2018. <https://www.nrel.gov/dgic/interconnection-insights-2018-11.html>

industry is in the early stages of defining how storage projects should be evaluated throughout the interconnection process.⁸

The Department recommends that, in the context of the currently open interconnection rulemaking proceeding (19-0856-RULE), one or more workshops should be held to specifically address storage interconnection, making use of existing best practices available through the NREL briefing paper cited herein as well as the newly released Interstate Renewable Energy Council's ("IREC's") 2019 Model Interconnection Procedures.⁹

Impacts to ratepayers and consumers

The Department's 2017 energy storage report to the legislature covered potential issues related to costs and benefits of energy storage projects in depth. These issues (including consideration of who should bear costs and receive benefits) have been part of the investigation of several storage projects since that report's publication.¹⁰ Energy storage "values" depend on use cases and must generally be stacked in order to exceed installation and operation costs. Potential values to ratepayers and individual consumers include avoided power supply costs (primarily capacity, or peak, related costs), integration of renewable energy, and resilience.

Aggregations of resources offer the opportunity create "virtual power plants" that can potentially benefit individual customers and ratepayers in general. In GMP's Tesla Powerwall and Bring Your Own Device pilots, for example, customers and the utility share the cost of a storage installation in the customer's home. The battery is available to the customer in the event of a power outage and to the utility and its ratepayers to reduce system demand during monthly and annual peaks. GMP's Aggregation pilot presents the opportunity for third parties to work directly with customers to aggregate fleets of batteries (and other devices) in response to GMP dispatch signals.

Through these programs, GMP has created value streams for customers and third parties that have attracted participation. Outside of GMP territory, such programs are being explored by other utilities, but have not yet been implemented.¹¹ However, there are other, non-utility value streams (i.e. New England wholesale electricity markets) that could enable third parties to develop similar shared-cost, shared-value programs with utility customers without the participation or even awareness of the utilities whose systems are being used by these batteries as they charge and discharge. Aggregations of such batteries being deployed to benefit individual customers (for backup power), and the region as a whole (reducing regional peaks, regulation, etc.), could nevertheless introduce costs for Vermont utilities and their ratepayers. This could happen if, for example, an aggregation is signaled to discharge to reduce the regional peak (in the late afternoon) and then immediately recharges just in time to add to the later Vermont peak. It

⁸ Ibid

⁹ Ibid, <https://irecusa.org/publications/irec-model-interconnection-procedures-2019/>

¹⁰ [Report to the Vermont General Assembly on the Issue of Deploying Storage on the Vermont Electric Transmission and Distribution System](#); see PUC Dockets 17-5003-PET, 17-5236-PET, 18-1658-PET 18-2902-PET, 18-3088-PET, 19-3167-TF, 19A-3193, 19A-1020, etc.

¹¹ Mr. Towbin's comments on the draft recommendations, available at <https://publicservice.vermont.gov/content/2019-energy-storage-regulatory-recommendations-2017-energy-storage-study>, recommend that utilities where residential storage is being deployed be incentivized to assist utilities where storage is not yet being deployed.

could also happen if discharging occurs simultaneously with solar output in a generation-constrained area.

The Department is working on a separate but related initiative to explore rate design pathways – for loads in general, specific end uses, and generation – to better align system costs with system benefits. There are potential implications for storage, such as price signals that place greater value on renewable generation during evening peaks, and therefore incent pairing solar with storage to shift its production from daylight to evening hours – but those are outside the scope of this particular report. There are also Federal Energy Regulatory Commission (“FERC”) proceedings looking into operational implications of aggregations of distributed energy resources such as storage that may have outcomes bearing on the concerns outlined above.¹²

In the meantime, many of these issues can likely be addressed in the context of the state’s interconnection rule (Rule 5.500), especially if *all* storage systems (with the exception of off-grid applications) deployed in the state are addressed by that rule, as proposed here.

Impacts to public health

Energy storage systems comprise several elements, which act in concert to provide the system with its functionality.¹³ For battery storage systems, these include the individual cells that make up the battery modules, the strings of modules, the storage control unit, and the inverter unit (which connects the DC battery to the AC home and grid). Public safety impacts from battery storage technologies (the type of storage currently being deployed in Vermont) relate primarily to fire hazards posed by particular battery chemistries, as well as issues that can arise within other parts of the battery storage system, such as the inverter, or with improper installation. While some lead-acid batteries are being deployed in Vermont, most installations use lithium-ion chemistries (particularly lithium nickel-manganese-cobalt). Lithium-ion batteries are prevalent in modern consumer electronics, but generally not at the energy densities and magnitude of residential- and grid-scale batteries.¹⁴

Concerns about fire safety risks are not merely speculative in nature. Recent utility-scale battery storage installation fires – for example, the 2012 Arizona Public Service Elden Substation battery fire, the 2019 McMicken Energy Storage Facility fire, and nearly two dozen storage facility fires in South Korea since 2017 – have highlighted potential risks that deserve attention.¹⁵

The storage industry is actively working to develop and deploy safer battery chemistries, such as lithium-ferro-phosphate. But in the meantime, prudent fire-prevention measures that consider

¹² See

<https://www.ferc.gov/eventcalendar/EventDetails.aspx?ID=10920&CalType=%20&CalendarID=116&Date=04/10/2018&View=Listview>

¹³ For the purposes of this report, “energy storage” means “batteries” unless otherwise noted, as batteries are the only advanced storage technology currently being deployed. As new technologies are deployed in Vermont, regulatory frameworks put in place now may need to evolve.

¹⁴ The primary hazard risks posed by large-format lithium ion-based energy storage systems include thermal runaway and resulting heat and gas emissions. See

https://readytalk.webcasts.com/viewer/event.jsp?ei=1263100&tp_key=06672291bf.

¹⁵ <https://pv-magazine-usa.com/2019/08/08/lithium-ion-not-prudent-and-create-unacceptable-risks/>

the entire energy storage system should be enacted, and first responders should be provided with the knowledge necessary to address battery storage fires should they occur.

Installations in buildings under the fire safety code jurisdiction of the Department of Public Safety (“DPS”) – generally all buildings *except* detached, single-family, owner-occupied dwellings – must adhere to DPS’s fire safety codes. Those codes incorporate updates to national fire safety codes, including from the National Fire Protection Association (“NFPA”). NFPA 855 is the most recently codified update and includes specific measures to address battery storage installations, including a requirement to install a sticker on the main electrical meter pack indicating the presence of an energy storage system in the building.¹⁶ One potential recommendation is to extend this requirement to detached, single-family, owner-occupied dwellings. As these are not under DPS’s jurisdiction, the requirement would need to be included in other applicable codes and standards, perhaps PUC Rule 5.500 (interconnection) or a new PUC rule specific to storage.

The Department did not receive feedback from fire safety professionals on any additional recommendations that should be included in this report, such as a notification to municipalities or local fire departments when a battery storage system is installed, or access to a database of such installations, and therefore does not have specific regulatory recommendations on those concepts to offer.

Impacts to environmental health¹⁷

The Agency of Natural Resources (“ANR”) has recommended that all batteries be banned from disposal (including landfill disposal and incineration) due to concerns about potential corrosivity, reactivity, fire hazard, and the safety of waste management personnel.¹⁸ Further, as society increases reliance on battery power, recycling the elements from batteries has both social and environmental benefits in terms of conserving resources. Batteries from sources other than households may also be subject to regulation under the Vermont Hazardous Waste Management Regulations (VHWMR) as either hazardous waste or universal waste when discarded.¹⁹ Owners/operators of larger energy storage facilities that require maintenance are required to determine if waste resulting from maintenance is subject to regulation as hazardous waste. If waste(s) are determined to be hazardous waste, the owner/operator must then comply with the VHWMR (e.g., notify ANR of hazardous waste activity using the Hazardous Waste Handler Site Identification Form, manage hazardous waste in accordance with applicable VHWMR requirements, etc.).

ANR suggests it is appropriate to prohibit the disposal of batteries and require their recycling for recovery of constituent materials. This could require updating the Vermont solid waste landfill

¹⁶ NFPA 855 will be incorporated into the next update of the Department of Public Safety’s Fire and Building Safety Code, slated for 2021.

¹⁷ While environmental health is outside the Public Service Department’s jurisdiction, it is within the Public Utility Commission’s jurisdiction under 30 V.S.A. § 248(b)(5), which assesses project impacts on aesthetics, historic sites, air and water purity, the natural environment, and public health and safety.

¹⁸ <https://dec.vermont.gov/sites/dec/files/wmp/SolidWaste/Documents/Universal-Recycling/2019-Report-on-Battery-Stewardship.pdf>

¹⁹ [Vermont Hazardous Waste Management Regulations](#)

ban statutes and possibly adding these batteries to an extended producer responsibility program where product manufacturers take responsibility for end-of-life management.²⁰ Also, amendments to PUC Rule 5.900 (decommissioning) to address energy storage facilities and/or address storage decommissioning as part of a new, comprehensive storage rule may be needed.

Regulation recommendations

The Department’s storage regulation recommendations seek to expand upon the recommendations in its 2017 report in the following ways:

- Clarify the PUC’s general jurisdiction over storage absent specific modifications to Title 30 requirements;
- Offer specific modifications to Title 30 requirements for storage facilities including a presumption of waivers of 30 V.S.A. § § 107-109 and – except for aggregators - § 231;
- Require storage over 100 kW be subject to 30 V.S.A. § 248 review, with appropriate process modifications for smaller and aggregated storage facilities and storage facilities interconnected or otherwise co-located with renewables;
- Recommend an appropriate pathway for siting and interconnection review of storage facilities;
- Offer potential revisions to various PUC rules to include storage.

Clarify the PUC’s general jurisdiction over storage absent specific modifications to Title 30 requirements

As a threshold matter, the Department recommends amending the definition of “energy storage facility” from Act 31 of 2019, in 30 V.S.A. § 201, as follows:

(4) As used in this chapter, “energy storage facility” means a device or system that captures energy produced at one time, stores that energy for a period of time, and delivers that energy as electricity for use at a future time~~uses mechanical, chemical, or thermal processes to store energy for export to the grid.~~

The amended language reflects the definition of “energy storage device” contained in IREC’s recently released 2019 *Model Interconnection Procedures*, which address storage for the first time and also contain provisions to address necessary interconnection review procedures for storage devices, including devices that do not export to the grid. The Act 31 definition addressed grid-exporting systems only and – as explained during IREC’s October 4, 2019 webinar about the procedures – energy storage systems connected in parallel to the distribution system can still introduce potential safety impacts regardless of whether they are exporting.²¹

²⁰ See <https://legislature.vermont.gov/statutes/section/10/159/06621a>

²¹ https://irecusa.org/wp-content/uploads/2019/10/IREC-model-interconnection-procedures-2019_100319.pdf. A notification – as opposed to interconnection review – process may be the most appropriate way to treat non-exporting systems that meet certain requirements. See for example https://www.pge.com/tariffs/tm2/pdf/ELEC_RULES_21.pdf, p. 255. A system connected in parallel to the distribution system can supply energy to the customer simultaneously with the supply of energy from the grid. The Department intends a focus here on battery storage with potential to impact the distribution system, not small-scale customer electronic backup devices such as uninterruptible power supplies, nor thermal storage such as hot water heaters.

Section 201 of Title 30 should also contain a definition of storage aggregation. This definition is derived from the North American Electric Reliability Corporation definition, though slightly modified to align with the State’s objectives for regulating storage aggregators under 30 V.S.A. § 231.

(5) As used in this chapter, “energy storage aggregation” means a virtual resource formed by aggregating multiple energy storage devices at different points of interconnection on the distribution system.

(6) As used in this chapter, “merchant energy storage aggregator” means an entity other than a distribution utility that is operating an energy storage aggregation of 100 kW or greater aggregate nameplate capacity, unless the Commission establishes a different threshold by rule or order.

The Department also recommends the following changes to 30 V.S.A. § 203, to clarify the jurisdictional role of the PUC and Department over energy storage facilities:

(1) A company engaged in the manufacture, transmission, distribution, storage, or sale of gas or electricity directly to the public or to be used ultimately by the public for lighting, heating, or power and so far as relates to their use or occupancy of the public highways.

(2) That part of the business of a company that consists of the manufacture, transmission, distribution, storage, or sale of gas or electricity directly to the public or to be used ultimately by the public for lighting, heating, or power and so far as relates to their use or occupancy of the public highways.

Offer specific modifications to Title 30 requirements for storage facilities including a presumption of waivers of 30 V.S.A. § § 107-109 and – except for aggregators - § 231

Presumption of waivers of 30 V.S.A. § § 107, 108, and 109 for standalone storage projects²²
Certain merchant renewable generators eligible for qualifying facility status under the Public Utility Regulatory Policies Act (“PURPA”), pursuant to PUC Rule 4.108, enjoy de minimis regulation in the form of exemptions from traditional utility regulation requirements. While standalone storage is not a qualifying facility under PURPA, the PUC has granted waivers of 30 V.S.A. § § 107, 108, and 109 to the few standalone merchant storage facilities that have been permitted under 30 V.S.A. § 248 thus far.²³ Codifying these waivers could make sense for merchant storage projects, and could be written in 30 V.S.A. § 209 as:

(k) Energy storage facilities. Except when owned by a retail distribution utility, an energy efficiency utility, or Vermont Electric Power Company, Inc., competitive suppliers

²² § 107 (Acquisition of control of one utility company by another; supervision); § 108 (Issue of bonds or other securities); and § 109 (Sales and leases; hearings)

²³ See Case Nos. 18-1658-PET and 18-3088-PET

of energy storage services that do not serve retail customers shall be exempt from 30 V.S.A. § § 107, 108, and 109.

Presumption of waiver of 30 V.S.A. § 231 for storage operators other than aggregators²⁴

The Department recommends that aggregators of storage, utility or third-party, be subject to 30 V.S.A. § 231 regulation, based on the potential impacts to ratepayers of aggregations as discussed earlier in this report. The degree of regulation of aggregators under § 231 is likely to differ from that required for other types of entities subject to § 231 and should be the subject of further review by the Commission.

(c) For energy storage facilities not already subject to this section, a person, partnership, unincorporated association, or previously incorporated association that owns and/or operates an energy storage facility is subject to this section only if the person, partnership, unincorporated association, or previously incorporated association is a merchant energy storage aggregator.

Require storage over 100 kW be subject to 30 V.S.A. § 248 review, with appropriate process modifications for smaller and aggregated storage facilities and storage facilities interconnected or otherwise co-located with renewables

The Department recommends revising a change made in Act 31 of 2019, which had set a threshold of 500 kW for 30 V.S.A. § 248 review of storage facilities:

(u) ~~A~~For an energy storage facility, a certificate under this section shall only be required for ~~an energy storage~~ a facility that has a capacity of ~~500~~ 100 kW or greater, unless the Commission establishes a different threshold by rule or order.

The Department recommends this change for several reasons. FERC allows for storage resources as small as 100 kW to participate in wholesale markets, which could implicate 30 V.S.A. § 248 criteria such as (b)(2) need and (b)(4) economic benefit.²⁵ Also, the ability of storage facilities to operate like a generator (putting out power) is far more limited than most actual generators. Conventionally “dispatchable” generators are generally rated only by their maximum output in kW or MW because their “stored” energy (in the form of fuel in tanks or water behind dams) is so large that it can generally be replenished before there is any real threat of it “running out” during a period of need. Such generators may run at maximum power for many hours or even days. Storage facilities are often much more limited in their reserve size, and therefore should be rated like conventional generators, in terms of their maximum power output (and their maximum demand when charging) in kW or MW, *but unlike conventional generators, they should also be rated in terms of their energy capacity in kWh or MWh.* This energy capacity may alternatively be expressed as *duration at maximum power output, in hours.* Regardless of which way it is quantified, it is a crucial and unique performance parameter of storage. The Department, Commission, and stakeholders should consider whether an appropriate

²⁴ § 231 (Certificate of Public Good; abandonment of service; hearing)

²⁵ FERC Order 841 (<https://www.ferc.gov/whats-new/comm-meet/2018/021518/E-1.pdf>)

kWh threshold exists to further delineate which storage systems should be required to obtain a CPG.

Although no other resource is reviewed under 30 V.S.A. § 248 based on a size threshold specified in 30 V.S.A. § 248, storage poses a unique set of discrete issues that do not necessarily implicate many of the Section 248 criteria.

However, there are several additional potential modifications to sections of 30 V.S.A. § 248 to completely integrate storage and ensure appropriate review. These could include:

- § 248(a)(4)(F)(i):
In any proceeding regarding an electric generation facility that will have a capacity greater than 100 kilowatts or an energy storage facility that will have a capacity greater than 1 megawatt and will be sited on a tract containing primary agricultural soils as defined in 10 V.S.A. § 6001, the Agency shall appear as a party and provide evidence and recommendations concerning any findings to be made under subdivision (b)(5) of this section on those soils, and may provide evidence and recommendations concerning any other matters to be determined by the Commission in such a proceeding.

- § 248(a)(4)(J):
(J) This subdivision (J) applies to an application for an electric generation facility with a capacity that is greater than 50 kilowatts and to an application for an energy storage facility that is greater than 1 megawatt, unless the facility is located on a new or existing structure the primary purpose of which is not the generation of electricity. In addition to any other information required by the Commission, the application for such a facility shall include information that delineates:

- § 30 V.S.A. § 248(k):
(k)(1) Notwithstanding any other provisions of this section, the Commission may waive, for a specified and limited time, the prohibitions contained in this section upon site preparation for or construction of an electric transmission facility or a generation or energy storage facility necessary to ensure the stability or reliability of the electric system or a natural gas facility, pending full review under this section.

- § 30 V.S.A. § 248(l):
(l) Notwithstanding other provisions of this section, and without limiting any existing authority of the Governor, and pursuant to 20 V.S.A. § 9(10) and (11), when the Governor has proclaimed a state of emergency pursuant to 20 V.S.A. § 9, the Governor, in consultation with the Chair of the Public Utility Commission and the Commissioner of Public Service or their designees, may waive the prohibitions contained in this section upon site preparation for or construction of an electric transmission facility or a generation or energy storage facility necessary to ensure the stability or reliability of the electric system or a natural gas facility. Waivers issued under this subsection shall be subject to such conditions as are required by the Governor, and shall be valid for the duration of the declared emergency plus 180 days, or such lesser overall term as determined by the Governor. Upon the expiration of a waiver under this subsection, if a

certificate of public good has not been issued under this section, the Commission shall require the removal, relocation, or alteration of the facilities, subject to the waiver, as the Commission finds will best promote the general good of the State.

Finally, amendments may be needed to municipal and regional planning and land use statutes to exempt storage projects that are subject to PUC jurisdiction from Act 250/local jurisdiction, in a similar manner to how other utility facilities are treated. For example, and consistent with later recommendations in this report:

- Amend 10 V.S.A. § 6001(3)(D):
The word 'development' does not include:

- (iii) The construction of improvements for an electric generation, energy storage, or transmission facility that requires a certificate of public good under 30 V.S.A. § 248, or is subject to regulation under 30 V.S.A. § 8011, a natural gas facility as defined in 30 V.S.A. § 248(a)(3), or a telecommunications facility issued a certificate of public good under 30 V.S.A. § 248a.*
- Amend 24 V.S.A. § 4413 (Limitations on municipal bylaws):
(b) A bylaw under this chapter shall not regulate public utility power generating plants, energy storage facilities, and transmission facilities regulated under 30 V.S.A. § 248, or subject to regulation under 30 V.S.A. § 8011.

Recommend an appropriate pathway for siting and interconnection review of storage facilities

The Department's draft recommendations offered two options for siting and interconnection review of storage facilities: (1) either modifying existing statute and/or related rules that provide for differential treatment of certain types or sizes of resources to include storage, or (2) creating parallel structures that exclusively focus on storage and potentially other forthcoming technologies that offer similar opportunities and challenges (e.g. vehicle-to-grid).

After considering stakeholder comments, the Department recommends that the second option – creating a regulatory framework focused exclusively on storage, that enables the PUC to create new rules or modify existing rules as appropriate, and that offers flexibility to accommodate innovations in distributed energy resources – is the appropriate one to pursue. Creating a dedicated framework for the regulation of storage would focus the efforts of the PUC and stakeholders on addressing all intended uses and right-sizing review criteria and processes by giving the PUC broad authority to adopt and amend rules to achieve certain objectives.

Therefore, along with modifying 30 V.S.A. § 248(u), the Department recommends language directing the PUC to amend existing rules or adopt and implement new rules, as appropriate, that govern the installation and operation of energy storage facilities. The Department is not, at this time, recommending legislative changes to actively incorporate storage into the state's renewable programs, though such changes may be appropriate in the future, after further discussion among stakeholders through the implementation of these recommendations. The Department is also not

proposing legislative language at this time that would explicitly allow for collection of a fee by the PUC, ANR, or itself to defray the additional burden involved in the review and issuance of permits for storage projects, though such a fee would be consistent with treatment of other facilities subject to Commission and Agency regulation and may prove necessary depending on future rules and the pace of storage adoption.

The proposed language could be modeled on language in 30 V.S.A. § 8010, which governs self-generation and net metering, as in:

30 V.S.A. § 8011

- (a) The Commission shall adopt and implement rules that govern the installation and operation of energy storage facilities.*
 - (1) The rules may establish a size threshold below which storage facilities need not submit an application or registration for a Certificate of Public Good pursuant to 30 V.S.A. § 248. However, such systems may be required to comply with rules pertaining to small storage systems as determined by the Commission.*
 - (2) The rules shall include provisions that govern:*
 - (A) The respective duties of retail electricity providers and energy storage facility owners;*
 - (B) The electrical and fire safety, power quality, interconnection, metering, and disposal of energy storage facilities;*
 - (C) The formation of aggregations of energy storage facilities and the resolution of disputes between energy storage facility owners and the interconnecting provider;*
 - (D) Energy storage facilities paired with other resources, such as net-metering and Standard Offer plants, including retrofits of existing plants.*
 - (3) The rules shall establish standards and procedures governing application for and issuance or revocation of a certificate of public good for energy storage facilities under the provisions of section 248 of this title. In establishing these standards and procedures:*
 - (A) The rules may waive the requirements of section 248 of this title that are not applicable to energy storage facilities, including criteria that are generally applicable to public service companies as defined in this title;*
 - (B) The rules may modify notice and hearing requirements of this title as the Commission considers appropriate;*
 - (C) The rules may seek to simplify the application and review process as appropriate.*

The Department also recommends that – to address comments received from the Department of Public Safety – that agency be consulted in the development of rules pursuant to 30 V.S.A. § 8011 in order to ensure that conflicts with Division of Fire Safety rules applicable to public buildings are not inadvertently created. The Department also supports the comment from VELCO that as part of the rulemaking, some level of distribution utility reporting on installed storage characteristics (including operating characteristics) be instituted.

Additional statutory changes are recommended in order to lay the groundwork for the PUC to be able to modify their existing rules to incorporate storage, including Rule 5.100 (net metering) and Rule 5.500 (interconnection). Both rules are currently in active rulemakings, and one of the areas of inquiry is the process for interconnection of net-metering registration systems (anything up to 15 kW, as well as rooftop solar and hydroelectric systems up to 500 kW). At present, and as a result of a disconnect between the two rules, the registration form is the de facto interconnection application for registration-eligible systems. The PUC has received comments from stakeholders addressing whether and how to make the form better serve that purpose. Because non-net-metering small generation sources also use the net-metering registration form for PUC – and thus utility interconnection – review (pursuant to 30 V.S.A. § 8007), it could also be the logical path for review (whether PUC, utility interconnection, or both) of small storage systems not subject to full 30 V.S.A. § 248 review.

An alternative pathway – and the one favored by the Department – would be to decouple the net-metering and interconnection processes, and instead address *all* interconnection (including of net-metered facilities and energy storage facilities) entirely within the context of the interconnection rule. This would create more flexibility to address accelerating advancements in distributed energy resource technologies (DERs), such as grid-interactive microgrids and electric vehicles, particularly if the rule is flexible enough to quickly accommodate similarly accelerating advancements in codes and standards that address DER system impacts, such as ISO-NE’s Source Requirements Document that address potential impacts of high penetrations of DERs on bulk transmission system reliability.²⁶

Regardless of how the net-metering and interconnection rules interact, both will need updates to address issues related to energy storage.²⁷ Standalone storage may be addressable with modifications to the interconnection rule, but net-metering systems will be increasingly interconnected or otherwise co-located with storage, either as new applications or retrofits to existing projects, as costs come down and price signals (from distribution utilities or ISO-NE markets) materialize. As it stands, storage systems are already being interconnected or otherwise co-located with net-metering systems in response to the ability of system owners to obtain the federal Investment Tax Credit for the storage system if it is charged at least 75% from solar; and Green Mountain Power’s Bring Your Own Device (BYOD) program offers an additional up-front incentive for batteries located in solar-saturated areas of its distribution system.²⁸

Other areas for exploration in one or both of these rules include whether and how to evaluate resource impacts based on intended use (e.g., should a solar + storage resource be evaluated based on nameplate gross or planned maximum export capacity, which especially in constrained areas can impact costs that are existential for a project; also whether the resource should be evaluated based on intended timing of charging, which can introduce constraints if it coincides

²⁶ https://www.iso-ne.com/static-assets/documents/2018/02/a2_implementation_of_revised_ieee_standard_1547_presentation.pdf

²⁷ This may also necessitate updates to fee structures associated with net-metering and interconnection applications.

²⁸ <https://www.nrel.gov/docs/fy18osti/70384.pdf>, <http://isonewswire.com/updates/2019/4/22/earth-day-2019-a-capacity-market-first.html>, <https://greenmountainpower.com/bring-your-own-device/battery-systems/>,

with peak usage times), and how to ensure that storage devices can't be charged with grid power that is later exported to the grid and compensated like net-metering generation.

In order to ensure that the PUC has the necessarily flexibility to address storage in existing rules, the Department recommends amending 30 V.S.A. § 8002, definitions used in Chapter 89 of Title 30 (Renewable Energy Programs), to include energy storage facilities, by inserting a stand-alone definition of “energy storage facility” that mirrors the definition in 30 V.S.A. § 201 (with the modifications suggested above):

- Insert a definition for “Energy storage facility”:

As used in this chapter:

(X) “Energy storage facility” means a device or system that captures energy produced at one time, stores that energy for a period of time, and delivers that energy as electricity for use at a future time.

Potential revisions to various PUC rules to include storage

The Department offers the following potential revisions to the following PUC rules to incorporate storage:

- Amendments to PUC Rule 5.200 Notification of Power Supply Transactions (unless a separate storage rule is developed that addresses contracts between distribution utilities and energy storage facility owners):
 - Amend 5.201 (Purpose) to state, “...Additionally, all Vermont electric utilities are required to notify the Commission and Department of certain contracts, as specified in section 5.202, entered into by an electric utility for the purpose of purchasing or leasing electrical generation, energy storage, or transmission facilities within Vermont.”
 - Amend 5.202 (Notification to the Public Utility Commission and Department of Public Service) sections (A), (C), and (D) to include “energy storage facility” after each instance of “electrical generation facility.”
- Amendments to PUC Rule 5.900 Decommissioning (unless a separate storage rule is developed that addresses decommissioning):
 - Amend the first sentence as follows: “This rule applies to all electric generation, electric transmission, and natural gas facilities that are or become subject to the jurisdiction of the Vermont Public Utility Commission pursuant to 30 V.S.A. § 248 and all energy storage facilities as defined in 30 V.S.A. § 201(4).”
 - Amend Rule 5.904 to include an equivalent section for storage facilities. At a minimum, for storage installations of all sizes, the Department recommends a provision for the proper disposal/recycling of the device(s) consistent with environmental regulatory parameters. For larger installations, the decommissioning requirements of Rule 5.904 should apply to stand-alone or integrated storage.

Conclusion

The Department appreciates the opportunity to make these recommendations and is also grateful for the input received from many stakeholders. Implementing the recommended statutory changes will enable further stakeholder discussion needed to enact essential reforms that acknowledge the changing nature of the electric system, without creating unnecessary barriers to development of a vibrant storage ecosystem in Vermont. The Department looks forward to engaging with the General Assembly to discuss these recommendations and is providing consolidated bill language as an attachment to this report to facilitate the discussion.

H.[x]

Introduced by [x]

Referred to Committee on

Date:

Subject: Public Service; energy; energy storage

Statement of purpose of bill as introduced: This bill proposes to clarify the jurisdiction of the Public Utility Commission over energy storage, modify Title 30 to address energy storage facilities, and address the consideration and application of energy storage.

An act relating to energy storage regulation

* * *

It is hereby enacted by the General Assembly of the State of Vermont:

Sec. 1. 10 V.S.A. § 6001 is amended to read:

§ 6001. DEFINITIONS

The word 'development' does not include:

* * *

(ii) The construction of improvements for an electric generation, energy storage, or transmission facility that requires a certificate of public good under 30 V.S.A. § 248, or is subject to regulation under 30 V.S.A. § 8011, a natural gas facility as defined in 30 V.S.A. § 248(a)(3), or a telecommunications facility issued a certificate of public good under 30 V.S.A. § 248a.

* * *

Sec. 2. 24 V.S.A. § 4413 is amended to read:

§ 4413. LIMITATIONS ON MUNICIPAL BYLAWS

* * *

(b) A bylaw under this chapter shall not regulate public utility power generating plants,

energy storage facilities, and transmission facilities regulated under 30 V.S.A. § 248, or subject to regulation under 30 V.S.A. § 8011.

* * *

Sec. 3. 30 V.S.A. § 201 is amended to read:

§ 201. DEFINITIONS

(4) As used in this chapter, “energy storage facility” means a device or system that captures energy produced at one time, stores that energy for a period of time, and delivers that energy as electricity for use at a future timeuses meechanical, chemical, or thermal processes to store energy for export to the grid.

(5) As used in this chapter, “energy storage aggregation” means a virtual resource formed by aggregating multiple energy storage devices at different points of interconnection on the distribution system.

(6) As used in this chapter, “merchant energy storage aggregator” means an entity other than a distribution utility that is operating an energy storage aggregation of 100 kW or greater aggregate nameplate capacity, unless the Commission establishes a different threshold by rule or order.

* * *

Sec. 4. 30 V.S.A. § 203 is amended to read:

§ 203. JURISDICTION OF CERTAIN PUBLIC UTILITIES

* * *

(1) A company engaged in the manufacture, transmission, distribution, storage, or sale of gas or electricity directly to the public or to be used ultimately by the public for lighting, heating,

or power and so far as relates to their use or occupancy of the public highways.

(2) *That part of the business of a company that consists of the manufacture, transmission, distribution, storage, or sale of gas or electricity directly to the public or to be used ultimately by the public for lighting, heating, or power and so far as relates to their use or occupancy of the public highways.*

* * *

Sec. 5. 30 V.S.A. § 209 is amended to read:

§ 209. JURISDICTION; GENERAL SCOPE

* * *

(k) Energy storage facilities. Except when owned by a retail distribution utility, an energy efficiency utility, or Vermont Electric Power Company, Inc., competitive suppliers of energy storage services that do not serve retail customers shall be exempt from 30 V.S.A. §§ 107, 108, and 109.

Sec. 6. 30 V.S.A. § 231 is amended to read:

§ 231. CERTIFICATE OF PUBLIC GOOD; ABANDONMENT OF SERVICE; HEARING

* * *

(c) For energy storage facilities not already subject to this section, a person, partnership, unincorporated association, or previously incorporated association that owns and/or operates an energy storage facility is subject to this section only if the person, partnership, unincorporated association, or previously incorporated association is a merchant energy storage aggregator.

Sec. 7. 30 V.S.A. § 248 is amended to read:

§ 248. NEW GAS AND ELECTRIC PURCHASES, INVESTMENTS, AND FACILITIES;

CERTIFICATE OF PUBLIC GOOD

* * *

(a)(4)(F)

(i) In any proceeding regarding an electric generation facility that will have a capacity greater than 100 kilowatts or an energy storage facility that will have a capacity greater than 1 megawatt and will be sited on a tract containing primary agricultural soils as defined in 10 V.S.A. § 6001, the Agency shall appear as a party and provide evidence and recommendations concerning any findings to be made under subdivision (b)(5) of this section on those soils, and may provide evidence and recommendations concerning any other matters to be determined by the Commission in such a proceeding.

* * *

(a)(4)(J) This subdivision (J) applies to an application for an electric generation facility with a capacity that is greater than 50 kilowatts and to an application for an energy storage facility that is greater than 1 megawatt, unless the facility is located on a new or existing structure the primary purpose of which is not the generation of electricity. In addition to any other information required by the Commission, the application for such a facility shall include information that delineates:

* * *

(k)(1) Notwithstanding any other provisions of this section, the Commission may waive, for a specified and limited time, the prohibitions contained in this section upon site preparation for or construction of an electric transmission facility or a generation or energy storage facility necessary to ensure the stability or reliability of the electric system or a natural gas facility, pending full review under this section.

* * *

(l) *Notwithstanding other provisions of this section, and without limiting any existing authority of the Governor, and pursuant to 20 V.S.A. § 9(10) and (11), when the Governor has proclaimed a state of emergency pursuant to 20 V.S.A. § 9, the Governor, in consultation with the Chair of the Public Utility Commission and the Commissioner of Public Service or their designees, may waive the prohibitions contained in this section upon site preparation for or construction of an electric transmission facility or a generation or energy storage facility necessary to ensure the stability or reliability of the electric system or a natural gas facility. Waivers issued under this subsection shall be subject to such conditions as are required by the Governor, and shall be valid for the duration of the declared emergency plus 180 days, or such lesser overall term as determined by the Governor. Upon the expiration of a waiver under this subsection, if a certificate of public good has not been issued under this section, the Commission shall require the removal, relocation, or alteration of the facilities, subject to the waiver, as the Commission finds will best promote the general good of the State.*

* * *

(u) *~~A~~ For an energy storage facility, a certificate under this section shall only be required for ~~an energy storage~~ a facility that has a capacity of ~~500~~ 100 kW or greater, unless the Commission establishes a different threshold by rule or order.*

Sec. 8. 30 V.S.A. § 8002 is amended to read:

§ 8002. DEFINITIONS

As used in this chapter:

* * *

([x]) “Energy storage facility” means a device or system that captures energy produced at one time, stores that energy for a period of time, and delivers that energy as electricity for use

at a future time.

* * *

Sec. 9. 30 V.S.A. § 8011 is added to read:

§ 8011. ENERGY STORAGE FACILITIES

a) The Commission shall adopt and implement rules that govern the installation and operation of energy storage facilities.

(1) The rules may establish a size threshold below which storage facilities need not submit an application or registration for a Certificate of Public Good pursuant to 30 V.S.A. § 248. However, such systems may be required to comply with rules pertaining to small storage systems as determined by the Commission.

(2) The rules shall include provisions that govern:

(A) The respective duties of retail electricity providers and energy storage facility owners;

(B) The electrical and fire safety, power quality, interconnection, metering, and disposal of energy storage facilities;

(C) The formation of aggregations of energy storage facilities and the resolution of disputes between energy storage facility owners and the interconnecting provider;

(D) Energy storage facilities paired with other resources, such as net-metering and Standard Offer plants, including retrofits of existing plants

(3) The rules shall establish standards and procedures governing application for and issuance or revocation of a certificate of public good for energy storage facilities under the provisions of section 248 of this title. In establishing these standards and procedures:

- (A) The rules may waive the requirements of section 248 of this title that are not applicable to energy storage facilities, including criteria that are generally applicable to public service companies as defined in this title;
- (B) The rules may modify notice and hearing requirements of this title as the Commission considers appropriate;
- (C) The rules may seek to simplify the application and review process as appropriate.