STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Case No. 22-0175-TF

Tariff filing of Green Mountain Power requesting a 2.34% increase in base rates effective on bills rendered on or after October 1, 2022

Case No. 21-3707-PET

Petition of Green Mountain Power Corporation for approval of a Multi-Year Rate Plan (MYRP) pursuant to 30 V.S.A. Sections 209, 218, and 218d

PREFILED DIRECT TESTIMONY OF KEVIN J. MARA ON BEHALF OF THE VERMONT DEPARTMENT OF PUBLIC SERVICE

April 20, 2022

Summary: Mr. Mara presents the Vermont Department of Public Service's position with respect to the proper inclusion of various projects contained in Green Mountain Power's ("GMP") Multi-Year Regulation Plan ("MYRP"). While the Department is generally supportive of GMP's MYRP, Mr. Mara offers recommendations in key areas including capital expenditures for transmission, substation, distribution, generation, and transportation.

Mr. Mara Sponsors the Following Exhibits:

Exhibit PSD-KJM–1	Professional Resume of Kevin J. Mara
Exhibit PSD-KJM-2	DPS2.Q45
Exhibit PSD-KJM-3	DPS2.Q48
Exhibit PSD-KJM-4	DPS2.Q61

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

A1. My name is Kevin J. Mara. My business address is 1850 Parkway Place, Suite 800, Marietta, Georgia 30067. I am the Executive Vice President of the firm GDS Associates, Inc. ("GDS") and Principal Engineer for a GDS company doing business as Hi-Line Engineering. I am a registered engineer in 23 states.

Q2. Please outline your formal education.

A2. I received a degree of Bachelor of Science in Electrical Engineering from Georgia Institute of Technology in 1982.

Q3. Please state your professional experience.

A3. Between 1983 and 1988, I worked at Savannah Electric and Power as a distribution engineer designing new services to residential, commercial, and industrial customers. From 1989-1998, I was employed by Southern Engineering Company as a planning engineer providing planning, design, and consulting services for electric cooperatives and publicly owned electric utilities. In 1998, I, along with a partner, formed a new firm, Hi-Line Associates, which specialized in the design and planning of electric distribution systems. In 2000, Hi-Line Associates became a wholly owned subsidiary of GDS. and the name of the firm was changed to Hi-Line Engineering, LLC. In 2001, we merged our operations with GDS, and Hi-Line Engineering became a department within GDS. I serve as the Principal Engineer for Hi-Line Engineering and am Executive Vice President of GDS. I have field experience in the operation, maintenance, and design of transmission and distribution systems. I have performed numerous planning studies for electric cooperatives and municipal systems. I have prepared short circuit models and

overcurrent protection schemes for numerous electric utilities. I have also provided general consulting, underground distribution design, and territorial assistance.

Q4. Have you testified in Vermont in the past?

A4. Yes. I submitted testimony in Case No. 18-0974-TF and Case No. 20-0276-PET before the Vermont Public Utility Commission ("Commission").

Q5. Have you testified before any other regulatory commissions?

A5. Yes. I have submitted testimony before the following regulatory bodies:

- Federal Energy Regulatory Commission ("FERC")
- District of Columbia Public Service Commission
- Florida Public Service Commission
- Public Utility Commission of Texas
- Michigan Public Service Commission
- Maryland Public Service Commission
- Corporation Commission of Oklahoma

I have also submitted expert opinion reports before United States District Courts in California, South Carolina, and Alabama.

Q6. What are your qualifications to provide testimony before the Commission?

A6. I have 40 years of experience as a planning and distribution engineer specializing in electric utility systems. In this capacity as a distribution engineer, I have assisted electric utilities in the design, construction, and planning of their electric distribution systems. This work has included development of distribution system over-current protection,

over-voltage protection, reliability improvements, and planned system upgrades. I have worked for electric utilities from Florida to Alaska in many different operating environments, and I have experience in a very diverse array of utility designs and operations. My professional resume is attached as Exhibit PSD-KJM–1.

Q7. Please describe GDS.

A7. GDS is an engineering and consulting firm with offices in Marietta, Georgia; Austin, Texas; Auburn, Alabama; Manchester, New Hampshire; Kirkland, Washington; Portland, Oregon; Orlando, Florida; and Madison, Wisconsin. GDS has over 170 employees with backgrounds in engineering, accounting, management, economics, finance, and statistics. GDS provides rate and regulatory consulting services in the electric, natural gas, water, and telephone utility industries. GDS also provides a variety of other services in the electric utility industry including power supply planning, distribution planning and design, generation support services, financial analysis, load forecasting, and statistical services. Our clients are primarily publicly owned utilities, municipalities, customers of privately-owned utilities, groups or associations of customers, and government agencies.

Q8. For whom are you appearing?

A8. I am testifying on behalf of the Vermont Department of Public Service ("Department" or "PSD").

Q9. Were your testimony and exhibits prepared by you or under your direct supervision and control?

A9. Yes, they were.

Q10. Please summarize the purpose of your testimony.

A10. I was asked to review the capital expenditures for transmission, substation, distribution, generation, and transportation. My review was focused on the prudency of each project, and the estimated cost of the projects.

Q11. Please summarize the scope of work performed by you to identify the proposed adjustments to the MYRP and rate proceeding.

A11. My scope of work for this proceeding included the following:

- A review of GMP's MYRP in Case No. 21-3707-PET;
- A review of GMP's rate filing in Case No. 22-0175-TF;
- Assistance with developing questions for the first round of discovery;
- A review of GMP's responses to the Department's first round of discovery ("Discovery #1");
- A review of each of the capital project details including the financial analysis, capital summary, labor summary, labor detail, stock materials, and O&M analysis;
- Use of Google Earth to review the site and the infrastructure location for many of the transmission and distribution projects;
- Preparation of the second round of discovery requests on GMP ("Discovery #2") to obtain additional information supporting GMP's MYRP; and
- A review and analysis of the responses to Discovery #2.

Q12. Can you please summarize your testimony?

A12. Yes. My testimony addresses some design issues that GMP should consider for adoption as well as opinions to exclude some capital projects in the MYRP. My recommendations are as follows:

- GMP should adopt storm hardening design standards for distribution lines exposed to downsloping winds and increased ice precipitation;
- The record should be clear that undergrounding single-phase lines is more costly than rebuilding overhead lines, and undergrounding should be considered when overhead build is not a viable option;
- GMP should review certain projects to determine if multi-phasing heavily loaded single-phase line adds to efficiency in terms of reducing line losses; and
- The Commission should deny the cost of upgrades to the Gage Hydro facility, as the upgrade costs far exceed the value derived from the energy produced by the hydro facility.

Q13. Please explain the term "storm hardening."

A13. Many utilities are working to improve their systems for increased resiliency and reliability. Reliability is normally thought of as reducing outages while resiliency is the ability of the utility to quickly restore power after an outage. Storms, whether ice storms or windstorms, can cause damages that are difficult to restore quickly due, in part, to the wide-spread nature of the event. Storm hardening is a term that describes a change in design philosophy that adds extra strength to a pole or system such that it has a greater likelihood of surviving an ice or windstorm.

Q14. Is storm hardening included in the National Electric Safety Code ("NESC") for the design of transmission and distributions systems?

A14. No. The NESC contains specified weather conditions with corresponding overload and strength factors to be applied to poles or structures. For distribution lines in the northeast, the NESC Rule 250B uses heavy loading which includes ½ inch of radial thickness of ice at 0° Fahrenheit with a 40 mile per hour wind. The overload and strength factors are based on the grade of construction. In general, Grade C is applied to distribution lines while Grade B is applied to transmission lines or special applications like crossing railroads, lakes, and interstate highways where greater strength is necessary.

Some utilities are modifying their design standards beyond the NESC requirements to storm harden their systems. This includes using Grade B strength factors for distribution lines and/or increasing the wind speeds applied to the lines and structures.

Q15. Regarding Distribution Project 166050 Stockbridge L3 to L1, what is your understanding of the purpose of this project?

A15. A GMP Financial Analysis stated that the primary purpose is to update and replace aged and deteriorating facilities. Further GMP states that the line is "adjacent to the green mountain ridgeline and experiences severe weather, down sloping winds and more frozen precipitation due to the elevation of the area."[1]

[1] Burke Exhibit GMP-MB-7: Project 166050 Stockbridge L3 to L1, Project justification, page 5.

Q16. Is GMP planning to storm harden this line?

A16. No. GMP is planning to design this line in accordance with Grade C and heavy loading weather conditions just like other distribution lines on their system.[2]

Q17. What is your recommendation for this project?

A17. My recommendation is that GMP adopt design standards for lines that have downsloping winds (wind speeds increase on downslopes) and increased frozen precipitation (icing load). This would include designing for Grade B strength and possibly using the extreme wind and ice loading recommended in the NESC for transmission lines and poles greater than 60 feet above ground (NESC Rules 250C and 250D). Although I have not done an independent design for the project, there are forty-four 45-foot class 3 poles on the project[3] and increasing these to class 2 poles adds about $25 per pole but increases the strength of the poles by 23%. A change in the design standard for this line and similar lines will result in a stronger line more readily able to withstand the effects of the known climate at this line location. While there is a slightly higher cost for the line rebuild, it will result in a line that would be twice as strong for these known weather events.

[2] Exhibit PSD-KJM-2 (GMP's Response to PSD Discovery Request DSP2.Q45).
[3] Burke's Testimony Exhibit GMP-MB-7: Project 166050 Stockbridge L3 to L1, Budget Tool. See 166050 Stockbridge L3 to L1 Budget _Tool_UI_Report (47).xlsx filed as part of the rate case workpapers.

Q18. Can you state your concerns regarding Distribution Project 172654, Shrewsbury L4?

A18. Yes. This project undergrounds 1.95 miles of existing overhead line which provides service to 74 customers.[4] GMP's design calls for a loop feed; meaning the primary cable (7.2 kV phase to ground voltage) starts at one end extends to the end of the project, and then the cable loops back to the beginning.[5] This is a common design technique in the electric industry due to the relatively long-time duration to repair a failed underground primary cable. However, this technique adds significantly to the cost of the project. The cost for undergrounding this 1.95 miles of overhead line is $581,859 or $298,389 per mile of overhead line removed. Reviewing GMP's cost for rebuilding overhead single-phase lines in this case, I developed an average cost per mile, which is roughly $172,363 per mile.[6] Thus, by undergrounding the 1.95 miles on Shrewsbury L4 instead of rebuilding the line overhead, there is an increased cost of $245,023.

Q19. Is it true, based on your analysis, that undergrounding a single phase line can more expensive than rebuilding an existing overhead lines?

A19. Yes, for this example, the cost is $126,026 more per mile for undergrounding or, looked at a different way, the cost increase per customer is $1,703. This conclusion contradicts GMP's statement regarding this project that

[4] Burke Exhibit GMP-MB-7: Project 172654 Shrewsbury Project Justification.
[5] Exhibit PSD-KJM-3 (GMP's Response to PSD Discovery Request DSP2.Q48).
[6] Average cost based on mileage and cost for the following projects 162196, 164840, 171732, 172280, and 169766.

> "It was determined most beneficial from a cost and feasibility standpoint to pursue the underground option for much of this line and rebuild overhead where underground was not feasible."[7]

GMP contradicted this statement in response to data requests asking if an analysis was done to consider tree wire for this project:

> "Not applicable because the original permit request for overhead was denied by the Town of Shrewsbury. As noted in testimony, undergrounding is cost comparable in this circumstance and is the preferred method for rebuilding single phase lines where possible."[8]

I think it is important to clarify for the record that undergrounding is not cost comparable in this case. However, since Shrewsbury denied GMP's overhead permit, then undergrounding would be appropriate. The option for rebuilding overhead lines should be considered when viable due to the cost differential of undergrounding and overhead rebuild.

[7] Burke Exhibit GMP-MB-7: Project 172654 Shrewsbury Project Justification.
[8] Exhibit PSD-KJM-3 (GMP's Response to PSD Discovery Request DSP2.Q48).

Q20. Do you believe the new single-phase line projects are efficiently designed?

A20. No. In the electric utility industry, there is a need to balance the load among the three different phases on a circuit, commonly referred to as "A" phase, "B" phase and "C" phase. Most residential homes are served by single phase transformers and could be connected to A, B, or C phase. In many cases, there is a single-phase line that extends from a three-phase circuit, and all transformers are connected to this single-phase line. Efficient design of a distribution system seeks to balance the load to reduce system losses. For example, a single-phase line will have three times the line loss compared to a three-phase line of the same conductor size and same load. Further, reliability is improved by placing customers on different phases because an outage may only affect one-third of the customers.

I have observed that GMP is rebuilding single-phase lines with more than 175 customers. In my opinion, these heavily loaded single-phase lines should be considered for conversion to three-phase to reduce line losses and improve reliability. The following are examples for projects:

Project	**Project Name**	**Type of Line**	**Number of Customers Served**
164840	Lunenburg L63	Single-Phase	232
169766	Concord L43- 432	Single-Phase	132
171732 & 173280	Winhall 51	Single-Phase	178

Multi-phasing these single-phase lines during a rebuild is more efficient and less expensive than modifying the lines at a later date. Further, multi-phasing the lines that are heavily loaded (serving many customers) provides more capacity for future load increases.

Q21. Do you have a recommendation in this proceeding?

A21. I am suggesting that GMP review these single-phase projects to determine if multi-phasing a portion of the line is more efficient at this time.

Q22. Regarding Project 179631 Gage Obermeyer System, can you explain the purpose of this project?

A22. Yes. The Gage Hydro facility is a small-head hydro powerplant that generates 2,641 MWh per year, which GMP estimates to have an annual revenue of $105,640.[9] Project 179631 is designed to correct a safety problem at the facility at a cost of $3,281,976. The payback period for this investment in the Gage facility is longer than 30 years. The Gage Hydro facility is referred to as a run-of-river dam, meaning the outflows from the dam essentially equal the inflows to the dam. The powerhouse controls the flow through the turbine or over the dam to maintain these flows. On top of the dam, there are flashboards which, in simple terms, are hinges. The flashboards pointing up vertically will impound more water behind the dam. If there is a flood, the flashboards will hinge horizontally with the flow of the river and water will spill out of the dam. To reset the flashboards after a flood, workers from an overhead, cable-suspended basket reach

[9] Burke Exhibit GMP-MB-7: Project 179631 Gage Obermeyer System Financial Analysis.

down to adjust the flashboards. Working from a basket system is no longer considered safe.

GMP is proposing a new system to replace the flashboards, which will not require this manual operation via a cable-suspended basket.

Q23. Do you have a recommendation for Project 179631 Gage Obermeyer System?

A23. Yes. The cost of upgrades to the Gage Hydro facility far exceeds the value derived from the energy produced by the hydro facility. GMP did an analysis of alternatives which included decommissioning of the facility.[10] However, the analysis did not include an option to operate the facility, as is, without producing electricity. Because this is a run of the river facility, it is possible to operate the facility without producing electricity and therefore without the need for the flashboards or any alternatives to the flashboards. Even if GMP contends this is not a viable option, the concern for the rate payers is that the facility will still require maintenance and future upgrades to the powerhouse or other ancillary facilities which will make the facility even more inefficient in terms of cost/benefit. Therefore, this upgrade as proposed should be denied.

Q24. **Does this conclude your direct testimony?**

A24. Yes.

[10] Exhibit PSD-KJM-4 (GMP's Response to PSD Discovery Request DSP2.Q61).