STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Case No. 23-____-PET

Petition of Green Mountain Power for approval	)
of its Zero Outages Initiative as a Strategic	)
Opportunity pursuant to 30 V.S.A. § 218d and	)
GMP's Multi-Year Regulation Plan	)

PREFILED DIRECT TESTIMONY OF
JOSH CASTONGUAY
ON BEHALF OF GREEN MOUNTAIN POWER

October 9, 2023

Summary of Testimony

Mr. Castonguay's testimony describes the successful resiliency work GMP has developed and launched to supplement and complement infrastructure grid hardening projects, including utility scale storage, microgrids and Resiliency Zones, and customer-driven residential storage. He explains how GMP will build on this innovative work to provide grid-wide resiliency to achieve zero outages for customers. Among other complementary distributed grid resources, Mr. Castonguay focuses on the important role customer and community storage solutions have as part of GMP's Zero Outages Initiative.

Exhibit List

Exhibit GMP-JC-1	Resiliency Zone Screening Criteria and Results

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Introduction

Q1. Please state your name, address, and occupation.

A1. My name is Josh Castonguay. I am employed by Green Mountain Power ("GMP") as Vice President, Chief Innovation Executive.

Q2. Please describe your educational and business background.

A2. I have been employed by GMP since 2003, working in engineering until 2009, and then moving into various leadership positions throughout the organization, including the control center and the transmission and distribution line department, among other responsibilities. In 2017, I became Vice President, Chief Innovation Executive leading generation, engineering, and the team working on our innovative technology and service. I graduated from the University of Maine in 2003 with a Bachelor of Science in Electrical Engineering Technology.

Q3. Have you previously testified before the Public Utility Commission ("Commission" or "PUC")?

A3. Yes, I have provided testimony on behalf of GMP in numerous proceedings, including, most recently, GMP's 2023 Rate Case (Case No. 22-0175-TF), GMP's Multi-Year Regulation Plan ("MYRP") proceeding (Case No. 21-3707-PET), GMP's BYOD & ESS

joint tariff proceeding (Case Nos. 19-3167-TF & 19-3537-TF (and as modified & extended in Case No. 23-1335-TF)), GMP's Climate Plan proceeding (Case No. 20-0276-PET), and GMP's petition to modify its service territory in support of GlobalFoundries U.S. 2 LLC's request to operate a self-managed utility (Case Nos. 21-1109-PET & 21-1107-PET), and have participated in a number of other proceedings and workshops on topics related to engineering, innovation, and distributed generation.

Q4. What is the purpose of your testimony in this case?

A4. My testimony explains why GMP is committed to deploying targeted resiliency solutions for customers and communities to meet the challenges of a changing climate in Vermont, and how we must deploy these storage solutions for customers now in coordination with grid hardening to reach zero outages by 2030. I describe how these storage solutions will be accelerated alongside transmission and distribution system (T&D) work in our Zero Outages Initiative through this filing.

I. Summary of Storage's Role in GMP's Zero Outages Initiative

Q5. Give us an overview of where community and customer storage fit within GMP's accelerated resilience work in the Zero Outages Initiative.

A5. We need to deploy solutions now that we know work for customers, keeping them connected and powered up even as severe storms and other threats increase. Our customers cannot continue to face the brunt of climate change when solutions exist today that can help them. Storage will play a central role in providing zero outages to customers. We can do this by continuing our successful Energy Storage System (ESS)

and Bring Your Own Device (BYOD) tariffs; rolling out more community-level storage including microgrids throughout our territory; expanding storage we provide directly to customers particularly in many of our rural areas; and developing innovative programs in the near future to use electric vehicles as storage to power homes and add value for customers. All of this critical climate resiliency work using storage will complement and coordinate with the expanded distribution system hardening discussed by Mr. Burke to provide zero outage service to all customers by 2030. We have already proven that our customers can achieve a zero-outage experience thanks to the combination of hardening our distribution system and adding energy storage and it is time we scale this up for every customer, no matter where they live, or what they can afford.

Specifically, we will build upon established storage programs using a variety of tools such as:

- Microgrids, first designed and deployed by GMP in Panton, and now underway in several other communities with identified resiliency challenges and vulnerabilities.
- Storage, including utility scale, mobile, portable, and customer-sited, all deployed to help strengthen the grid, support continued growth of distributed renewable energy, and provide community and customer resilience to stay on through outages.
- Other important customer programs that support both resilience and load management like smart panel upgrades; vehicle to home (V2H), vehicle to grid (V2G), and vehicle to everything (V2X) that provide backup capacity in addition to valuable time-shifting load management; and storage-paired solar that can help customers through longer outages.

We need the ability now to scale up significantly and flexibly deploy solutions that work for all customers—using grid hardening and undergrounding where possible in commercial areas, suburban areas, and main-line feeders, while we support customers in the most rural areas by supplementing these line hardening projects with customer storage and other innovative tools. We know more innovations are coming, and we will continue to lead in bringing these to customers to achieve zero outages by 2030.

Q6. How does this work advance equity for all GMP customers?

A6. Equity is at the center in of providing zero outages service to all customers. There is a very important geographic and financial equity component that is supported by the work this filing describes. As Mr. Burke also notes, all customers expect reliable, resilient electric service, regardless of income or location. This is more important now than ever before as customers use technology in their home for work, education, healthcare and more, and as transportation and heating increasingly use electricity to power a clean, sustainable future. It is our responsibility to provide continuously reliable service to all our customers, regardless of location on the electric system.

Storage programs have, up to now, primarily been voluntary offerings paid for by customers. Voluntary offerings are valuable in that they empower customers as early adopters of technology that enables more grid transformation to benefit all, while responding to the growing need for reliability and resiliency. While we have worked to keep the costs of these programs low through lease payments and incentives that share value created with customers and have also piloted programs to provide free storage in some circumstances, there have been meaningful barriers to participating for many

vulnerable customers. With this technology now tested and proven, we must distribute it more widely and with equity squarely in mind.

Q7. Describe the resources GMP seeks in this filing now to further accelerate storage solutions for customers, and what you expect will be needed in the years ahead to implement storage as a part of GMP's Zero Outages Initiative?

A7. Storage is a proven solution that delivers multiple benefits to customers and the entire grid, and it complements grid hardening work as a part of our initiative to deliver zero outage service to customers by 2030. As discussed in Mr. Burke's testimony, the Zero Outages Initiative requires us to accelerate T&D and storage resiliency approaches together. As part of this strategic effort to accelerate our Zero Outages Initiative, we are seeking approval to invest up to $30M (approximately $15M per year), over and above currently expected investment levels in additional storage solutions over the final two years of MYRP, FY25 and FY26. This request is an "up to" amount predicated upon the scaling up that will happen to accomplish this work along with the T&D projects as described by Mr. Burke that we expect to be underway in those two years. As we always do, we will adapt as we go based on actual experience and project planning, and if we find we can deploy more systems for customers over this time we would return to the Commission. We will invest these resources for customers to continue to build out storage through the ESS & BYOD programs, which remain popular, along with the types of additional Zero Outage storage projects described in my testimony below, which would be subject to PUC review and regulatory approval as appropriate.

Importantly, we will only include in any annual rate request the level of investment that we have actually deployed. Our current MYRP supports about $7M annually in storage investments, targeted at the ESS program primarily. With customer sign ups no longer restricted in that program and with federal grant storage programs, Resiliency Zones, and targeted rural customer storage resilience work, a much greater level of investment in the next two fiscal years is needed. As discussed further in Ms. Doane's testimony, Zero Outages Initiative capital investments will only be incorporated into rates after base investments have been used and projects are successfully completed and producing benefits for customers. The request in this filing is for an additional investment *up to* $30M over two years also because we will continue to monitor and pursue grants and other partnerships to leverage all available resources and lower overall costs for customers.

Meanwhile, in the years ahead after the MYRP, in FY27 through FY30, we know additional deep investments in storage will benefit all customers and be needed to deliver zero outages service for all and adapt to the changing environment of the electric grid. We will be scoping what is possible as we roll out this initial phase of the Zero Outages Initiative and will continue exploring innovative approaches to bring storage technology to all customers. We see a future where all customers will benefit from storage provided in a variety of ways: directly through whole-home backup; in smaller, more targeted storage systems that service specific critical loads or are a part of a home metering system; through vehicles connected to their homes or the grid; and through community

microgrid solutions. We are asking to accelerate this work now using the proven solutions already available.

II. GMP's Customer and Community Programs for Resiliency

Q8. Why does GMP deploy customer and community resiliency programs in addition to T&D upgrades described generally by Mr. Burke?

A8. Storage is flexible, responsive, and there when customers need it. We know that a combination of T&D upgrades as detailed in Mr. Burke's testimony, combined with storage solutions are the way to enhance reliability, increase resilience against climate change and other grid threats, and provide grid management while cutting carbon and costs for all. Customer and community-focused storage solutions are delivering results for customers right now, providing multiple benefits and saving money. That is why these proven solutions are paired with T&D upgrades in our Zero Outages Initiative for customers.

A comprehensive approach is needed for customers to experience zero outages, as with grid hardening alone there still could be impacts not only from very significant, unpredictable weather events but also from potential regional grid events, whether a physical or cyber interruption to service. Customer and community storage can ensure customers do not experience outages and remain connected in these events. And in the many rural places we serve, it may be best to deploy customer-level systems right to individual customers as the first resilience solution to keep them powered up, so that they experience uninterrupted service just like customers in more urban areas have now.

In addition, while the Zero Outages Initiative has a primary focus on reliability and resilience in the face of extreme events, all of these solutions ultimately feed into our broader distributed energy resource platforms providing a host of additional benefits day in and day out. This can include managing peak energy demands, increasing renewable generation hosting capacity as well as supporting the intermittency of these renewables, providing the regional grid operator with various services that lower costs for all customers, and much more. It is the flexibility of these resources that allows them to meet the needs of a changing grid all while providing crucial resilience for customers facing the challenges of a changing climate.

The National Renewable Energy Laboratory (NREL) has published helpful tables that highlight these layered, flexible benefits provided by storage, in both cost reduction and potential shared value.[1] As these show, storage enables a host of possibilities for customers and communities, while also helping utilities manage the local grid to lower costs for all customers and contributing to the strength of the larger regional grid.[2] It is the ultimate multi-tool, and with advancements in technology and duration in the years ahead its value to customers and the greater grid will only grow. We are often asked the question, will the grid handle the transition to a much more electrified future? GMP continues to answer that question with a resounding yes, both due to the fact that we are leading in the ability to manage flexible electric resources and because we continue to

[1] See https://www.nrel.gov/state-local-tribal/blog/posts/batteries-101-series-use-cases-and-value-streams-for-energy-storage.html,

[2] We are also proud to note that we have found ways to use residential storage for Frequency Regulation service, the first aggregated customer use in that program for ISO-NE, and for voltage support, two use cases that are not reflected in the NREL charts.

deploy battery storage systems. With the heavily distributed storage network, working integrally with the distributed loads and generation we can manage the grid in an entirely new way, making it flexible, bi-directional, and a cost-saving lever for all customers.

Q9. Please explain the scope of GMP programs that you are using now to increase resilience for customers and communities.

A9. Two prominent examples of this work are our residential energy storage programs and our first-of-its-kind microgrid technology, which enables renewable generation paired with battery storage to power an isolated portion of a circuit in the event of system outages or emergencies.

Residential energy storage complements larger distribution scale storage. We successfully piloted this concept several years ago and now offer a customer lease program through the ESS tariff and a customer-owned BYOD tariff for residential batteries. The ESS program, which provides home batteries for a customer lease payment of $55/month, is very popular and has consistently had a long waiting list. Following the Commission's recent approval to lift the annual cap on this program, all the customers that are interested in participating are now able to sign up to receive this system. We are excited to bring this resiliency solution to more customers and also immediately after announcing the lift, heard from multiple customers with health conditions who were excited to have backup for their medical equipment.

As described more below, microgrids and other solutions are being deployed under GMP's Resiliency Zone ("RZ") program, developed under the 2021 Climate Plan to provide targeted solutions to resiliency-challenged communities. We have an

operational microgrid in Panton and RZ projects incorporating microgrids are in various stages of development in towns selected through a data-driven screening process throughout Vermont. We are also in the midst of rolling out an RZ in Grafton that uses dispersed residential batteries provided directly by GMP rather than a centralized microgrid to provide resilient power within a very rural part of the electric system.

The recent launch of the O'Brien Farms 'Hillside East' all-electric neighborhood brings much of our innovative work together in a ground-up design of what will be a resilient, fossil-fuel free community of 155 homes. That project will incorporate a storage-supported microgrid, a resiliency package of home storage paired with rooftop solar, efficient electric heating, and smart electric panel control and vehicle charging, and will serve as a replicable model for resilient neighborhoods throughout Vermont.

In addition, we are working on several innovative projects that will further connect distributed resources on the grid or bring new energy resources online—such as V2H, V2G, and V2X charging from EVs—and help decarbonize and strengthen the reliability of the grid and increase resilience during emergencies. Looking ahead, customers will be able to think of their electric vehicles as another battery that can power up homes when needed, providing resiliency.

Q10. How do you see these types of programs evolving over the next several years to support zero outages for customers?

A10. The proven tools we are deploying in these programs will continue to be expanded upon, as we are continuously evaluating evolving technology. As noted, V2X is one ongoing focus we are excited about that will expand with the adoption of EVs. The potential of

V2X to both augment home resilience and backup while also contributing to the fleet of battery storage for grid management makes it a critical solution within the Zero Outages Initiative in the years ahead. Likewise, storage in all forms will be needed to continue to support the growth of renewable generation and we are developing and exploring new use cases for utility scale storage to accompany residential storage. For example, our North Troy battery project, developed in part with a DOE grant, is testing a new use case for utility-scale batteries to help optimization of the transmission system and help increase utilization of renewable generation.

We have also started using several new portable battery options to support customers, from large Nomad Transportable Power Systems (NOMAD) systems capable of backing up entire circuits if needed, to small batteries that can bridge critical loads for customers in need during outages caused by severe storms. In the most recent severe storms in September, we delivered a few of these small systems to customers with oxygen machines and similar medical equipment to provide invaluable peace of mind that these critical devices would keep running as we worked to restore damage.

As I describe below, we seek to ramp up our storage programs in Fiscal Years 25 and 26 in support of our Zero Outages Initiative through additional investment of up to $30M, and thereafter continue to provide the latest storage innovations to support all our customers so that they do not experience outages by 2030.

Q11. Can you explain in greater detail what benefits V2X provides and how GMP plans to incorporate V2X charging?

A11. V2X is an important opportunity to access the large capacity for energy storage in EVs. There are currently about 10,000 EVs in the state, about 7,000 of which are GMP customers. That is already three times the current number of in-home storage installations and is many times greater in the capacity it could provide. This will grow significantly under any forecast of transportation electrification. Tapping into the significant storage and controllable load value of this EV fleet will be an important companion solution to bringing storage into customer homes. By way of comparison, two Powerwall batteries in a home will provide about 27 kWh of energy storage backup and the average electric vehicle can have between 85 and 120 kWh of stored energy. For some customers, having an EV in their garage is like having 10 Powerwall batteries to tap into.

V2X works through bi-directional charging where EV batteries supply power to an external load. When that load is a customer home (V2H), the EV provides resilience similar to a stationary battery and could also serve as a form of demand response, adding more flexibility to the load management value EV charging already provides. Also, as with stationary batteries, EV storage can supply power to the larger grid (V2G), amplifying our Virtual Power Plant and fleet of battery resources for peaking, outage resilience, and potentially energy supply savings. By compensating EV owners for this partnership and providing these grid services, the cost of EV charging is reduced while also saving money for all GMP customers—further promoting the electrification of transportation to reduce carbon emissions and increasing off-peak load that helps lower costs for customers.

GMP has been testing several V2X applications to ensure we are ready to deploy this technology as it becomes available. We have tested V2G with Fermata and Wallbox at our Colchester office and are currently working with partners on the South Burlington School District's clean school buses program to provide stored energy back from these customer-owned buses to the grid when they are not en route. All this work complements the ramping up of existing programs we know work now, while getting ready for the next phase of innovations.

Q12. What projects or grants are in process right now involving storage that will help accelerate this work?

A12. GMP is actively pursuing several grants to help accelerate the delivery of resilience through storage and grid management for customers. GMP, in partnership with the Town of Bethel, submitted an application to the Grid Resilience and Innovation Partnership's (GRIP) Grid Resilience Utility and Industry Grant program under the Department of Energy's (DOE) Grid Deployment Office for a resiliency project on the Bethel BE-G28 circuit. We received a letter of encouragement to submit this application after providing a concept paper to develop a Bethel Resiliency Zone and zero outage circuit, which partitions the BE-G28 circuit into four zones, each tailored with a custom set of resiliency solutions to keep customers powered up. If granted, GMP will have a 50% cost share for the $20M project over an anticipated timeline of five years. As can be seen in Mr. Burke's testimony, this zoned zero-outage circuit approach is the model for how we plan to roll out the Zero Outages Initiative throughout our territory.

The Department of Public Service (DPS)—in partnership with GMP, several other distribution utilities, and VELCO—applied for a different tranche of available GRIP Grid Innovation Program awards to support a coordinated transmission and distribution storage project to bring over 75MW of multiscale energy storage systems to Vermont, with a focus on deployment in disadvantaged communities. The primary goal of the project is to build a coordinated framework for managing an increasing volume of bi-directional energy on the grid to support Vermont's energy goals and to maintain grid functionality. The requested award is for approximately $214M. If granted, this award will help GMP deploy over 40MW of residential, commercial, and utility scale energy storage across our service territory. GMP's share of the overall program would be approximately $116M and require a 50% cost share, resulting in approximately $58M of capital spending over multiple years.

NOMAD, in partnership with GMP, applied for and received a $9.5 million Long Duration Energy Storage Demonstrations award through the DOE's Office of Clean Energy Demonstrations (OCED). This award will fund the installation of NOMAD mobile energy storage systems that will each be able to provide full output power over 10 hours. GMP will work with NOMAD to identify five sites for the batteries across our service territory, which will include disadvantaged communities and those that experience frequent outages. These installations will also support the development of microgrids with islanding capability to provide backup power to clusters of customers. One important note is that GMP has already had experience utilizing a NOMAD to backup customers during planned outages, in one case backing up an entire circuit in the

town of Proctor, and in another preventing a large commercial customer from experiencing an outage due to needed work on the grid, keeping their business powered up during that time. From this work, we have learned how we can more quickly set up this interconnection, including the development of an interconnection trailer that will accompany the NOMAD making setup time much quicker. This experience is being carried forward into this grant and we will be able to use funding to support these interconnection systems as well.

GMP also submitted a pre-application to OCED's Energy Improvements in Rural Areas program in partnership with the Town of Guilford for a Resiliency Zone microgrid project to provide greater reliability for the Guilford Central School, Town Clerk's Office, Town Garage, and nearby customers, with an ultimate goal of establishing the Guilford Central School as an emergency shelter. While this project was not selected by OCED to move forward to the full application phase, GMP will continue to work with the Town of Guilford to develop a Resiliency Zone that will serve the needs of their community and look for other funding opportunities that fit this exciting project.

GMP was recently awarded a $1.5 million grant from the State's Energy Storage Access Program to provide energy storage to income-qualified Vermonters in single and multiunit housing, with a focus on those that have medical equipment that need power or who live in areas with greater outage frequency.

In July 2023, DOE announced that the DPS will receive $6M in funding through the Grid Resilience State and Tribal Formula Grants. GMP looks forward to the Department's announcement of how the award will be dispersed across the state and will

seek to utilize this funding to support resiliency projects in specific communities for customers.

The DPS is also coordinating a significant application for the Environmental Protection Agency's Solar for All program, which is designed to use federal funds to make access to solar easier for income qualified customers. The DPS is soliciting feedback from GMP, other utilities, and many other stakeholders, and the design it plans to submit is expected to include a storage component to keep residential customers powered up.

As the challenges of climate change continue to impact communities all over the country, we anticipate more funding opportunities like these will become available. We are following these developments and applying for funding or partnering on programs that align with our goals for our customers. We will be ready to support deployment through matches as required, knowing that these strategic opportunities are critical to lowering the costs for this infrastructure for all customers, and seek to use the funding sought in this filing to make that happen.

III. Microgrids and Community-Scale Storage for Resilience

Q13. Explain the work GMP has done on microgrids and how further microgrid deployment will support the Zero Outages Initiative.

A13. GMP's first microgrid with full islanding capability of a portion of a distribution circuit came online in Panton in 2022. The Panton microgrid pairs a 1 MW/4MWh battery with a 4.99 MW solar generation facility to power the island that includes critical town facilities and residences. This was in addition to our Stafford Hill project which has the

ability to island a single commercial customer, the Stafford Technical High School. The significant difference being that when you island a broader portion of the distribution system, the engineering for the protection to ensure a safe, stable, and reliable island becomes significantly more complex. Both projects have been successful in their ability to island the intended facilities.

Using the knowledge we gained through this project, we have continued to develop the concept of Resiliency Zones, many of which will utilize microgrids powered by renewables paired with storage as an alternative or a complement to traditional hardening techniques to address unique resiliency challenges presented by Vermont's changing weather and rugged topography. Our Resiliency Zone initiative is a way to think more holistically about resiliency from the community perspective, including both smaller-scale targeted solutions to ensure first responders, communication infrastructure, and other community emergency resources remain powered up during emergency conditions, as well as larger-scaled community microgrids. The first round of planned Resiliency Zones has been designed and developed, and we are starting to deploy them. These are truly done in partnership with the identified community to assure that we are delivering solutions that meet their desired resiliency needs and ensure the overall resiliency of their community.

Our Zero Outages Initiative will continue to expand these Resiliency Zones, recognizing that reliable service is a critical element in community resilience, equity, and safety across the state. As we continue the transition to a clean electric future for our heating and transportation, and as more home healthcare services and technology become

available, it only increases the importance of providing this service. Our Zero Outages Initiative brings this same level of resiliency to customers across our entire territory, regardless of location. This is the heart of equity, and it is the level of electric service required in the face of the ever-increasing impacts from climate change as described in Mr. Burke's testimony. The status quo where rural areas have infrastructure more often hit with damaging storms than elsewhere will no longer work. Customers that live rurally, by choice or by circumstance, are as deserving of resiliency as those that live in our urban centers.

Microgrids are an important part of achieving zero outages, even as the grid around them becomes storm hardened. Microgrids will be deployed strategically to target specific resilience challenges where traditional T&D infrastructure hardening alone is unlikely to reach the level needed. For example, on some circuits, key infrastructure such as emergency shelters, community centers or locations that can provide essential goods to customers may be far enough outside of the mainline locations that they will not be fully covered by the work in our Zone 1 or Zone 2 of the zero outage zone. In this case, the added resiliency of a microgrid would provide the necessary backup to keep them up and running during a system event. As we move forward, we will prioritize the most impacted areas first. Deploying microgrids will allow us to target some of these areas independent of the surrounding transmission and distribution infrastructure, while we continue our storm hardening in other areas that maximize the benefits from those improvements. And when these systems are not providing emergency backup, like all storage, they can provide a host of grid services.

Q14. GMP's Climate Plan and IRP contemplate specific Resiliency Zone identification criteria. How were those criteria developed and how have they been used?

A14. The criteria for selecting Resiliency Zone candidates were developed under GMP's Climate Plan in collaboration with the Department of Public Service. The criteria were chosen to allow for a data-driven selection process that took a broader view of resiliency beyond the provision of reliable electric service to identify where resiliency solutions were most needed. These criteria will be reevaluated, and the screening results updated during GMP's periodic IRP review upcoming in 2024 and beyond. It is also our understanding that the state, at the recommendation of the Climate Council, is currently working on a Municipal Vulnerability Index which may provide additional inputs into this process.

Under the RZ screening criteria, communities are evaluated for electric reliability, social vulnerability, and communications connectivity, with several variables under each criteria informing a ranking scale. This approach is centered on a commitment to equity for rural Vermont and all GMPs customers. For detailed methodology behind each of these variables, please see **Exhibit GMP-JC-1**, which also provides the results of the initial screening by reference to the top fifteen Vermont towns. We have work already planned or underway in six of these fifteen towns. This builds on the electric reliability reporting that GMP and all distribution utilities have been providing under Rule 4.900 for many years, by adding layers of data to go a few steps further, overlap key needs of a community, and determine where the greatest vulnerabilities to energy and communications capability exist.

Q15. Give some detail on the RZs that GMP currently has underway to address the identified community needs.

A15. Following on the successes of our partnership on the microgrid in Panton, six projects are currently being developed as planned in GMP's Integrated Resource Plan and guided by the RZ screening process. These project locations—which are generally in the most impacted outage areas of the state—are described below:

- Brattleboro: The Brattleboro Resiliency Zone addresses the resiliency needs of Tri-Park Housing Corporation's Mountain Home Park, where an approximate 1MW/4MWh energy storage system with islanding capability will be installed to support the Mountain Home Park community during severe weather and outage events.
- Grafton: The Grafton Resiliency Zone is a targeted approach to install residential battery storage for customers that experience the greatest reliability challenges in Grafton. Residential storage is the preferred resiliency solution due to this section of the circuit being heavily forested and its inability to host a renewable generation and energy storage microgrid. This circuit is an example of a rural, forested area, with low customer density on individual lines, and is well suited for an alternative residential storage solution. This community is a further example of the connection between communications and reliable electric service. Due to the nature of their communications infrastructure, which is mostly fiber to the home, when storms cause damage, residents lose phone connectivity due to the fiber modems requiring power. Some of these modems have a few hours of battery backup but that is not enough to

cover significant events. Furthermore, there is poor or no cellular connectivity for a lot of the area. Storage installations are underway for the 62 customers that experienced more than 20 outages between 2018-2020.

- Rochester: The Rochester Resiliency Zone incorporates renewable generation and energy storage facilities with microgrid capability to island downtown Rochester along Route 100. The island will contain critical infrastructure including the town water pumps and the emergency shelter at the Rochester Elementary School. Permitting for the generation and storage components of the project is currently being reviewed under Section 248 (Case No. 23-1639-PET).
- Guilford: GMP is engaged with the Town of Guilford to develop a Resiliency Zone to provide greater reliability for the Guilford Central School, Town Clerk's Office, Town Garage, and nearby customers. This project is currently in the discovery phase to determine the best resiliency solution to meet the needs of these customers.
- Rockingham: GMP is engaging with the Town of Rockingham to identify resiliency solutions for critical town infrastructure in the Bellows Falls area.
- Bethel: GMP has engaged with the Town of Bethel to develop a zero-outage circuit that expands upon the Resiliency Zone concept to bring increased resiliency throughout the town rather than single solution that may serve central critical town infrastructure on part of a circuit or a group of dispersed customers in a town. As previously described, this project partitions the BE-G28 circuit into four zones as shown in **Exhibit GMP-MB-9**, each with a tailored set of resiliency solutions to keep customers powered up.

All these projects show the type of individual community approaches that can aid resilience for customers throughout our territory, including in the most rural areas. The Bethel project in particular provides a complete example of how Zero Outages Initiative planning and implementation will occur across other circuits and demonstrates how we can bring all of the zero outage tools to bear—distribution undergrounding and storm hardening, microgrids, and storage—to solve the various resilience challenges and achieve a larger zero outage grid efficiently and effectively for the community. Continuing this planned work under the MYRP, we aim to begin three Resiliency Zone projects per year using these selection criteria and have established a collaboration with Windham Regional Commission to help with preliminary planning for Resiliency Zones in Windham County, where many of the top towns are located but may lack municipal resources to support and engage in a project. We will continue to work with other community partners who are interested in microgrid projects and also seek grants or other funding sources to continue this work.

IV. Expanding Customer Storage Solutions to Support Zero Outages Initiative

Q16. Can you provide more detail on the roles customer storage fill in GMP's distribution system currently and how it will support the distribution system and greater grid in the future?

A16. Battery storage is a proven and incredibly flexible distributed energy resource, providing our customers with a host of benefits. First, and as it relates to this filing, batteries provide backup power during an outage. When the batteries are not providing emergency

backup power—which will be the majority of the time—they are available to provide many other benefits. To name a few:

- Peak Demand Reduction – both local and regional—During times of high demand on the grid, GMP can leverage these energy storage systems to reduce peak demand charges and to avoid having to purchase more costly and dirtier power. These systems will reduce the demand of each home in which they are installed, and any excess energy stored in the batteries that is not needed by the individual home can further reduce overall demand during these periods.
- Voltage Regulation/Reactive Power – Energy storage systems are capable of maintaining and supplying proper voltage to the system so that the distribution network can function properly for GMP customers. With more storage systems installed and available for voltage regulation, other necessary dedicated infrastructure such as switched and fixed capacitor banks and voltage regulators may be avoided or eliminated in some circumstances, reducing expenditures.
- Power Factor Correction – The inverter equipment associated with the battery storage can provide reactive power and control power factor if needed. In some instances, such as commercial customer applications, this can be a very beneficial resource helping these customers reduce costs due to exceeding thresholds on power factor requirements.
- Frequency Regulation – GMP is currently using a subset of our customer storage to participate in the ISO-NE Frequency Regulation Market to help maintain the frequency level of the grid within operational requirements generating revenues for

all customers. An aggregated group of energy storage can be used in place of other generators, including traditional fossil-fueled plants.

- Energy Time Shifting – Real time energy pricing fluctuates with time. Energy storage can take advantage of these changing prices by discharging during periods of high pricing or charging when prices are low or even negative in some cases. The result is a financial saving for all GMP customers.

Finally, as we continue decarbonization through electrification, the need for storage as a flexible, time-shifting energy resources become increasingly important to meet load with renewable resources at the least cost for customers. As has been explored and proven in other proceedings, all these grid services provide financial benefits that accrue to keep power costs lower for all GMP customers and help offset over time the investment of installing the storage solution.

Q17. How does customer storage support GMP's Zero Outages Initiative?

A17. As Mr. Burke notes, as we analyze our distribution circuits and look at the best resiliency measures for each zone in our system, there will be a portion of customers where individual storage is the optimal solution to achieve zero outages. This typically will be in the part of the circuit we are calling Zone 4, focused on the rural, remote ends of the circuit. These are portions of the circuit where the customer per mile count is very low and burying or hardening every last mile of distribution feeder may not be the right approach, particularly when the layered benefits of storage are considered. We will look at this comparison when reviewing storage as the preferred solution for customers in these areas of our system.

Q18. Describe in more detail those layered benefits from customer storage that can make it an advantage in GMP's Zero Outages Initiative.

A18. The overall multiple benefits of storage to the local and regional grid and to customers directly are described above and depicted in the NREL material. When these systems are widely deployed at the individual customer level, it is also important to recognize that customer-sited storage supports not only customer resilience and lower fossil fuel use but also safe, efficient restoration by GMP crews during storm response. Storm hardening on the distribution system directly reduces or prevents outages across the grid as a first line of defense, by allowing lines to remain powered despite tree contacts or underground out of the way of storm impacts. Some storm clean-up and restoration activities will need to occur on these hardened lines, but in instances where the line is powered up and no safety risks are present, these activities can be re-prioritized to focus crews where they are needed most.

Even if there are outages on the distribution system, protection devices help limit their extent while residential storage and microgrids ensure that the customers who live in the areas most likely to experience faults on the grid remained powered up and outage free. In a similar way to hardened tree wire, the storage associated with these resources allows crews time to safely complete clearing and restoration while the customer on the end of the effected line still has power.

Looking ahead, in addition to the advances that inevitably will bring benefits from V2X storage solutions, I envision stationary batteries at customer sites playing a wider and more flexible role than just whole-home backup. For example, as the technology

continues to develop, smaller, more targeted load storage (mimicking those smaller devices we are starting to deploy to customers in need during a storm) may back up critical devices and storage also could become an integrated, widespread replacement for the utility meter, offered as a standard part of electric service. These advancements will be key to widely providing the benefits of storage to all customers, meeting the challenge of climate change by thinking differently about keeping customers connected.

Q19. How does GMP plan to deploy customer storage in these Zone 4 locations and what is the scale of this work?

A19. Our deployment of customer storage in Zone 4 locations will be different from, and complementary to, our existing voluntary leased or owned storage programs. Until now, in-home storage programs have been driven by customers' interest and ability to participate, with the participating customer either paying a monthly lease payment or enrolling their own device in our load control platform for an incentive to lower the cost of obtaining the electric backup power. These programs are now proven to have delivered positive benefits for all customers.

All of this work has highlighted just how important these resources are, not just for individual customer resilience, but for the broader grid—including for customers who have not self-selected to host storage or have been unable to self-select because of cost. Our approach to storage moving forward will focus on expanding this benefit equitably to other customers as a utility service, much like the Grafton pilot currently underway. We will focus initially on those areas—like Zone 4—where they can provide better overall benefits compared to other possible grid hardening options. Storage should be a service

that GMP provides to these customers to ensure no outages in an equitable manner, just as undergrounding, and hardened grid infrastructure in our more urban areas provides. This is a critical and natural next step in the evolution of storage solutions – one which recognizes their value as a broader utility resource and deploys them strategically as another utility tool to provide customers cost-effective service across our entire system, as a complement to voluntary storage programs other customers may choose.

The customer storage systems in the Zero Outages Initiative will be targeted specifically at locations of the distribution system where we find that it represents the optimal solution to zero outages for customers compared to other means. We will expect to broaden this type of storage deployment through additional resiliency pilots like the Grafton RZ—partnering with customers to offer an installed residential battery owned and operated by GMP as a grid asset with no lease payments and moving to a tariffed offering once we have reached scale. In this way, the battery program within the Zero Outages Initiative will be an important complement to, and extension of, our ESS and BYOD program, making the type of service both more equitable and accessible by reducing any barrier to participation, while also targeting and deploying batteries in specific areas where they can provide the greatest benefit and a zero-outage experience for our customers.

The scale of this work will increase in the years ahead. The additional investment we seek now will, for comparison purposes, allow us to make commitments to vendors and installers to triple the level of installations we had expected in setting the MYRP amounts for our ESS and BYOD program that was based upon about 400 installations a

year. This presents a tremendous workforce driver for Vermont and a sustained opportunity for clean energy jobs. Even after taking the systems needed to clear the substantial wait list into account, this level of investment will allow us to develop additional community pilots now to deploy systems directly to customers at no additional cost to them in vulnerable rural areas – some of which are included in the federal government's Justice 40 initiative[3]—while learning how quickly we can provide these systems to more customers with similar needs throughout our territory. Meanwhile, we will continue to operate the voluntary ESS and BYOD programs in parallel with storage deployed as a part of the Zero Outages Initiative so that in the years ahead all customers will have access to storage.

Q20. How are you taking into account the costs and benefits of deploying customer storage directly in support of zero outages without a customer lease payment?

A20. Residential batteries installed as part of our Zero Outages Initiative will be prioritized to provide emergency backup power to the host customer and secondarily will provide additional benefits described above. Under current tax guidance, these systems are eligible for the Investment Tax Credit ("ITC") provided under the Inflation Reduction Act of 2022. The overall investment to install a battery would also mirror an ESS installation, except that there is no customer lease contribution. Unlike the ESS or BYOD programs, however, which are customer driven and designed to have net positive rate

[3] The Justice 40 Initiative is the federal government's framework to deliver at least 40% of the benefits of certain programs to disadvantaged communities. See https://www.energy.gov/em/justice40-initiative#:~:text=The%20Justice40%20Initiative%20is%20a,federal%20investments%20to%20disadvantaged%20communities.

impacts, Zero Outages storage installations would be deployed in areas that would otherwise require more expensive storm-hardening work to achieve zero outage resiliency, and therefore prioritize reliability benefits. When compared to the avoided investment expense of the alternative, this approach will save all customers money, while continuing to generate similar benefits as our other battery programs.

Q21. Why is it critical to advance the deployment of storage now, using current technology, rather than waiting for product advances in the years ahead?

A21. Unfortunately, due to climate change driven weather events, we have run out of time and our customers need the solutions now. The question of timing and waiting is often asked when deploying new innovative solutions, however, thanks to the work GMP has done, we are well beyond the testing stage of deploying storage and with proven results, we now need to move much more quickly. We have successfully deployed a number of utility scale projects that are delivering benefits for customers, and our customer storage systems have been proven through several pilots and are now more widely available through voluntary tariffs.

The technologically advanced world we live in means that customers rely even more heavily on electric service for their lives and livelihood. Electrification of transportation and heating will also continue to accelerate, helping drive down carbon usage. With this increased electrification comes the need for increased grid flexibility to assure that significant system upgrades are not needed while we make this transition. We have proven that we can avoid upgrades in some cases, thanks to our flexible load programs and the deployment of energy storage. Most important is that we remain nimble

so as technology evolves, we can quickly adjust and assure the most appropriate solutions are making their way to customers. We know that over the course of the next few years there will continue to be advancements in the technology, and we will be ready to adapt.

The accelerated work for our Zero Outages Initiative supports not only reliability and resilience for our customers but also the more closely coordinated, two-way, clean, affordable grid that will deliver continuous service in the years ahead. In the near future, we want every single home to have access to storage, whether in the form of stationary storage in the home, or a large mobile battery system on wheels in their driveway that can keep their home powered up. All these systems will work in concert to manage a much more distributed energy system that manages many intermittent resources, along with intermittent electric loads to produce an always clean, incredibly efficient, resilient, and more affordable energy system that is always on for customers. That is what all our customers need, and we are committed to delivering for them.

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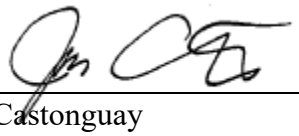
more affordable energy system that is always on for customers. That is what all our customers deserve, and we are committed to delivering for them.

Q22. Does this conclude your testimony at this time?

A22. Yes, it does.

I, Josh Castonguay, declare that the above statements provided in my testimony are true and accurate to the best of my knowledge and belief. I understand that if the above statement is false, I may be subject to sanctions by the Commission pursuant to 30 V.S.A. § 30.

Dated at Colchester, Vermont this 9th day of October 2023.



Josh Castonguay