November 2, 2017

Anne Margolis, Renewable Energy Development Manager
Vermont Department of Public Service
112 State Street, Montpelier, VT

Re: Joint Comments of Burlington Electric Department (BED) and Vermont Public Power Supply Authority (VPPSA) on Act 53 Energy Storage Report

Dear Ms. Margolis:

Burlington Electric Department and Vermont Public Power Supply Authority commend the Department of Public Service on responding to the Act 53 by researching the possibilities for storage in Vermont and producing a thorough report. In general, the draft report highlights the distinctions and variation in storage technology and application – it is clear and should be highlighted that a "one-size-fits-all" report will not be advantageous for Vermont. As noted in the report, Vermont is already "punching above its weight" - BED and VPPSA urge caution in developing statewide policy to further support and/or incentivize storage deployment while the market is already moving apace; we look forward to future discussions on how this infant industry should grow. BED and VPPSA offer several areas where additional emphasis is warranted, and specific comments on one policy deployment mechanism.

Points for additional emphasis or clarification

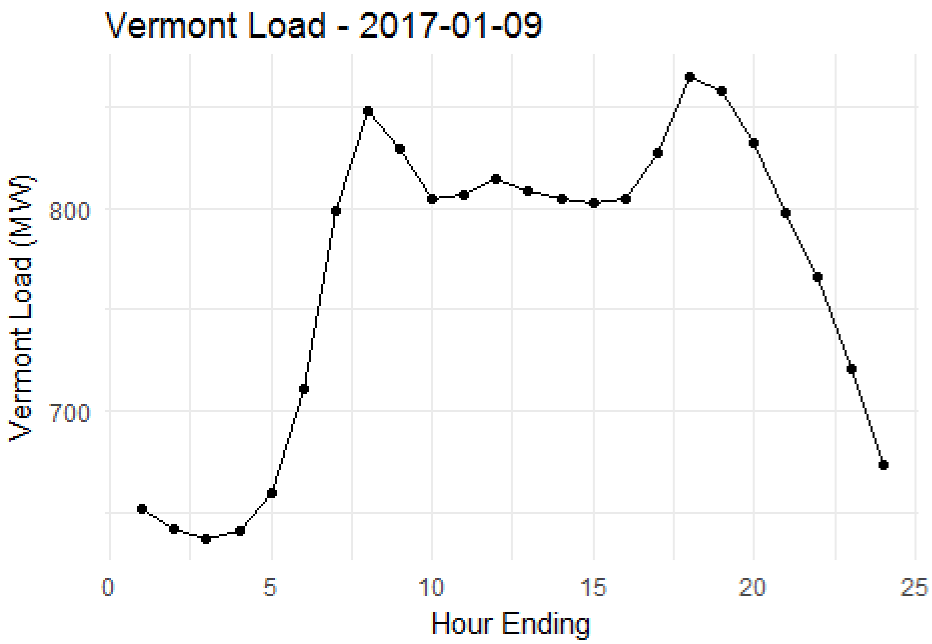
Losses

Page 7 states, "energy storage essentially captures energy produced at one time for use at another time". This statement may leave a false impression that there is a one-for-one transfer of electricity. Although energy storage can certainly be used to reduce kW, there will be kWh conversion losses along the way. Valuation of the benefits of storage must consider these losses, including evaluation of *when* they occur. Understanding that, in general, energy storage is a net consumer of energy is fundamental. On a similar vein, energy storage is only renewable if it is charged with renewable energy.

Declining marginal value of storage

As mentioned in regards to frequency regulation (page 13), the marginal value of storage will likely go down as more is deployed (i.e. each MW of storage deployed will generally produce less value than the previous MW.) Indeed, this is likely to be the case for all storage value streams. For example, peak shaving will likely become more difficult and/or require additional MWh for each MW of savings as peaks continue to flatten.

This can be seen by (in addition to the annual load duration curves (page 12)) examining a peak day's hourly load.[1] Vermont's current 2017 peak occurred in the evening but the load was above 800 MW for the majority of the day. This implies that the first MW of peak-shaving could have been achieved with only a 1 MWh battery, but (had enough storage been deployed to flatten the load in all hours where the load was above 800 MW to flatten it to 800 MW) then an addition 1 MWh battery would have only been able to flatten the load an additional 1/16 of a MW.



Storage may provide significant societal value but understanding which value streams represent avoided costs is key

When considering societal value, it is important to distinguish between actual reductions in societal cost versus reductions in Vermont ratepayers cost. Some of the significant benefit streams discussed in the report, such as reduced transmission charges, are actually cost-shifts rather than societal cost savings. That is, if a Vermont utility reduces its load at the time of Vermont's peak, transmission charges that would have been borne by that utility are now borne by other utilities in Vermont and the region. In this case, while real benefits accrue to the ratepayers of the utility that has reduced its load, societal benefits do not accrue unless physical transmission investments are not avoided.

Monetized Benefit Streams

Page 11 states, "Given that anticipating the peak load is an art, the utility will need to reserve several hours in the month to ensure that a storage asset discharges during peak hour(s)". This is certainly a true statement. But more nuance is necessary - anticipating the peak load amount and timing of the peak is complicated by flattening load shapes, utilities competing to reduce peak demand and attempting to anticipate each other's actions, and that shoulder month peaks

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[1] https://www.iso-ne.com/static-assets/documents/2017/02/2017_smd_hourly.xlsx VT Tab, RT Demand Column

are more unpredictable given weather patterns and other load reducing generation on the system. Value streams need to consider the probability that storage will not *always* be deployed at the time of monthly or annual peaks.

The report correctly notes that reliability and renewable integration can be non-monetary benefit streams. However, avoiding a "poles and wires" solution has real economic benefit to a utility and should be treated as such. Avoiding a power outage provides real but hard to quantify value that could be treated as a non-monetary benefit. This can be difficult to quantify, for example the study that attempts to quantify monetary avoided disaster recovery costs may assume that a disaster has already occurred (though to be fair BED and VPPSA did not have time to review all the reports cited).

Similarly, the reduction of economic impact due to curtailments of generators may be an economic value to affected utilities. The possibility of increasing the amount of renewable generation that supplies customer demand is the non-monetary benefit. Care should be taken in specifying non-monetary benefits and those that are easier to quantify. For those non-monetary benefits, they should be reviewed in the context of current regulatory frameworks. As the report notes (p.14), socializing costs of utility scale storage in order to integrate renewable energy would be a deviation from current norm where the last project to be constructed on a specific line is required to fund any transmission or distribution upgrades necessary to connect that generator. The report should highlight that abandoning the "cost-causer pays" model could have unintended consequences and should not be done lightly.

The section on energy arbitrage notes that due to historically low energy prices this value may be limited. Energy arbitrage value is driven by intra-day spreads more than the average level of energy prices. Energy prices with low average levels but high volatility can give arbitrage value. Negative bidding and DNE structures, along with the growing number of intermittent resources, may help to support this value stream even in time of low average energy prices.

Finally an understanding of the potential overlap in value streams is important. For example, to the extent a storage option is being discharged for capacity or transmission benefits, its reliability benefits are being simultaneously eroded. For example, if an outage were to occur after a potential ISO-NE peak event, but before the storage was recharged, both values would not be actualized. Another example would be that, depending on timing, for some summer months it might be difficult to maximize potential capacity benefits (based on high New England loads) while also being able to fully target Vermont transmission peaks (which frequently do not overlap completely) for ISO transmission savings.

Energy Efficiency Utilities Deploying Storage

The report raises the idea allowing energy storage to be a measure that EEUs could incentivize. VPPSA and BED suggest that the final report recommend against allowing EEUs to incentivize storage. Storage value streams that can accrue to a broad set of ratepayers tend to be site- and application-specific, and thus not appropriate for a prescriptive societal screening. The interconnecting utility is uniquely situated to manage the impacts of storage as it relates to avoiding a specific constraint or charges associated with specific times of peak; EEU intervention could create unintended consequences across the utility system both physically and financially.

For example, there could be situations where an EEU incentivizes storage that a customer uses to first shave their own demand peak and then charges during a Vermont or ISO-NE peak. Deploying storage by C&I customers to avoid and/or reduce demand related charges may benefit the end user customer but not necessarily result in net societal benefits as the costs to serve the C&I customer would be shifted to other customers (to the extent that utility costs are not reduced by the same amount as their revenues are). Such cost shifting is not a possible outcome under current rate structures (the report takes a soft stance on this)– it is a probable one. See page 13 under the section on Demand Charges. The comment by James Gibbons – while used elsewhere – was directed toward this specific situation. The end of the C&I use case on page 17 fails to remind the reader of this effect as well.

The energy efficiency utilities are not well suited to provide energy storage services (either grid connected or behind-the-meter), as they do not have the visibility into the specific conditions of distribution circuits. Nor, do the EEU's have the obligation to provide safe, reliable energy services pursuant to 218c. Thus, EEUs are not the appropriate agent to pursue or implement statewide storage policy. The past practice of EEU's in reducing load has been arguably reducing the burden on the transmission and distribution system by reducing energy consumption. As noted earlier, these devices consume energy, and return reduced amounts of energy to the grid (if badly controlled at problematic times potentially). It cannot be emphasized enough that storage is not a form of energy efficiency and that its inappropriate deployment can increase costs just as its appropriate deployment can reduce them.

Renewable Energy Standard and Tier 3

The draft report notes the Legislative language in the Renewable Energy Standard statute (page 35). VPPSA and BED suggest that the final report recommend further exploration of how to include storage as an eligible Tier 3 measure, even if direct links to fossil fuel savings are limited. One of the goals of the Renewable Energy Standard Tier 3 is to "market transformation", and energy storage has the potential to help in this effort. Creating a mechanism where utilities could meet its Tier 3 obligation through deployment of storage could, if structured properly, provide an additional potential value stream that makes storage more cost-effective for deployment without *requiring* deployment where it may not yet be cost-effective or where it may create unintended consequences.

Control of Storage Discharge/Charging Cycles

One potential point that could be added is that the control of storage should perhaps be determined by its primary or most significant value streams. Storage deployed to relieve transmission and distribution constraints would be best controlled by the utilities owning such assets. Storage leveraging ISO-NE markets could be dispatched by an entity other than a DU under some circumstances – provided doing so does not cause T&D impacts. Storage deployed primarily for reliability might be best controlled by the customer so that it is available when needed, and so that pursing other value streams do not imperil this value, but this would make capturing market and T&D impacts difficult.

Integrating Renewables

While storage has potential to assist with the integration of renewable energy, all of the integration issues used as examples in the report seem to be intra-day issues of a single resource. The use of storage to advance renewable integration, particularly if the constraint is serious or of multi-day duration is a complicated undertaking and requires significant understanding of the electrical system. However as noted elsewhere, the benefit of storage toward integrating renewables should be monetizable when compared to other alternatives to meet the level of renewable integration needed to meet state goals. In the Venn diagram on page 9, the monetary value of reliability/resiliency really stands out as being very difficult to quantify.

Additional Report

One additional report that BED and VPPSA have found useful is *Charging Ahead*[2] by IREC. If it has not already, the Department may want to consider this report as an additional resource. Neither BED nor VPPSA are attempting to endorse any of its conclusions here.

Conclusion

BED and VPPSA appreciate the opportunity to comment on the Department's report. It is a robust report that is nuanced in its delivery of information, and it makes clear that a "one-size-fits-all" approach is not warranted for storage deployment in Vermont.   Deploying storage without a clear understanding of the underlying system, what problem the storage is being deployed to solve (or what value is it being deployed to capture), and who will control the storage to accomplish those goals has the real potential to create rather than solve problems, and to incur net costs rather than net benefits.

VPPSA and BED recommend that any policy approach be flexible and not overly prescriptive on the scale and size appropriate for each type of utility in the State, considering all of the site-specific variables that affect the monetary and non-monetary impacts of a storage project. We look forward to continued discussions on how best to support this infant industry.

[2] http://www.irecusa.org/wp-content/uploads/2017/04/IREC_Charging-Ahead_Energy-Storage-Guide_FINALApril2017.pdf