STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Case No. 25-____-TF

Tariff filing of Green Mountain Power	)
Corporation requesting approval of a Zone 4	)
Energy Storage Tariff	)

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

April 15, 2025

Summary of Testimony

Mr. Castonguay's testimony details GMP's proposed Zone 4 Energy Storage Tariff, a key component of GMP's Zero Outage Initiative. Mr. Castonguay addresses the specific areas requested by the Commission in the October 18, 2024, Final Order in Case No. 23-3501-PET.

Exhibit List

Exhibit GMP-JC-1	Map of Initial Zone 4 Circuits
Exhibit GMP-JC-2	Zone 4 Energy Storage Customer Agreement
Exhibit GMP-JC-3	Financial Analysis
Exhibit GMP-JC-4	PUC Rule 2.401(c) Estimate of Revenues and Costs

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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 Officer, Generation & Power Supply.

Q2. Please describe your educational and business background.

A2. I have been employed by GMP since 2003, working in engineering until 2009, and then in various leadership positions, including the control center and the transmission and distribution ("T&D") line department, among other responsibilities. In 2017, I became Vice President, leading generation, engineering, and the team working on our innovative technology and service. I also oversee the power supply and customer care teams. 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 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), GMP's

petition to modify our 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 GMP's Zero Outages Initiative Petition (Case No. 23-3501-PET), and have participated in a number of other proceedings and workshops on topics related to energy storage, engineering, innovation, and distributed generation.

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

A4. The purpose of my testimony is to provide background on GMP's use of energy storage for customers and to describe our proposed Zone 4 Energy Storage Tariff (the "Storage Tariff"), including responding to the Commission's requests in the Zero Outages Initiative Order of October 18, 2024, in Case No. 23-3501-PET (the "Order"). I detail how GMP will deploy home energy storage systems under the Storage Tariff as a component of the Zero Outages Initiative ("ZOI") to customers in the most rural parts of our territory. I explain how these systems will not only deliver reliability to customers in rural parts of the state but will also be a critical component of the cost-effective management of an increasingly distributed grid. I further explain how the energy storage deployed under the Storage Tariff is designed to correspond with the distribution reliability projects authorized by the Order. The testimony also responds to the Commission's specific information requests in the Order on the proposed Storage Tariff.[1]

[1] Order at 28.

Here is how my testimony is organized:

Section I provides a background on energy storage and the various ways that it provides cost-effective local and grid level benefits. Section II summarizes the proposed Storage Tariff and outlines the implementation of the energy storage deployed under it. Section III specifically responds to each of the Commission's information requests in the Order.

Q5. What supporting information is GMP providing in this filing?

A5. We provide the proposed Storage Tariff, a map identifying the circuits that will be covered by the tariff, the proposed Customer Agreement, and a detailed cost-benefit analysis. Specifically, **Exhibit ("Exh.") GMP-JC-1** shows the location of the four initial circuits that will be covered by the Storage Tariff and **Exh. GMP-JC-2** is the Customer Agreement for participating customers in the Storage Tariff. **Exh. GMP-JC-3** is a detailed financial model showing the per-system and program-wide costs and benefits based on a range of expected outcomes and **Exh. GMP-JC-4** shows the forecasted benefits through an estimate of revenues and costs consistent with PUC Rule 2.401(C).

I. Background – Energy Storage as a Grid Asset

Q6. Please summarize how GMP utilizes energy storage and explain how storage is a grid asset.

A6. GMP is fast approaching a decade of experience deploying and managing energy storage systems.[2] The storage systems we use today are diverse. They range from large to small, from stationary to mobile, and together, they create a portfolio of energy storage deployments that address several grid-level and customer-level needs. Over the last ten years, our energy storage programs (for example, our Energy Storage System lease program ("ESS") and the Bring Your Own Device program ("BYOD")) have started as innovation pilots. This ensured we paced the programs appropriately and incorporated learnings and improvements to what are now tariffed flagship customer programs. Now, years later, storage is an integral part of creating a more resilient grid[3] and advancing broader state energy policy,[4] and we are well positioned to build upon GMP's nationally recognized experience launching and operating successful energy storage programs.

[2] *See generally* Case No. 23-3501-PET, Prefiled Direct Testimony of Josh Castonguay, filed Oct. 9, 2023, at 5-11, 23-32. GMP is amenable to re-filing in this proceeding all testimony, discovery and evidence regarding the Zone 4 storage program presented in that case in order to facilitate and streamline Department and Commission review here.

[3] *See* GMP's 2024 proposed Integrated Resource Plan ("IRP"), filed in Case No. 24-3614-PET, at 3-40 through 3-47.

[4] *See generally* DPS 2022 Vermont Comprehensive Energy Plan at 70 (describing "the 'Swiss army knife' nature of storage, which can help manage peaks, time-shift demand and supply, smooth renewables integration, provide frequency regulation and other grid support, and—if properly configured—provide resilience during grid outages.")

There are three broad categories of proven ways that GMP and our customers use energy storage today: (1) for continuous energy supply in the event of grid outages; (2) for grid support such as peak reduction, load management, frequency regulation, and voltage support; and (3) for cost optimization such as lowering power supply costs (and often the carbon that comes with it) and extending substation capacity and electrical equipment life. A further explanation of each is provided below.

(1) **Continuous Energy Supply**. Grid outages take place for various reasons. They can be *planned* (for example, to safely perform maintenance on equipment), *unplanned* (for example, during extreme weather that damages poles and lines), or *required* (for example, during regional load shedding events as we are seeing in other parts of the country). Energy storage provides a source of power supply to customers or the grid during any of these events. This stored energy can be electrically connected to critical loads in a home, like refrigerators, cooking equipment, medical equipment, lighting, and heating, or to an entire home's load, as we have seen with our ESS and BYOD programs, Resilient Neighborhood pilot in South Burlington, and our Resiliency Zone pilot in Grafton ("the Grafton Storage Pilot"). This allows a home to stay powered up through any kind of grid outage, whether planned, unplanned, or required.

Storage as a source of power supply during grid outages is not limited to residential use cases. For example, in the summer of 2023, during a planned grid outage for system maintenance, GMP's mobile energy storage enabled a Vermont manufacturer to continue operations. Our engineers and field team deployed our 2 MWh transportable battery to keep this important Vermont business connected. This mobile energy storage

can be used to support a local business like this one or in several other ways during any kind of grid outage, including to power a fire department during a storm, operate a ski lift, or keep hundreds of homes powered up. In August 2023, this mobile storage unit successfully supplied energy to approximately 205 homes in Proctor, VT avoiding a 7-hour outage for those customers while we safely performed planned maintenance at the Proctor substation. Additionally, we recently worked with an assisted living facility in Montpelier who was interested in learning about energy storage to supply them in the event of a grid outage. After reviewing their electrical needs and the parts of the grid serving them, we were able to electrically set them up to use our mobile energy storage. This assisted living facility can now be cleanly powered separate from the grid if necessary. Our engineers and field experts brought their grid and storage expertise to bear on this solution and the learnings from it served a critical, affirming role in how storage can leverage the grid while providing great customer outcomes. And just like our stationary storage, when these mobile storage systems are not providing this critical backup they will provide all the other grid benefits and cost reduction values.

Additionally, energy storage can prevent broader outages on the grid. Our Resilient Neighborhood in South Burlington, for example, can be used to provide grid stability or respond to a regional load shedding event if necessary. This same neighborhood can also be used in reverse to put stored energy onto the grid. The use of storage in this way extends to all our aggregated energy storage systems in homes across the state or to distribution circuits connected to microgrids like GMP's solar and storage facility in Panton.

As I will explain in more detail below, these examples show how technology and storage are enabling us to manage the distribution system in a much more efficient and value-added way than the grid of the past. The need for this level of management is increasingly important in the face of various changes at both the grid and local community level, including extreme weather events, cyber and physical threats to the grid, expanded flexible resources with a cleaner and more distributed, intermittent supply, increased use of electricity for critical services like communication, heating and transportation, and the impacts from the rural nature of our beautiful state with lengthening vegetation growing seasons. Energy storage is an important piece of the grid technology and management that we use to support these modern grid changes.

(2) **Grid Support**. What also makes energy storage so unique, as compared to a traditional backup generator for example, is that the energy storage system is a grid asset that can be deployed at critical times for grid stability and overall grid management. It improves grid power quality and flexibility, supports grid frequency and voltage regulation, and balances grid supply and demand across the entire system. As such, residential energy storage forms a critical part of our distribution system infrastructure. As of the date of this testimony, we have deployed over 40 MW of dispatchable residential storage located in homes across the state. Together with 26 MW of grid scale and mobile storage, we have a total of 66 MW of aggregated energy storage across

Vermont.[5] Here are some specific ways that storage plays a key role in supporting and managing today's grid:

- *Grid Peak Shaving*. This is one of the more well-known use cases for energy storage across the country. GMP's aggregated energy storage systems are discharged during key peak periods to lower our contribution to peak demand. The reduction of peak demand lowers power supply and other costs as we describe in more detail below. It also lowers carbon emissions by reducing reliance on carbon-intensive generating units often used during peak demand periods in Vermont and New England.
- *Grid Regulation Services*. The regional grid operates at a frequency of 60 hertz. ISO New England ("ISO-NE"), the region's independent system operator, needs generators across the region to participate in a market that can adjust the output of power resources moment to moment to keep this frequency and the system in balance. We were the first utility to perform this essential regional grid service with battery energy storage and we continue to grow it successfully today.
- *Grid Reactive Power and Voltage Support*. Reactive power and voltage support is critical for maintaining the stability and power quality of the grid. GMP's energy storage systems can provide or absorb reactive power depending on grid needs. Our storage inverters can deliver or absorb

[5] Together with electric vehicles and other flexible loads, GMP has approximately 48 MW of connected flexible resources.

reactive power by adjusting the phase angle between the voltage and current. By doing this, the system can support voltage regulation and maintain power quality on the grid. For example, energy storage can help stabilize the grid when a voltage drop or over-voltage condition exists.

- *Grid Substation Capacity*. Substation capacity is an important aspect of modern grid management and planning, both in terms of forward power flows and reverse power flows. Without this, increasing electrification and adding important renewable resources could choke existing transformer capacity causing unstable grid conditions or requiring expensive substation upgrades. This is another area where energy storage can assist grid planning and management in two core ways:

  ***Electrification*:** Energy storage can be *discharged* during peak demand hours, measured at the substation level, if forward power flows approach a substation transformer's nameplate capacity limits. As such, energy storage increases the headroom for additional electrification of end-uses like transportation and heating and extends the asset life of existing equipment such as large power transformers.

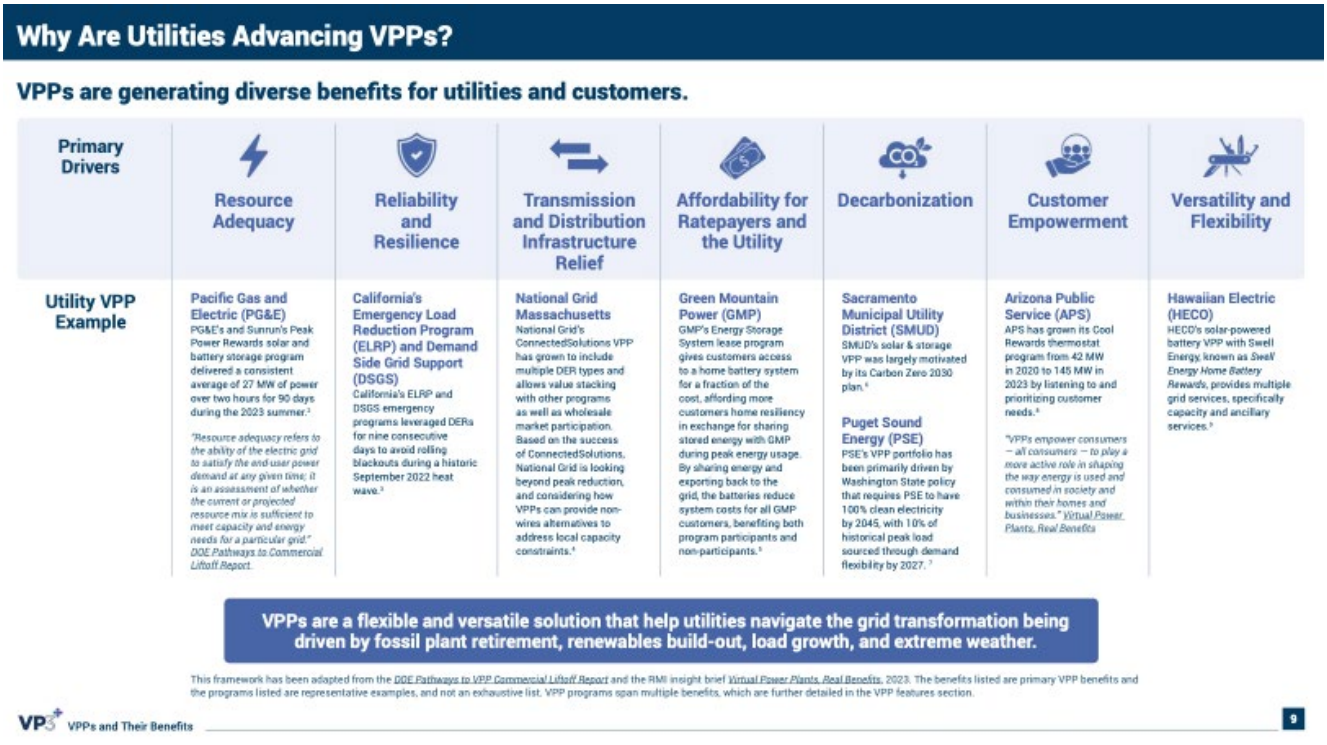
  Renewable and Distributed Generation: Energy storage can be *charged* during peak reverse-flow hours, when reverse power flows approach a substation transformer's nameplate capacity limits. As such, energy storage can increase the headroom for additional renewable and

distributed generation on a distribution circuit and can shift energy use to a time when it is needed such as evening hours or peak.

(3) **Cost Optimization**. Another unique and very important characteristic of energy storage is the ability to manage it to achieve cost reductions and optimize market opportunities of the overall grid. We have designed our energy storage programs to ensure all customers, participating or not, are able to realize energy storage program benefits. Here are some of the central ways that our management of energy storage does this:

- *Reducing Vermont's Peak Demand*. Peak reduction, as mentioned above, is one of the core reasons that Vermont has been a recognized leader, both in the region and the nation, for our distributed energy storage programs. We have been managing the grid's peak with distributed energy storage for many years to drive cost and carbon reductions. In 2024, GMP's energy storage programs were featured in Rocky Mountain Institute's ("RMI") Virtual Power Plant Flipbook (the "RMI Report"), stating at the outset that: "Fortunately, we don't need to start from scratch. There is a wealth of experience that utilities and industry partners can tap as they seek to develop or refine existing programs."[6] Below is a summary table pulled from the RMI Report highlighting various virtual power plant ("VPP") programs across the country in each primary driver category.

[6] RMI Report at 4, *available at:* https://rmi.org/wp-content/uploads/dlm_uploads/2024/07/VP3_flipbook_v1_3.pdf



All energy storage systems across our system are aggregated together and dispatched at certain times to reduce the overall system's peak demand. This significantly lowers power supply and regional grid costs by reducing Vermont's share of the regional system's peak demand. Our existing energy storage systems have resulted in capacity and power supply reductions of as much as $3 million in a year. RMI summarizes VPPs as follows: "…grid-integrated aggregations of distributed energy resources such as batteries…can help balance electric loads and provide several grid and community benefits, such as supplying critical grid services (including capacity, energy, ancillary services, and resilience), alleviating stressed

T&D systems, and integrating more renewables for a cleaner energy supply."[7]

- *Value in the Wholesale Markets.* Energy storage resources can participate in or receive value from the ISO-NE wholesale electricity markets. Examples of these markets currently are the Day-Ahead Market, Real-Time Market, the Regulation Market, the Day-Ahead Ancillary Services Initiative, Voltage Support Service, and the Forward Capacity Market. Energy storage like batteries can move continuously and nearly instantaneously between charging and discharging in a continuous range of generation and consumption. If wholesale market values shift or new markets are created, we can adjust our participation in the market that achieves the greatest value.
- *Value to the Transmission and Distribution System*. Energy storage leverages the traditional grid and can provide direct cost-saving benefits to the T&D system infrastructure. For example, energy storage can:
  (1) reduce the strain on transformers, substations, and distribution lines extending the asset lives of this critical equipment.
  (2) reduce energy losses in the distribution system.
  (3) reduce or eliminate the need for shunt capacitors and voltage regulators on a distribution circuit.

[7] RMI Report at 6.

(4) increase substation capacity avoiding substation upgrades.

(5) improve cost-effective integration of renewable energy and additional electrification.

(6) reduce or eliminate the need for peaking power plants which can be carbon-intensive, expensive to operate and used for only brief periods. Energy storage can be used instead, thereby reducing fuel costs, operating costs and capital investment of these often-aging traditional peaking units.

(7) reduce the frequency and duration of interruptions by providing another source of energy during grid outages.

(8) reduce the costs of restoring power during grid outages. In rural areas and those prone to grid outages, energy storage can allow us to optimize our field resources to restore the grid and can also minimize the need for local emergency response services. As outlined above, this is increasingly important to a modern grid and the customers we serve across the state.

(9) reduce the amount of regional transmission and generation capacity. This reduction could be substantial in the region. ISO-NE highlighted that a peak demand reduction of just 10% by 2050 would avoid $10

billion in otherwise necessary transmission investments.[8] Vermont Electric Power Company ("VELCO") recently released a 2024 Vermont Long-Range Transmission Plan (the "VELCO LRTP") The VELCO LRTP shows that approximately 80 MW of load reducers like storage in the northern and northwest areas of Vermont alone could defer or even eliminate the need for $381 million of transmission buildout.[9] At the whole system level, approximately 100 MW of storage in 2035 across the state, combined with EV charging management could eliminate the need for over $120 million of subtransmission upgrades[10] and $190 million of bulk transmission upgrades beyond the $381 million required in northwestern Vermont.[11]

(10) Reduce or defer the need for local transmission. Similar to the benefits that would reduce regional transmission, these systems can reduce the need for transmission upgrades. Our 2024 IRP identifies the potential need for transmission upgrades in the mid 2030's if we are

[8] ISO New England, 2050 Transmission Study Fact Sheet at 1 (February 14, 2024), *available at*: https://www.iso-ne.com/static-assets/documents/100008/2024_02_14_pac_2050_transmission_study_factsheet.pdf

[9] 2024 VELCO LRTP at 9, *available at*: https://www.velco.com/sites/default/files/2024-09/101252_Velco_CC24_singles.pdf

[10] GMP's 2024 Proposed IRP at 3-46.

[11] 2024 VELCO LRTP at 9.

unable to manage the loads – however with minimal peak management these upgrades can be deferred.[12]

In summary, energy storage, in addition to local customer benefits, is a crucial grid asset enhancing efficiency, reliability, flexibility, and cost optimization of the modern grid.

[12] 2024 Green Mountain Power Integrated Resource Plan, Appendix E, page 15

II. The Zone 4 Energy Storage Tariff

Q7. Please provide an overview of the Storage Tariff.

A7. The Storage Tariff is an important addition to the overall storage strategy we outlined above. This proposal comes after years of experience deploying energy storage under our other programs, and after years of unprecedented damaging storms disproportionately affecting central and southern Vermonters. This Storage Tariff seeks to deliver lasting and more cost-effective solutions for the entire grid by coupling distribution line upgrades and undergrounding with energy storage in our most rural communities.

Vermont is one of the most rural states in the country, with some of the highest percentages of forested land.[13] Much of this forested land is in our service territory in central and southern Vermont. As a result, our grid infrastructure serves a lower customer density that is geographically isolated and more susceptible to weather-related disruptions requiring more difficult, costly and time-consuming restoration efforts. Energy storage coupled with our reliability investments in these areas can directly impact the quality of life, economic viability, and emergency preparedness of these rural communities. The Storage Tariff is a missing piece of our energy storage strategy to address several grid-level and customer-level needs.

As noted in the Order, to appropriately target our ZOI planning, we separated each of our circuits into four broad zones of decreasing customer density.[14] "Zone 4" is

[13] United States Forest Service, Forest Inventory and Analysis Fiscal Year 2016 Business Report, pp. 71-72 Table B-11 (August 2017), available at

the most remote portion of GMP's circuits, consisting of single-phase lines feeding the fewest customers per mile. As described in our initial ZOI petition, residential storage is determined to be the least-cost alternative to provide resilient and reliable service in these Zone 4 areas.[15] For this initial deployment, eligibility under the Storage Tariff will be targeted to the Zone 4 areas of (1) the Brattleboro EJ-G7 circuit, (2) the Wilmington 56G1 circuit, (3) the Chester CH-G11 circuit, and (4) the Dummerston DM-G6 circuit. A typical energy storage installation under the Storage Tariff will consist of a whole-home connection with approximately 30 kWh of stored energy located inside or outside the eligible premises, all pursuant to the terms and conditions of the Customer Agreement. Customer participation in the Storage Tariff will be voluntary. As further described below, our outreach and customer service team will be devoted to ensuring eligible customers who wish to participate have all the information they need to understand the program both at the outset and throughout their entire participation.

The Storage Tariff seeks approval of up to $30 million of energy storage systems for these initial four circuits.[16] The Storage Tariff would be available until September 30, 2026.

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https://www.fs.usda.gov/sites/default/files/fs_media/fs_document/publication-15817-usda-forest-service-fia-annual-report-508.pdf. Vermont is the fourth most forested state by percent of land area.

[14] Order at 11-12.

[15] *See* Order at 11-12. Storage Tariff capital projects will follow GMP's established capital documentation standards under the approved ZOI accounting framework, including necessary financial analysis and consideration of alternatives.

[16] Storage Tariff capital investments will be treated in accordance with the approved ZOI accounting procedure. *See* Order at 14-15, 33 and Exhibit GMP-LD-1 (rev.) filed in Case No. 23-2501-PET.

Q8. Where and how will GMP implement the Zone 4 energy storage deployment under the Storage Tariff?

A8. As mentioned above, eligibility will be initially limited to the Zone 4 areas of the Brattleboro, Wilmington, Chester, and Dummerston circuits identified above. A map showing the location of these circuits is provided as **Exh. GMP-JC-1.** There are approximately 1,200 customers in Zone 4 on these four circuits, spanning approximately 34 rural towns. This highly targeted approach ensures we first do this work in areas currently experiencing significant outages from damaging storms while simultaneously providing the data and insight to inform ZOI and any further development in other parts of our service territory.[17] All customers located in Zone 4 on these four circuits will be eligible to participate in the Storage Tariff. We will focus communication and installation on these circuits for customers who rely on home medical devices (for example, customers on our critical care list) or participate in our Electric Assistance Program. Additionally, the initial four circuits overlap communities where more than 25% of the customers are at or below two times the federal poverty level.[18]

Q9. During implementation, how will GMP communicate with customers in Zone 4 locations?

[17] *See generally* Order at 23-24 (describing the benefits provided by deploying across the initial circuit list).

[18] *See generally* State Municipal Vulnerability Index website for data by towns. Available at: https://experience.arcgis.com/experience/fa443357641345efabd35e695947202b

A9. We intend to use various communication methods, along with high-touch community outreach, partnership with the towns, and local knowledge resources to ensure customers who are considering participation have the information and resources they need. This direct outreach will begin with GMP team members meeting with town leaders and emergency managers to discuss planning and communication, and to craft a customized approach based on the town's needs and customers. Over the last several years, we have worked closely with these local leaders and emergency resources during major weather events. To inform us of what an effort like this takes and to plan accordingly, we also tap greatly into the experience we gained in the ESS program, the BYOD program, the Energy Storage Access Program ("ESAP"), the Grafton Storage Pilot, and our day-to-day work with our rural Vermont customers. For example, in the Grafton Storage Pilot, 58 customers were eligible for energy storage in our Resiliency Zone and 42 customers signed up, or 72%. We were pleased with the adoption rate, and we learned it required a variety of outreach methods, including town meetings, phone calls, letters, and home visits. Direct information was important, and so too was neighbor-to-neighbor information sharing. After storm damage resulted in outages, we saw more adoption. Customers noticed their neighbors who had installed energy storage through our program stayed powered up during grid outages and then called to enroll. The geography of the area, the characteristics of the homes, and the makeup of the customers in Grafton demonstrated that successful deployment of these systems requires intensive, direct communication with customers in addition to collaboration with community leaders and trusted local contractors.

Additionally, for customers who desire internet resources, we will have dedicated online resources with robust information about ZOI and the Storage Tariff. Throughout the process, each eligible customer will be provided with a GMP team member's direct contact information, in addition to a dedicated internal customer care team.

Q10. How will the customer agreement be structured?

A10. The customer agreement is modeled on the Commission-approved ESAP agreement,[19] and is subject to GMP's standard general Terms and Conditions (incorporated into the customer agreement) like all GMP services that cover GMP equipment installed at customer locations. See **Exh. GMP-JC-2.** We learned in the Grafton Storage Pilot that customer understanding of the agreement is critical to their participation in the program. They want to understand what is expected of them, what is expected of us, and how the storage in their home will benefit the entire grid and their neighbors who may not have it. The Customer Agreement is designed to be simplified with easy-to-understand legal provisions, and we expect to walk through it with each participating customer, much like we do today, for example, when obtaining an easement for a right of way.

Q11. How will GMP track and evaluate outcomes under the Storage Tariff?

A11. GMP will adopt and begin reporting on the energy storage metrics adopted in the Order.[20] Combined with the T&D metrics, these will provide important insight to the

[19] *See* Case No. 24-0145-TF, Final Order Approving ESAP Tariff Rider, June 4, 2024.

[20] See Order at 27, requiring GMP to report based upon Attachment 1 to GMP's Brief.

performance and success of this initial Zone 4 solution and the efficiency, operations, reliability, and resiliency benefits of the full ZOI circuit improvements across all zones. These metrics are: tracking general progress (e.g. number & type of systems installed); assessing performance at providing grid services and creating value for all customers; measures of equitable deployment (e.g. MVI factors; number of Energy Assistance Program customers participating; and number of critical medical care customers participating); and assessing battery performance during outages (e.g. failure to start index). ZOI metrics will also capture overall circuit performance through a variety of reliability measures, and we will report how storage is aiding reliability in these areas.

III. Response to Commission Information Requests in the ZOI Final Order

Q12. What specific information did the Commission ask GMP to address in this tariff filing?

A12. The Commission's Order requested that GMP address the following:[21]

1. A cost-benefit analysis for the storage proposal. "In completing the cost-benefit analysis, GMP should factor the cost of replacing or removing the battery storage systems at the end of their useful life. GMP will also need to explain whether these customers will need to have new storage systems."

[21] *See* Order at 28-29.

2. Testimony or legal brief as to "whether and how providing the same residential storage systems to one class of customers at no cost but charging a different class of customers for the same service is consistent with 30 V.S.A. §§ 225 and 229."
3. A plan for prioritizing customers for selection under the tariff, including any equity-related or other screening mechanisms.
4. A list of equipment that will be provided under the program with an explanation for each alternative solution that was considered and rejected.
5. Additional information on customer lease agreements describing how GMP will have systems installed in rentals and mobile homes, and how transfers of ownership will occur.[22]

Information Request 1: Cost Benefit Analysis

Q13. Please summarize the cost-benefit analysis prepared for this tariff.

A13. The detailed cost-benefit analysis provided at **Exh. GMP-JC-3**, examines capital investment, operations, maintenance, and decommissioning costs. In summary, it demonstrates that the program will generate a net benefit for all GMP customers over the life of the system, taking into account a range of variables and assumptions. The modeling directly builds on GMP's long-standing residential storage cost-benefit analysis used to evaluate previous storage programs using results from the performance of those systems. That cost-benefit model has been updated in this filing as follows:

[22] *Id.*

- This model reflects a reasonable range of expected values, based on current forecasts and our experience over the past decade operating similar residential energy storage systems.
- It is a 20-year model, rather than a 15-year model in prior versions. We expect a lifespan well beyond the original model estimates. We did not include end-of-life replacement batteries in the model for this reason as well. Importantly, we are not seeing any material battery degradation for the energy storage programs we installed almost 10 years ago. Additionally, this model assumption is based on data from these same battery cells in other applications such as cars and larger scale power pack systems. For example, GMP's larger scale battery systems, utilizing Tesla Powerpacks, which use similar battery cells, are designed to perform for over 20 years. New energy storage systems that are coming on the market are providing longer warranties and higher cycle guarantees, which points to the longer expected life of these systems.
- The upfront capital cost incorporates the fact that some households will require additional material and labor to connect the storage system than others.
- No customer payment is included, reflecting that the systems under the Storage Tariff will be installed as Zone 4 storage grid assets.
- We reduced the peak shaving benefits over the modeled term. This is based on an assumption that the amount of peak shaving per MW of capacity will decline as more in-state and regional peak shaving resources result in flatter peaks. The model also assumes more peak discharges per month to account for this as well.

This assumption may be conservative because 1) increased electrification will continue to drive up peak even with increased peak shaving resources, and 2) new large transmission buildouts in the region will put upward pressure on costs that increased peak shaving will help curtail.

- We included a value for Vermont-based T&D system upgrade deferral. Both the 2024 VELCO LRTP and our 2024 IRP show that reduced peaks could defer transmission projects at key locations in Vermont. Storage provides this peak reduction and the model should allocate an appropriate value to this function. We estimated values for this benefit based on independent studies of anticipated values in other New England states, focusing in particular on avoided costs for Vermont, as described further in Q16 below.
- Revenues from the Regulation Market are included.
- End of life system removal and recycling costs are included. We considered a range of possible end-of-life costs and we discussed potential recycling values with several major battery system recycling companies. These were used to produce the range in the model, including a higher cost scenario that assumes no contribution from recycling. Based on our experience and discussions with recycling companies, it is unlikely these systems will have no recycling value.

We also provide an overview of the Program's three-year revenues and costs, consistent with PUC Rule 2.401(c) in **Exh. GMP-JC-4**, based on our updated financial analysis, which similarly shows a range of values based on current forecasts and our experience managing these systems.

Q14. Does the model include the value of resilience provided by Zone 4 energy storage systems?

A14. Consistent with prior ESS financial analyses, this model does not include any value for anticipated resiliency benefits, and the program stands on its own as a benefit to customers, even before any additional beneficial value of resilience. Defining any specific value of resiliency can be done in a separate proceeding, as suggested by the Department in its recent petition to open a separate resilience docket.[23]

Q15. The model contains a benefit for deferring T&D projects for load growth projections. Can you explain how that benefit flows to customers and why it is appropriate to include it in the model?

A15. The VELCO LRTP and the IRP over the term of this model show growth-driven overloads on the T&D system that energy storage will help to alleviate thereby avoiding or deferring investments. In the IRP, we performed an 8760 all-hours time-series analysis of a representative group of 10 circuits. This analysis shows the potential for mainly short duration overloads in the 2035 time frame, for which storage is a solution to reduce those peak demands.[24] For any facilities that are not considered pool transmission facilities

[23] *See* Vermont Department of Public Service Petition to Open a Resilience Investigation, filed February 14, 2025, Case No. 25-0339-PET. *See also* Order at 32 (encouraging Department to consult with distribution utilities and provide either a status update or petition requesting a general resiliency investigation).

[24] *See* 2024 Proposed IRP at Appendix E: RLC Engineering Studies.

("PTF") paid for by the entire region,[25] GMP customers will pay all (for GMP assets) or a large majority (for VELCO assets) of the cost of upgrades to resolve these potential issues. The analysis shows that, unless we are able to sufficiently reduce peak demand, such upgrades would be needed on the transmission, sub-transmission or distribution systems. Energy storage, including Zone 4 systems, help mitigate or avoid these overloads and defer the need for these upgrades.

Q16. How did you quantify the value for T&D system upgrade deferral?

A16. The range of values for T&D upgrade deferral are based on published values from the 2024 Avoided Energy Supply Component Study ("AESC 24").[26] AESC 24 calculated avoided PTF costs across ISO-NE and reported, state-by-state, non-PTF avoided local T&D values through a survey of utilities around New England. No value for non-PTF, local T&D deferral was assigned to Vermont in the study based upon a now outdated 2018 study that assumed negligible load growth in the state.[27] However, current projections from GMP's load forecasting vendor and the VELCO Long Range Transmission Plan show 1-2% growth per year over the next decade, with greater growth expected in specific areas of the system. Values for other New England states range from

[25] Any deferral to PTF investments would also provide benefits, though less direct benefit than deferred or avoided projects solely within Vermont. In addition to general regional benefit of avoiding a PTF investment, Vermont electric customers would also benefit through lower RNS rates.

[26] Available at https://www.synapse-energy.com/sites/default/files/inline-images/AESC%202024.pdf.

[27] AESC 24 at 288, 298.

$14.05/kW-year (Connecticut) to $246.79/kW-year (Maine).[28] Maine or New Hampshire (valued at $79.98/kW-year) are more representative of Vermont's local T&D system so we have aligned the model conservatively slightly below New Hampshire with a range of values centered around $75/kW-year.[29] It is worth noting that even with a more conservative T&D deferral value, the program still would provide a positive net present value under reasonable mid-range values for other primary assumptions.

Information Request 2 – Consistency with Title 30

Q17. Please explain why GMP's tariff proposal, when compared to the ESS program, which includes a monthly lease payment, is consistent with 30 V.S.A. §§ 225 and 229.

A17. While legal briefing during this proceeding can analyze this further, from my perspective the ESS program and this proposed Storage Tariff serve different purposes. This Zone 4 energy storage proposal is a solution designed to deliver equitable reliability in the most cost-effective manner in specifically eligible geographic locations, at a lower cost compared to other infrastructure solutions, such as undergrounding. The ESS program, by contrast, is a voluntary program driven by individual customer interest offered across our service territory and is not specifically focused on areas of greater need or where an alternative line upgrade would be necessary or contemplated to deliver the improved

[28] AESC 24 at 288.

[29] The New Hampshire value was based on a 2018 study using transmission and substation loading forecasts (but not local distribution), incorporating energy efficiency, solar, and demand response, but not policy goals for electrification, which could lead to higher values if peaks rise. AESC 2024 at 288-89.

customer experience that ZOI is ultimately going to achieve. Both programs are 'opt in' for customers and both provide direct benefits to participating customers and broader benefits to all GMP customers as outlined throughout this testimony. GMP has a portfolio of storage programs, all with different purposes based on customer and grid needs. These include:

- *Utility-scale storage*, such as the solar and storage microgrid in Panton;
- *Mobile storage*, as described above and deployed to keep neighborhoods or businesses powered up during planned or unplanned outages;
- *Residential storage leasing,* through the ESS program for customers who wish to join regardless of their geographic location or reliability;
- *Residential storage deployment,* with no customer payment through VLITE and the ESAP to customers in our Electric Assistance Program.
- *Zone 4 storage program*, through this proposed limited Storage Tariff where reliability needs and geographic location on a distribution circuit are determining factors similar to traditional T&D distribution reliability improvements.

The Storage Tariff is time- and dollar-limited and targets specific geographic locations where these investments will have the greatest impact for customers. This approach of geographic targeting on specific circuits guided by outage data is consistent with other reliability investments we routinely make on the system, such as undergrounding and storm hardening. In these rural Zone 4 locations—which currently see the greatest impact during outages—the program allows GMP to provide a service experience equivalent to what we provide to customers in other parts of the same circuit,

or that customers in more urban areas experience. The prioritization of Zone 4 energy storage as a grid asset in select areas is no different than identifying specific line upgrades for priority work in areas showing reliability challenges. Based on the modeling and analysis I describe, storage is the most effective solution to achieve this and does not result in a cost-shift.

Deploying a program of this statewide scope requires a steady, phased approach. Providing equitable service to all customers requires prioritization of those customers who have experienced more outages from storm damage in geographically isolated areas more vulnerable to grid threats. Lastly, this is a tariffed program reviewed by the Commission under Section 225 and is applied to a set of circuits and potential locations identified in the tariff on uniform terms and therefore is not a special contract.

Information Request 3 – Plan for Prioritization

Q18. Describe further GMP's plan for prioritization and explain how the selection process accounts for equity.

A18. As described in A8 above, our initial Storage tariff is targeted to prioritize Zone 4 customers in four specific circuits in southern Vermont that have seen significant outages from damaging storms recently. These circuits also overlap with communities where more than a quarter of our customers are at or below two times the federal poverty level, based on data available in the State's Municipal Vulnerability Index. Within these circuits we will focus our outreach, communications, and installation work for more vulnerable customers including those on our critical care list and those who participate in our EAP program.

Information Request 4 – Storage Equipment

Q19. What equipment will GMP use to implement Zone 4 Energy Storage under this tariff and has GMP considered alternative storage solutions?

A19. We routinely explore and test storage options as various battery technologies improve and become available on the market. We are constantly working with potential technology partners and exploring the best and most cost-effective options as early in the process as possible. This ensures our equipment is safe, cost-competitive, and thoroughly vetted. It also ensures we can provide optionality to customers over time and that we are not single-sourced to any one technology partner. We have tested and deployed over 10 different energy storage systems since the inception of our programs.

We have had the most success over the years, both in terms of performance and cost, with the Tesla Powerwall system. And more recently, we have successfully deployed the Franklin Whole Home energy systems. We expect to offer these two options to customers in the Storage Tariff with more likely to be added during deployment.

Due to the rapidly evolving nature of storage technology and our desire to offer optionality to customers, we will continue to explore and test these technologies and, if successful, offer those in our programs that are cost competitive and compatible with our grid management service. When testing this equipment, we are examining several factors, including electrical safety, ease of installation, performance during an outage event, and performance during a grid dispatch event. We also screen for only financially sound technology partners with a high level of customer service and a long-term commitment.

Q20. How will this program evolve over time; does GMP have alternative strategies that may be used in the future?

A20. The Storage Tariff forms an important part of our overall energy storage vision. As described above, our initial Storage Tariff will focus our work on the four identified circuits, working to get as many Zone 4 customers signed up as possible. This initial work will help inform how we evolve the program over time. By the end of 2026 we anticipate having acquired enough data and insight that we will make a more detailed recommendation to the PUC on how to next prioritize circuits and customers. At that time, GMP will file a comprehensive report on the status of deployments, customer uptake, customer demographic data along with other agreed metrics. This will include our proposal for further prioritization which will be informed by our initial four circuit deployments.

We are hopeful the success of this program will evolve over time to include more communities, eventually offering grid asset energy storage to customers as part of our service. As new technologies emerge and are tested, local energy storage will continue to help meet the need for flexible resources and provide reliability for participating customers with benefits to the entire grid. Developing energy storage in all forms and sizes will continue to be crucial to support the growth of renewable generation and electrification, keep customers connected during grid outages, and manage the modern grid with lower costs. Additionally, we are developing new solutions and use cases to complement residential storage, including installation and optimization of larger utility-

scale batteries and vehicle-to-home and vehicle-to-grid bidirectional charging that builds on Vermont's growing electric vehicle fleet.

Information Request 5 – Additional Information on Customer Agreements

Q21. Please explain how GMP will have systems installed for customers at rental or mobile home properties as part of the program?

A21. Rental units and mobile homes in Zone 4 are eligible for energy storage as any other eligible customer in Zone 4. We have several customer energy programs with rental and mobile home properties, including the ESS program and ESAP, which help guide our process and communication with these customers. The Customer Agreement is signed by the GMP account holder, which can be a tenant in a rented unit or the owner of a mobile home who leases the underlying land. Similar to other GMP programs, renters and lessees will need signed consent from the property owner in order to participate.

With respect to mobile homes and some rental properties, we have found that energy storage may be better suited outdoors due to space constraints. We have also found that connecting storage to the electrical systems in these locations can require additional materials or updates, which we have factored into the financial model.

No matter where we are installing, there are multiple types of energy storage systems and energy storage interconnection devices that enable a variety of installation configurations to meet the needs of a specific premise, including indoor or outdoor installations and interconnection at the main electric panel or at the customer's meter.

Q22. Do customer agreements account for transfers of ownership of the underlying residential property?

A22. Yes. Ownership transfers will be handled in the same manner as our ESS program and our ESAP. Customers who sell their properties will transfer the Customer Agreement to the buyer of the property via an Assignment and Assumption document that transfers the rights and obligations of the Customer Agreement from one to the other. The process can be completed electronically.

Q23. Will customers have the ability to terminate the customer agreement if desired?

A23. Yes. As with the ESS program and ESAP, customers can stop participating and terminate the Customer Agreement by allowing GMP to remove the energy storage system or, in very rare cases, paying an early termination fee calculated in the tariff if they do not want to surrender the equipment.

Q24. Does this conclude your testimony at this time?

A24. Yes.