February 18, 2021

Rosemary Chiavetta, Secretary
Pennsylvania Public Utility Commission
Commonwealth Keystone Building
400 North Street
Harrisburg, PA 17120

Submitted via e-file

Re: Policy Proceeding – Utilization of Storage Resources as Electric Distribution Assets Docket No. M-2020-3022877

Dear Secretary Chiavetta:

Please find comments of the Natural Resources Defense Council in the above-referenced matter.

Thank you very much.

Sincerely,

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BEFORE THE PENNSYLVANIA PUBLIC UTILITY COMMISSION

Policy Proceeding—Utilization of Storage Resources as Electric Distribution Assets	**Doc. No. M-2020-3022877**

Natural Resources Defense Council

Dated: February 18, 2021

Natural Resources Defense Council

Comments to the Pennsylvania Public Utility Commission

Utilization of Storage Resources as Electric Distribution Assets

Docket No. M-2020-3022877

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I. Introduction and Summary

The Natural Resources Defense Council ("NRDC")[1] appreciates the opportunity to provide these comments in response to the questions raised by the Pennsylvania Public Utility Commission ("PUC") in its December 3, 2020 Secretarial Letter at Docket No. M-2020-3022877, "Policy Proceeding – Utilization of Storage Resources as Electric Distribution Assets."[2]

While energy storage is not a new technology, its use as a grid asset has been rather limited. Even after rapid growth in recent years, only 24,364 MW of storage capacity was installed on the grid in the United States as of January, 2021 and pumped hydroelectric facilities constituted over 90 percent of that capacity.[3] In Pennsylvania, 1,581 MW of storage capacity is currently installed on the grid, of which 1,522 MW is pumped hydroelectric. Currently, most of the growth in storage in grid applications is in the form smaller-scale, modular chemical-based technologies, including lithium-ion battery energy storage systems ("BESS"); consequently, our comments focus on battery storage.

In general, we recommend that the PUC consider storage as one of many complementary technologies, including energy efficiency and demand response, that can improve reliability and resiliency while helping the state create a cleaner, more flexible grid and meet its climate goals.

[1] NRDC developed these comments with assistance from Synapse Energy Economics.

[2] On December 19, 2020 the Secretarial Letter was published in the Pennsylvania Bulletin with notice of a 30-day public comment period. 50 Pa.B. 7259. On December 28, the Office of Consumer Advocate filed a motion requesting an extension of the comment period, and on December 30 the Commission granted the motion, extending the deadline for comments to February 18. 51 Pa.B. 411.

[3] S&P Global Market Intelligence, Power Plant Unit Screener Data. Accessed 2/16/2021, (Subscription required). *See also* U.S. Department of Energy. "Pumped Storage Hydropower." Accessed Feb. 12, 2021. Available at: https://www.energy.gov/eere/water/pumped-storage-hydropower.

Battery storage represents a unique grid resource among these technologies, as it is both a source of load when charging and a source of generation when discharging. Because of this functionality, strategically locating BESS within transmission and distribution (T&D) systems has significant potential to displace aging, single-function conventional technologies that have been relied upon for decades to create a reliable grid. But the question of utility ownership of those systems must be considered in view of other available alternatives, including bilateral contracts between electric distribution companies and third-party parties for storage services. And storage should be integrated into distribution system in a manner that advances the commonwealth's efforts to reduce both high energy burdens for low income customers[4] and high pollution burdens for environmental justice communities.[5]

II. Responses to the PUC's Questions

Question 1: ***What applications can electric storage provide as a distribution asset for utilities that would facilitate improved reliability and resiliency?***

Energy storage can provide many types of services at several levels of the electricity grid system: wholesale market services (energy, capacity, and reserves), T&D system services, and customer benefits such as electric bill management and emergency power. On the distribution system, storage can provide the following types of reliability and resiliency services:[6]

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[4] *See* Docket M-2019-3012599, "2019 Amendments to CAP Policy Statement."

[5] *See, e.g.,* Environmental Quality Board, proposed rulemaking for CO2 Budget Trading Program, 50 Pa.B. 6212 ("the Department is seeking comment on potential approaches for the implementation of this proposed rulemaking that would address equity and environmental justice concerns in this Commonwealth").

[6] Synapse Energy Economics and Slipstream. 2020. *Energy Storage in Iowa: Market Analysis and Potential Economic Impact.* Prepared for the Iowa Economic Development Authority.

- **Voltage support and frequency regulation**: Distribution grid operators must control frequency and voltage in order to balance and maximize power on the grid. Balancing power involves matching supply with demand, and maximizing power requires aligning voltage with current. Disruptions in balance can limit electricity supply and damage T&D resources, thereby leading to reliability concerns. Storage is a unique asset in that it can provide both frequency regulation by changing operation direction (charge versus discharge) as well as voltage support by aligning voltage with current along distribution lines.

- **Renewable energy integration**: Storage can be used to reliably integrate clean distributed energy resources by managing the variable output of solar and wind generation. When used in a hybrid system with solar or wind, the stored energy in batteries can be used to provide firm capacity to the grid from an intermittent resource. In some locations with higher penetration of renewable energy than currently exists in Pennsylvania, the ability of the grid to accommodate new renewable resources is limited and may lead to wind and solar production being curtailed due to oversupply or T&D constraints that limit power transfers between zones.[7] Energy storage can increase the hosting capacity of the distribution system to accommodate new distributed sources of renewable generation. In order to prevent curtailment of wind or solar energy, storage units can harvest the clean energy that would otherwise be curtailed and reliably provide it back to the grid when it is needed (e.g., evening peak). This flexibility will prove

[7] For example, each year approximately 4 percent of the wind generated within the footprint of the Midcontinent Independent System Operator is curtailed, see U.S. Department of Energy Office of Energy Efficiency and Renewable Energy. 2018 Renewable Energy Grid Integration Data Book. Available at https://www.nrel.gov/docs/fy20osti/74823.pdf.

valuable as the cost of renewable resources continues to decline and the share of renewable resources on the grid increases. It will also facilitate compliance with emissions reduction goals set forth in Governor Wolf's Executive Orders 19-01 (" Commonwealth Leadership in Addressing Climate Change and Promoting Energy Conservation and Sustainable Governance") and 19-07 ("Commonwealth Leadership in Addressing Climate Change through Electric Sector Emissions Reductions").

- **Emergency back-up power and resilient microgrids**: Battery storage can provide resilience to critical facilities (*e.g.*, hospitals, police stations, etc.) and underserved communities by supplying instantaneous uninterruptible power that is often provided today using fuel-based generators that bring noise, pollution, and fuel access risks. Resilient microgrids (which include a combination of a battery system and one or more generation resources, such as a solar photovoltaic (PV) array or a back-up generator) include inverters designed to "island" in the case of an outage event.[8] This allows the microgrid to continue to provide power to critical facilities when the grid is unavailable.

- **Congestion relief**: Transmission lines can become congested during periods of high energy demand, which creates reliability concerns and may necessitate new infrastructure investments or demand-side measures. Energy storage sited downstream of the congested lines can provide energy to desired locations during such periods. Storage resources must be designed and operated in a manner that meets or exceeds the number of hours that the

[8] Islanding is when a microgrid disconnects from the larger grid during an outage to supply power to one or more facilities. Once the power on the larger system is restored, the microgrid reconnects to the larger grid.

transmission line is congested to fully realize the reliability benefits or to avoid additional investments or measures.

Storage deployed on the distribution system can also provide valuable services in addition to reliability and resilience, including:[9]

- **Avoiding or deferring traditional utility investments**: Grid operators are tasked with ensuring that the T&D system capacity is sufficient to serve customers during the periods of peak usage. In areas with growing energy use, downstream storage can help operators meet the increased demand during peak periods without the need for expensive wires-based system investments. For example, transformers and other equipment at utility substations have limited capacities and must be upgraded when the peak demand on the system increases due to growth in consumption. Battery systems located at substations can be used to deliver energy at peak times and therefore delay or avoid utility investments to upgrade substations.

- **Wholesale market services**: Energy storage systems sited within the distribution system can provide wholesale market services. BESS owners can earn revenues by providing grid services in one or more of PJM’s wholesale markets. This includes participation both as a capacity resource in PJM’s capacity market known as the reliability pricing model (“RPM”) and in PJM’s ancillary services market, which includes markets for “regulation” – in this context, a reliability product used to correct for short-term (seconds and minutes) changes in electricity use and supply that can impact the stability of the power system.

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[9] Synapse Energy Economics and Slipstream. 2020. *Energy Storage in Iowa: Market Analysis and Potential Economic Impact*. Prepared for the Iowa Economic Development Authority.

PJM's Regulation D "(RegD") market has been a focus of BESS developers for years because it requires fast-ramping services, which batteries are particularly good at, and the service receives a market premium relative to the standard regulation services. Finally, BESS can participate in energy markets through energy arbitrage, which involves charging with low-cost off-peak power and injecting energy back onto the grid during high-priced peak hours.

- **Reducing emissions**: Because charging and discharging a battery results in losses of 10–30 percent (known as roundtrip losses), batteries consume more energy than they provide.[10] Therefore, it is possible for the operation of a battery to increase emissions from the grid. However, if operated strategically, energy storage can help to reduce grid emissions. If the battery charges during a very low-emissions hour (in PJM, typically off-peak) and discharges during a very high-emissions hour (typically on-peak), the operation of the battery may reduce emissions despite the roundtrip losses. Similarly, if a battery is paired with and charged only by a renewable resource (*e.g.*, solar plus storage), the system can help to reduce grid emissions.[11] Furthermore, storage has the potential to reduce emissions impacts on the frontline communities that live near fossil fuel peaker plants, which tend to be inefficient and may harm local air quality.[12] Implementing

[10] U.S. Department of Energy. 2019. *Energy Storage Technology and Cost Characterization Report*. Available at: https://www.energy.gov/sites/prod/files/2019/07/f65/Storage%20Cost%20and%20Performance%20Characterization%20Report_Final.pdf.

[11] Synapse prepared comments on behalf of the Maryland Office of People's Counsel regarding the evaluation of several utility proposals for battery storage systems. The emissions comments begin on Page 16 of the PDF. https://webapp.psc.state.md.us/newIntranet/Casenum/NewIndex3_VOpenFile.cfm?FilePath=//Coldfusion/Casenum/9600-9699/9619/27.pdf.

[12] Union of Concerned Scientists. "How to Ensure Energy Storage Policies Are Equitable." Nov. 2019. Available at: https://www.ucsusa.org/resources/equitable-energy-storage#ucs-report-downloads

storage that is charged with renewable energy resources to operate during peak hours can promote more equitable public health outcomes.

Storage can be deployed in behind-the-meter applications on host customer premises. These customer benefits include:

- **Electric bill management**: Time-of-use (TOU) electricity rate structures vary the price of energy throughout the day. TOU rates are higher during peak usage periods (late afternoon or early evening) and lower during periods of low demand (late evening or early morning). Storage systems can store energy when the cost is low and discharge energy to reduce purchases during high price periods. This feature has the potential to lower the overall cost of energy for host customers if a TOU rate option is available. Storage systems can be used to reduce electric bills for commercial and industrial customers with demand charges, a component of the electric bill based on the customer's peak demand.[13] Battery storage systems can be used to reduce peak usage and thereby reduce a customer's demand charges.

- **Solar self-consumption**: For economic reasons, pairing solar with storage offers the greatest advantage in jurisdictions without net metering. However, this paring also allows customers to increase self-consumption of clean energy. As Pennsylvania offers net metering, pairing solar with storage may still be an attractive option for host customers with sustainability goals.

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[13] To the extent that demand charges are designed to recover a utility's embedded costs, there is a potential for cost shifting from commercial and industrial customers to other customer classes. In time, a change in rates may be needed to re-align revenues with cost causation, and may thus limit the economic viability of this BESS strategy in the long-term.

- **Emergency back-up power**: Batteries for emergency backup power are a viable alternative to fuel-based backup generators, especially in environmental justice communities overburdened by pollution While fuel-based generators still cost less up front, there are advantages for battery-based systems including reduced noise, lower emissions, and the mitigation of fuel supply risks.

Behind-the-meter storage systems can be aggregated by the distribution utility or a third-party aggregator to serve as a virtual power plant ("VPP") while also providing benefits to the host customers. A VPP is an aggregation of many distributed resources that can be dispatched to provide grid services, similar to the way a central power plant is operated. Vermont's investor-owned utility, Green Mountain Power ("GMP"), was the first utility company in the nation to offer its customers a BESS to be operated as a VPP. In 2017, GMP began a pilot program offering residential customers the opportunity to own a Tesla Powerwall battery system. Participating customers were offered a reduced price for the Powerwall and the option for a 10-year payment plan. In 2018, the pilot was extended to include a Bring Your Own Device (BYOD) option, which allows customers to purchase a BESS from a provider other than Tesla and receive an incentive payment from GMP. In exchange for the reduced cost of the system or the BYOD incentive payment, customers agreed to allow GMP to remotely charge and discharge the batteries to create a VPP. When not being dispatched by GMP, the battery systems provide resilience in the form of emergency backup power to the host customers. The pilot program attracted 2,000 participants.[14] In 2020, the Vermont Public Utility Commission approved GMP's

[14] Green Mountain Power. December 2018. *GMP Customers Keep Lights on With Stored Low Carbon Energy During Storm Outages,* available at https://greenmountainpower.com/gmp-customers-keep-lights-on-with-stored-low-carbon-energy-during-storm-outages/.

request to make the energy storage pilot program permanent with a limit of 500 customers for each program (GMP's Powerwall and BYOD) and a review after two years. In addition to the limitation of 500 participants, the BYOD program is capped at 5 MW per year and participants are eligible for an additional $100 incentive for systems located within parts of the GMP distribution system that are constrained.[15] GMP is the first utility in the country to get tariff approval to offer customers these types of programs. In 2020, GMP claimed that its growing network of energy storage systems, including both residential and utility-scale BESS, reduced costs for all GMP customers by about $3 million. These benefits were realized by reducing power demand during energy peaks, particularly in summer months, by approximately 13 MW.[16,17]

Question 2: ***What are the defining characteristics of electric storage used for distribution asset planning as distinguished from generation resources? What thresholds, if any, would classify electric storage as a generation resource and therefore outside permitted distribution ratemaking and recovery?***

As described in response to Question 1, energy storage is a unique type of asset that can serve transmission, distribution, and generation functions. Storage therefore defies the simple generation-versus-distribution dichotomy that was the basis of electricity sector restructuring in

[15] V.P.S.B No. 9, *Green Mountain Power Corporation Bring Your Own Device (BYOD) Program Second Revised Tariff Sheet 311*, available at http://greenmountainpower.com/wp-content/uploads/2020/08/GMP-BYOD-Tariff-2nd-Revision-6-1-20.pdf.

[16] Green Mountain Power, September 2020, *GMP's Energy Storage Programs Deliver $3 Million In Savings for All Customers During 2020 Energy Peaks*, available at https://greenmountainpower.com/gmps-energy-storage-programs-deliver-3-million-in-savings/.

[17] Greentech Media, October 2020, "From Pilot to Permanent: Green Mountain Power's Home Battery Network Is Here to Stay," available at https://www.greentechmedia.com/articles/read/from-pilot-to-permanent-green-mountain-powers-home-battery-network-is-sticking-around.

Pennsylvania and other states served by competitive wholesale power markets. Ideally, storage should be statutorily classified in a way that fully accounts for the many services it is designed to provide to the distribution system. If a single classification category is strictly required under Pennsylvania's Electricity Generation Choice and Competition Act of 1996, it should be based on the primary function the battery system is designed to perform.

This debate has arisen in three other states with wholesale markets: Connecticut, Texas, and New York. In 2019, the Connecticut legislature approved the ability for electric distribution utilities ("EDUs") to own wholesale storage assets. The new legislation retains the original language from Connecticut's electric restructuring law of 1998 but provides an exception for energy storage systems. Connecticut has an ongoing regulatory proceeding to implement the 2019 law by exploring the value of storage and determining territory-specific implementation details. [18]

In Texas, municipal utilities and electric cooperatives have been allowed to own and operate energy storage devices since September of 2019. [19] On February 8, 2021 the Texas legislature introduced a bill that would restrict T&D utilities from owning and operating energy storage but would allow them to enter into a "contract with a power generation company to provide electric energy from an electric energy storage facility to ensure reliable service to distribution customers."[20] The following criteria need to be met in order to allow this type of contract: the

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[18] Connecticut Public Utilities Regulatory Authority. *PURA Investigation into Distribution System Planning of the Electric Distribution Companies –Electric Storage,* Docket No. 17-12-03RE03. Available at: http://www.dpuc.state.ct.us/DOCKCURR.NSF/8e6fc37a54110e3e852576190052b64d/40d99b6c688d057485258489005bbbd9?OpenDocument.

[19] Mai, HJ. 2019. "Texas utilities poised to get ability to own energy storage assets." *UtilityDive*. Available at: https://www.utilitydive.com/news/texas-utilities-poised-to-get-new-ability-to-own-energy-storage-assets/560797/.

[20] State of Texas. *Relating to use of electric energy storage facilities in the ERCOT power region.* Bill No. HB 1672. Available at: https://capitol.texas.gov/BillLookup/History.aspx?LegSess=87R&Bill=HB1672.

agreement must be obtained through a competitive solicitation, the terms of the contract must be more cost-effective than investment in distribution alternatives, and the capacity of the storage device may not exceed the amount needed for reliability purposes. The total capacity of EDU storage contracts may not exceed 40 MW; the Commission can determine how that cap is allocated to each EDU. The bill authorizes the Commission allow distribution utilities to recover costs through the rate base, provided that the rates are shown to be reasonable and necessary.

New York also recently launched a tariff allowing its distribution utilities to split wholesale revenues from storage assets with customers.[21] Under this system, the distribution utility cannot own and operate the storage system; instead, it is required to contract with an independent developer. The utility will then be able to charge customers for the cost associated with building and operating the battery system. Any additional profits would then be split, with 70 percent of the profits being paid back to all ratepayers.[22]

Two of the three states discussed above do not define generation thresholds[23] for storage to be included in the distribution system; however, they instead require that storage on the distribution grid is owned by either an independent party (New York) or by the generation utility (Texas, though the draft legislation has not been passed). Furthermore, Texas is proposing capacity limitations for each EDU as well as the total amount of storage that can be installed across the

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[21] Nemo, Leslie. 2021. "New York approves utility revenue sharing for battery storage systems." *UtilityDive*. Available at: https://www.utilitydive.com/news/new-york-approves-utility-revenue-sharing-for-battery-storage-systems/594207/.

[22] New York Department of Public Service. *Rochester Gas and Electric Corporation filed the following Statement: Value of Distributed Energy Resources Value Stack Credits (VDER CRED).* Bill No. 42 to PSC No. 19 - Electricity. Available at: http://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterSeq=64602&MNO=21-00239.

[23] The term "threshold" as used by the PUC in the Secretarial letter is ambiguous. Our comments interpret the term to refer to ownership as it relates to Commission regulations and oversight.

state's distribution systems. Though Connecticut allows EDUs to own storage assets on the distribution system, its commission is still engaged in a proceeding to determine whether there should be operation, size, or other limitations for those storage assets.

To explore ownership models and battery operations, some jurisdictions have pursued demonstration projects including authorizing utility pilot programs to gain experience with the logistical, regulatory, and operational challenges associated with energy storage projects. As one example of a pilot program, the Maryland General Assembly passed Senate Bill 573 in 2019, known as the Energy Storage Pilot Program Act. Subsequently, the Maryland Public Service Commission established an Energy Storage Pilot Program requiring each Maryland investor-owned electric distribution company to solicit offers to develop energy storage projects and to submit at least two energy storage proposals for the Commission's consideration.[24] The total capacity for the combined storage projects across all utilities included in the Energy Storage Pilot Program is not to exceed 10 MW of capacity. One of the goals of the pilot program was to explore different energy storage ownership and operation models. The program explicitly encouraged utilities to pursue different models, including utility ownership and operation, third-party ownership and operations, and the VPP model discussed above. In their proposals, the utilities were required to demonstrate the cost-effectiveness of the proposed battery solutions. The Commission required the utilities to use a recommended Benefit-Cost Analysis approach

[24] Maryland Public Utilities Commission. August 2019. Order Establishing an Energy Storage Pilot Program, Order #89420. Available at https://www.psc.state.md.us/wp-content/uploads/Order-No.-89240-Case-No.-9619-Order-Establishing-an-Energy-Storage-Pilot-Program.pdf.

developed by the Maryland Energy Storage Working Group, which includes value streams for reduced emissions and deferred distribution system upgrades.[25]

Question 3: ***Is it prudent for utilities to include electric storage in their distribution resource planning and, if so, where and under what circumstances? Further, is it appropriate for utilities to include such investments in rate base?***

Yes, it is prudent for utilities to include storage in their distribution planning, provided that Pennsylvania updates its distribution planning process to ensure consideration of non-wire alternatives and otherwise drive the creation of a decarbonized electric power and distribution system.[26] BESS should be compared alongside and in combination with other traditional investments or demand-side measures to address an identified need in the most cost-efficient way possible. If the storage system provides a lower cost solution than the alternative(s) then inclusion in the rate base would be prudent. However, it is imperative and prudent that storage solutions can be compensated for the many services that they can provide to the distribution grid, to allow storage to be competitive with traditional solutions.

As described above, battery storage provides many different types of valuable services to the electric grid. Our experience in other jurisdictions suggests that BESS deployments that

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[25] The Energy Storage Working Group includes the distribution utilities, the Energy Storage Association, PJM, and the Consumer Advocate.

[26] Comments filed in this matter by the Office of Consumer Advocate ("OCA") note that "traditional approaches to utility distribution planning are not equipped to properly evaluate the benefits of non-wires alternatives compared to traditional investment in aging infrastructure. Accordingly, the Commission should consider a more comprehensive planning process, such as IDP." NRDC has not yet had the opportunity to review the particulars of the OCA's recommendation, but supports recommendation as a general matter. NRDC notes that pursuant to the requirements of the Accelerated Renewable Energy Growth and Community Benefit Act, the New York Public Service Commission recently initiated a proceeding to establish a planning process to guide future investments in local transmission and distribution and to establish a T&D capital plan for each utility, in order to ensure that New York's electric grid will support the State's climate mandates.

provide multiple services to the grid must be able to "stack" several revenue streams to be cost-effective. As such, this requires flexible market and regulatory structures to maximize the value of grid assets, including but not limited to BESS. In this proceeding or subsequent ones, the state should identify compensation frameworks that will properly compensate storage and other DER system owners for the distribution-level services that their resources provide.[27]

The energy storage pilot projects discussed above can be useful in gaining knowledge about how best to structure and incentivize cost-effective investments in energy storage. Through a pilot, utilities could pursue storage projects that would otherwise not be possible due to existing regulations. A pilot could tap into grants or other funding sources specifically targeted to energy storage projects. The learnings from pilot programs can provide a basis for future evaluations to assess the prudency of utility investments in storage and other technologies and systems for a more flexible and resilient grid.

Some states have mandates requiring utilities to consider alternatives to traditional wire-based solutions—otherwise known as non-wires alternatives (NWA)—in their distribution planning and investment decision-making processes. Because of its cost-competitiveness and the availability of new value streams, battery storage accounts for the majority of NWA solutions in the United States.[28] Several states have successfully implemented a BESS as an NWA. For example, in 2017 Arizona Public Service purchased a 2 MW/8 MWh BESS for less than the cost

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[27] As an example of a compensation framework in place outside of Pennsylvania, see New York State's Value of Distributed Energy Resources (VDER) Program. "The Value Stack." Available at: https://www.nyserda.ny.gov/all-programs/programs/ny-sun/contractors/value-of-distributed-energy-resources.

[28] Menonna, Francisco. 2020. "US utilities are leaving non-wires alternatives on the table." *Wood Mackenzie*. Available at: https://www.woodmac.com/news/editorial/us-nwa-on-the-table/.

of a traditional wires alternative.[29] In doing so, it was able to shift renewable generation to peak hours and defer building a 20-mile transmission line. In 2019, National Grid installed a 6 MW/48 MWh BESS on Nantucket Island in Massachusetts. This investment helped National Grid avoid building another underwater transmission cable and will also allow it to drive electricity prices down during peak periods.[30] The estimated cost of the transmission cable was nearly $200 million. In comparison, the battery solution cost $81 million, yielding nearly $120 million in capital investment savings. Perhaps the most well-known NWA program is the Brooklyn Queens Demand Management Program (BQDM).[31] This program reduces peak demand by more than 50 MW by utilizing customer-sited distributed generation and energy efficiency. The program has included three BESS installations totaling 8.6 MW. Overall, the total projected cost of the program is $200 million, which is significantly less than the traditional solution which was estimated at a cost of more than $1 billion. On Long Island, all capital projects are evaluated for non-wire solutions, and PSEG Long Island continuously evaluates the need for energy storage systems on the distribution grid.[32] So far, PSEG Long Island has deployed two storage systems totaling 10 MW/80 MWh.

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[29] Bade, Gavin. 2017. "APS to deploy 8 MWh of battery storage to defer transmission investment." *UtilityDive*. Available at: https://www.utilitydive.com/news/aps-to-deploy-8-mwh-of-battery-storage-to-defer-transmission-investment/448965/.

[30] Gheorghiu, Iulia. 2019. "There once was a 48 MWh Tesla battery on Nantucket, which saved National Grid $120M in its budget." *UtilityDive*. Available at: https://www.utilitydive.com/news/Tesla-national-grid-battery-energy-storage-8hour-long-duration-diesel-generation-system-nantucket/564428/.

[31] Chuangpishit, Shadi et al. "Innovative Solutions and Approaches Taken by North American Utilities in Leveraging Benefits of DERs and Grid Modernization Technologies." *CIGRE*. October 2020. Available at: https://cigreconference.ca/papers/2020/C6/362/362.pdf

[32] Central Hudson Gas & Electric Corp. et al. "Utility Transmission and Distribution Investment Working Group Report." Nov. 2020. Available at: http://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=20-E-0197&submit=Search.

States with some form of NWA mandate include California, Maine, Michigan, New Hampshire, New York, Rhode Island, and Vermont. For example, utilities in Maine must identify potential opportunities for NWAs when they file their capital investment plans. As required by statute, Maine created an NWA coordinator role within the Office of the Public Advocate to review utility investment plans, evaluate their cost-benefit calculations, and recommend a course of action for the utility.[33]

Pennsylvania does not have an NWA framework or a neutral NWA evaluator, as has been implemented in Maine. Further, Pennsylvania's distribution system planning process lacks transparency. Together with the lack of an NWA framework, the lack of transparency represents a fundamental problem that the PUC will need to remedy in order to realize the goal of building a dynamic, reliable, clean, and cost-effective distribution grid. Storage may play a key role in building this grid, but BESS (along with other resources) will be hindered by the lack of clear market signals that a robust, transparent distribution planning process would provide.

Policymakers should also consider underserved, environmentally burdened communities during the creation of storage policies and targets.[34] Policymakers could include tools such as a "carve-out" for storage that can specifically be set aside for communities suffering from poor air quality. Cost containment mechanisms and incentives should also be considered so that these communities do not unduly bear burdens associated with storage installation. Policies and tax

[33] For more details see: State of Maine, Office of the Revisor of Statutes. *Subchapter 2 - Energy Planning; Construction; Purchases.* Available at: http://www.mainelegislature.org/legis/statutes/35-a/title35-Ach31sec0.html.

[34] Union of Concerned Scientists. Nov. 2019. "How to Ensure Energy Storage Policies Are Equitable." Available at: https://www.ucsusa.org/resources/equitable-energy-storage#ucs-report-downloads.

credits can be designed to make energy storage more affordable for utilities and customers in general, and for specific groups such as affordable housing owners, low-income households, small businesses, and schools in particular.

The PUC should, at a minimum, establish guidance on how and when utilities should consider NWAs. In addition, the PUC should provide additional transparency into the distribution system planning process. Such guidance should include the following:

- The utility should be required to show that it considered NWAs before making a traditional investment and provide a detailed cost-benefit analysis to support final decisions.
- NWA assessment and load forecasting should use common assumptions and methodologies statewide, wherever appropriate.
- Load forecasts should use up-to-date information on DER penetration and electrified load and should fully incorporate the expected impacts from existing state and local policies. Load forecasts should include a counterfactual, no-DER load forecast, which allows the analyst to isolate the impact of additional DERs on system needs and determine the costs that would have occurred but for the incremental DERs. These forecasts, along with documentation of assumptions, should be publicly accessible.
- Load forecasts should use a study horizon and provide sufficient temporal and geographic detail to allow NWAs to be developed and implemented.
- Assessment of NWAs should capture their full values. In addition to avoided energy, capacity, and T&D values, NWA benefits may include increased flexibility to respond to

system needs, and reductions in emissions (*i.e.*, criteria pollutants and carbon emissions) and the associated public health benefits.

- NWA assessment should include all available measures, including but not limited to storage, demand response and time-varying rates, targeted energy efficiency, and distributed energy resources.

Finally, we recommend enacting legislation to create a neutral NWA evaluator role in the Commonwealth of Pennsylvania to increase the success of the NWA framework in the distribution planning process.

III. Conclusions and Recommendations

Conclusions

Battery storage is a unique and valuable grid resource that can provide wholesale market services (energy, capacity, and reserves), T&D system services, and services that benefit host customers. When deployed on the distribution system, storage can provide voltage support, frequency regulation, support for renewable energy integration, emergency back-up power and resilient microgrids, and congestion relief. It also provides valuable services in addition to reliability and resilience, including deferring or avoiding T&D investments and potentially reducing emissions when paired with a renewable source of generation in a hybrid system. Other jurisdictions are demonstrating the value of BESS in terms of lowering electricity prices due to peak shaving. But flexible market and regulatory structures are needed to maximize the value of grid assets, including but not limited to BESS. Our research has indicated that other jurisdictions (Connecticut, Texas, and New York) are aware of the benefits that storage provides and are creating regulatory and legislative changes that allow storage to be utilized on the distribution system.

Recommendations

We recommend that the PUC consider storage as one resource among many complementary technologies that can help the state decarbonize its electric power and distribution systems and meet its climate goals. Storage should be considered within the broader context of technologies and strategies that enable utilities and third parties to provide a flexible, resilient, and clean grid. In Pennsylvania, this will clearly require updating the state's distribution system planning process, as the Office of Consumer Advocate has recommended in its comments in this docket.

In this proceeding or subsequent ones, the state should identify compensation frameworks that will properly compensate storage system owners for the distribution-level services that their resources provide.

In the context of distribution system planning and investments, BESS should be compared alongside and in combination with other traditional investments or demand-side measures to address an identified need in the most cost-efficient way possible. If the storage system provides a lower cost solution than the alternative(s) then inclusion in the rate base would be prudent.

Respectfully submitted,

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