STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Petition of Green Mountain Power Corporation for a certificate of public good authorizing the purchase of electricity from Great River Hydro, LLC	))))	Case No. 21-____-PET

PREFILED TESTIMONY OF DOUGLAS C. SMITH ON BEHALF OF GREEN MOUNTAIN POWER CORPORATION

March 4, 2021

Mr. Smith reviews GMP's power supply portfolio and needs, discusses some of the key features of the proposed Great River Hydro power purchase agreement, explains how the purchase's flexibility and other characteristics will make it a positive component of GMP's power supply portfolio for customers. Mr. Smith explains how the purchase will help GMP meet its power supply goals and its renewable energy and carbon reduction obligations and goals, and why the purchase meets the applicable criteria of 30 V.S.A. § 248.

TABLE OF CONTENTS

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1. Introduction

Q1. What is your name, occupation, and business address?

A1. My name is Douglas Smith. I am Chief Power Supply Executive at Green Mountain Power Corporation ("GMP" or the "Company"), 163 Acorn Lane, in Colchester, Vermont.

Q2. Please describe your educational background and pertinent professional experience.

A2. I have **worked** in the energy industry for over 30 years, focusing on topics that include electric system and portfolio planning, wholesale and retail power transactions, and market price forecasting. I hold a Bachelor of Science degree in Mechanical Engineering from Brown University.

I began my career as an analyst at the Vermont Department of Public Service (the "Department") and was subsequently promoted to the position of Electrical Planning Engineer. From 1991 to 2007, I worked at La Capra Associates ("La Capra"), a Boston-based consulting firm that specializes in planning and regulatory issues in the electric

industry, first as an analyst and ultimately as the Technical Director. While at La **Capra** I advised several Vermont utilities regarding their power transactions, risk management strategies, and Integrated Resource Plans. On behalf of state agencies and large electricity customers, while at La Capra I reviewed the procurement strategies of numerous large utilities in the eastern, central and western U.S. I also led the firm's forecasting of New England wholesale electricity market prices, and assisted in the siting applications of several proposed electric generating plants.

I joined GMP in 2007 as the Manager of Energy Resource Planning and Rates. I was subsequently promoted to Director, Power Supply, and I assumed my current position in 2018. In this capacity I have a primary role in the development of the Company's power supply strategy, and in the evaluation of potential power supply sources. I also have a primary role in the development of GMP's Integrated Resource Plans.

Q3. Have you previously testified before the Vermont Public Utility Commission?

A3. Yes, I have testified before the Commission on numerous occasions; a few pertinent examples include Docket 7742 (regarding a proposed long-term power purchase from NextEra Energy Seabrook, LLC), Docket 8682 (proposed GMPSolar Williamstown project) and Case No. 19-4464-PET (proposed Lowell to Morrisville transmission upgrade project). I have testified regarding topics that include resource planning, proposed power contracts, electric utility rates, and potential transmission projects and potential non-transmission alternatives.

Q4. What is the purpose of your testimony?

A4. My testimony explains why the proposed power purchase agreement ("PPA") to purchase energy and **renewable** attributes from Great River Hydro, LLC ("GRH"), is needed and is beneficial for GMP customers, and why it is consistent with GMP's 2018 Integrated Resource Plan ("IRP"). I also address the other criteria of 30 V.S.A. § 248 that are applicable to a power purchase of this type, including compliance with the Department's 20-year energy plan.

Q5. Please summarize GMP's purchases under the proposed PPA.

A5. My GMP colleague Christopher Cole introduces the proposed PPA, explains its most notable terms, and presents the PPA as Exhibit GMP-CC-1. GMP will purchase hydroelectric energy **and** environmental attributes supplied from GRH's hydroelectric fleet in two components—peaking hydroelectric energy and firm hydroelectric energy—along with a steady volume of environmental attributes. The peaking energy will be supplied from the Fifteen Mile Falls facilities (the "FMF Facilities"), three GRH plants that collectively have a significant degree of ponding capability and dispatch flexibility, so GRH is able to shape the output on an hourly and to some extent daily basis to meet the highest periods of regional demand. As my colleague Andrew Quint and I will illustrate, GMP and our customers will benefit significantly from this operational flexibility through the peaking hydroelectric energy. The peaking deliveries will start in 2023 and ramp up to a maximum of 50% of the supplying plants' actual hourly output starting from 2029 through 2052. The firm energy will be supplied from GRH's hydroelectric facilities on the Connecticut River and the Deerfield River on an around-

the-clock basis, starting at a level of 5 MW and ramping up to a maximum quantity of 30 MW from 2033 through 2052.

Q6. Approximately what portion of GMP's projected annual energy and renewable attribute needs will the PPA provide?

A6. Total estimated energy deliveries ramp up from roughly 145,000 MWh in 2023 to a projected maximum **of** roughly 625,000 MWh/year starting in 2033; this volume represents about 15% of GMP's current annual energy requirements. For context, at its maximum, the average volume delivered under the PPA will be roughly 40% less than the volume of our current long-term PPA with H.Q. Energy Services (U.S.) Inc. ("HQUS"), about 50% more than the average annual output of GMP's existing hydroelectric fleet, and roughly a third more than GMP's long-term PPA from NextEra Seabrook. Actual deliveries of peaking energy will fluctuate from year to year based on actual streamflows and output from the FMF Facilities, but the figures above provide a reasonable average annual illustration. The 800,000 environmental attributes per year that GMP will receive under the PPA represent roughly 19 percent of GMP's current annual energy sales; to the extent that our customers' electricity consumption increases over time, as I will discuss below, the PPA's share of GMP's total needs will decrease.

Q7. Please summarize your primary findings and recommendations.

A7. The PPA fits well with GMP's portfolio and our customer's energy usage over the course of its term. It will help GMP to meet our obligations under Vermont's Renewable Energy Standard (the "RES") along with our own carbon and renewable energy goals at a

favorable cost, while leaving room in our portfolio for other resources now and in the future. This agreement will anchor our portfolio with a well-priced resource, helping to support increased electrification—a key way to meet the State's carbon goals—in the years ahead. Because energy under the PPA will be supplied from a unique fleet of hydro plants—including some with significant storage capacity—the energy will feature a degree of firmness and flexibility that distinguishes it from most renewable energy resources and adds value in our portfolio. These features make the GRH PPA complementary to the continued deployment of other renewable power options and an appropriate component of a highly renewable, reliable, long-term supply portfolio for GMP's customers.

More specifically, my primary findings with respect to the proposed PPA are as follows:

Need. GMP's power supply has diversified over the past decade, as GMP has obtained significant new long-term power supply sources through both ownership (e.g., Kingdom Community Wind, Enel hydro facilities, and joint venture solar and storage) and power purchase agreements (including HQUS, NextEra Seabrook, along with multiple long-term power purchase agreements from smaller renewable power plants). Net-metered solar generation in GMP's territory has increased rapidly, particularly during the past five years, becoming a significant part of our electricity supply. The resulting portfolio is projected to meet much of GMP's energy needs during the near term, but GMP's need for renewable energy increases substantially in the 2030s and beyond, as existing long-term PPAs representing a large share of existing supply will expire during this time frame.

The need likely will grow as electrification takes hold later in this decade and beyond. The PPA will provide a meaningful foundation of energy and environmental attributes backed by GRH's hydroelectric fleet, to serve GMP customers into the 2030s and beyond, while leaving a substantial additional annual need that will be fulfilled from other sources. The PPA is structured to deliver significant volumes of renewable energy during times when it is most needed. Ultimately, the PPA will serve projected electricity needs of GMP customers that could not otherwise be provided in a more cost-effective manner through energy efficiency, load management or other demand-side resources.

Economic Benefit. The PPA supports GMP's goal of clean, low-cost power because it will provide a significant volume of renewable energy and attributes at lower prices than many current renewable alternatives. In fact, the GRH PPA will enter the portfolio as one of GMP's lowest-priced energy sources. The contract pricing will escalate annually at a fixed, moderate rate; this will tend to stabilize GMP's net power costs and therefore the electric rates that our customers pay. These pricing features should contribute to affordable electricity for our customers, enhance the economic competitiveness of Vermont businesses, and support cost-effective electrification of energy uses presently supplied by fossil fuels. In addition to reasonable pricing, the PPA's structure—which utilizes the seller's unique hydroelectric fleet—will enhance the value of the energy that GMP receives, and the robustness of that value over time. The PPA will be a useful complement to the substantial volumes of energy in GMP's current power supply and the large additional volumes of intermittent renewables that GMP will need in order to achieve and maintain a fully renewable and reliable power supply over the longer term.

IRP. The PPA is consistent with GMP's approved IRP, which focuses on achieving Vermont energy and climate goals in a low-cost way, while managing considerations of portfolio diversity, flexibility, and stability. The PPA will move GMP's portfolio toward the Illustrative Future Portfolio presented in the IRP which includes long-term additions of plant-contingent existing hydro power and firmed hydro purchases, with a more favorable output profile and favorable pricing, allowing the addition of other resources to meet renewable energy needs over the course of its term.

Other Section 248 Criteria. The PPA complies with the other applicable Section 248 criteria because it will promote the general good of the State and allows a portion of the energy needs of GMP's customers to be served economically by existing facilities without undue adverse effect on system reliability or stability. It is also consistent with the Department's Comprehensive Energy Plan and 20-year electric plan.

2. GMP'S Power Supply Portfolio

Q8. Please summarize the primary components of GMP's current power supply portfolio.

A8. GMP's power supply comes from a mix of owned generation, longer-term PPAs, and some shorter-term supply purchases, and is weighed toward renewable and carbon-free resources. Diversity helps to provide reliability for our customers. Our mix of owned generating plants includes a fleet of more than 100 MW of instate hydroelectric plants; the Kingdom Community Wind plant (63 MW); the Searsburg wind plant (6 MW); and the McNeil wood-fired plant (31% ownership, or about 15 MW). GMP also owns a

small fraction of the Millstone 3 nuclear unit in Connecticut and receives a portion of around-the-clock energy from the facility. These owned facilities are complemented by our PPAs, including:

- HQUS: This PPA is a long-term, stably-priced energy purchase for about 1 million MWh/year, which is about 22% of GMP's annual energy requirements. The purchase provides a fixed annual quantity of energy, with a "7x16" profile (about a 67 percent annual capacity factor); the price is adjusted annually based on a mix of general inflation and New England energy market prices.

- NextEra Seabrook: This PPA backed by the Seabrook nuclear facility provides 60 MW of unit-contingent energy.[1] Deliveries under the contract are scheduled to decline by 5 MW starting June 2021 and by another 5 MW starting in June 2029.

- Renewable PPAs: GMP purchases about 82 MW of wind energy and capacity from the Granite Reliable project in northern New Hampshire, and the full output of the 30 MW Deerfield Wind plant in southern Vermont. We also receive output through a number of solar PPAs through both joint venture projects and bilateral arrangements.

- Standard Offer: GMP is the largest purchaser (through Vermont Electric Power Producers, Inc.) of output under long-term contracts from projects developed under Vermont's Standard Offer Program. The majority of Standard Offer capacity—all

[1] NextEra Seabrook also provides larger volumes of capacity.

from projects sized 2.2 MW or smaller—has been solar, although the program also supports small hydroelectric, wind, biomass, and digester projects.

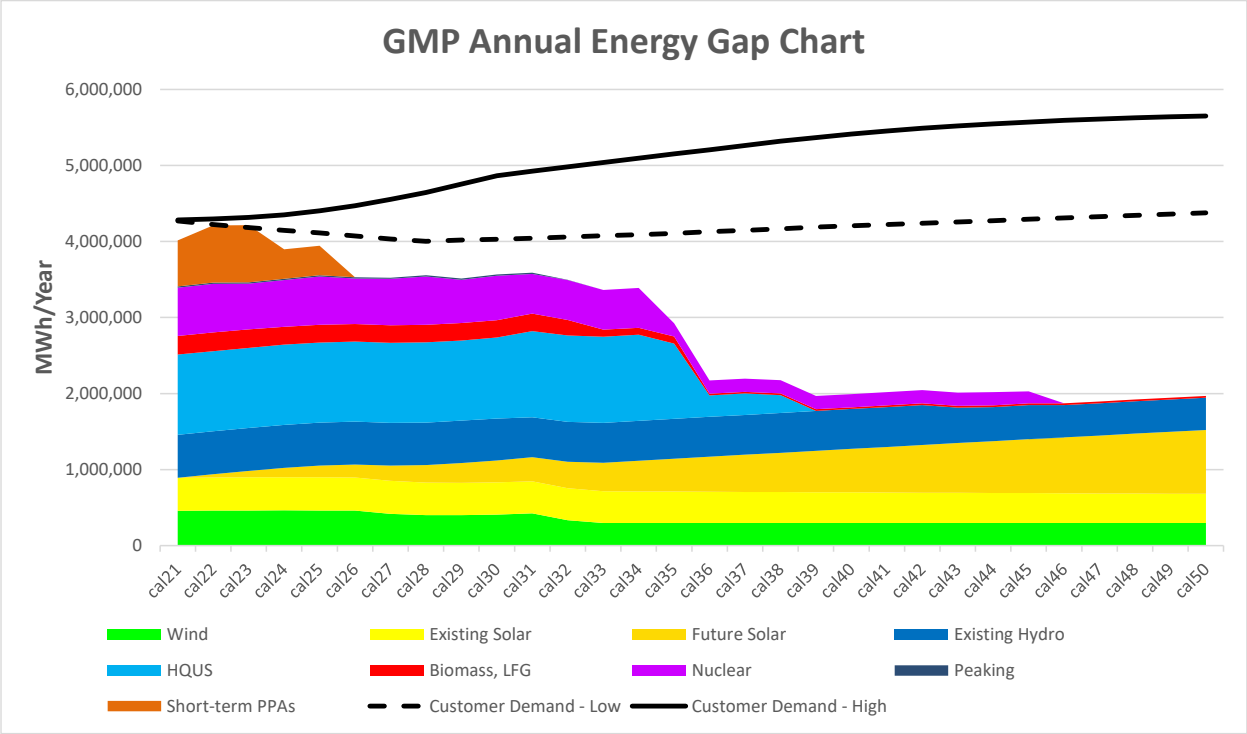
Chapter 5 of the IRP presents more details on many of the specific sources in GMP's supply portfolio. In aggregate, the current portfolio is characterized by a high degree of near-term price stability and an air-emission profile that is well below the regional average. As I will discuss below, a substantial volume of the larger PPAs that support these features will expire in the late 2020s and 2030s.

Q9. How much of GMP's future needs for energy are projected to be supplied by presently committed sources?

A9. **Figure 1** below compares the projected energy output of GMP's committed and expected power sources to a range of possible future energy requirements, on an annual basis.[2]

[2] Expected resources in the chart include assumed growth in small-scale solar and Standard Offer consistent with the current statutory framework, captured in the "future solar" bar. While these also could be considered a part of GMP's open position, we have consistently planned for these resources while recognizing that the pace and quantity may vary and may be supplemented or offset by the open position.

Figure 1



In short, while GMP's projected open energy position is limited in the near term consistent with our hedging strategy and expected needs, it is likely to increase greatly heading into the 2030s, especially if continued clean electrification takes hold as we hope and expect. With the expiration of significant PPAs from Granite Reliable Wind in 2032, the majority of HQUS deliveries in 2036, and NextEra Seabrook in 2034, GMP's energy needs will increase substantially. **Figure 1** also illustrates how the magnitude of energy needs in the 2030s and beyond will depend increasingly on the path of future electricity consumption—and particularly the extent to which Vermont and GMP are successful at electrifying energy uses like transportation and heating that are provided today by fossil fuels. We view this PPA as part of our layered strategy over the coming years to

continue to fill a portion of our portfolio with long-term, stable, reliable, and well-priced resources, recognizing that we will continue to have significant need in future years.

Q10. Can you please summarize the two paths of future electricity consumption that are shown in Figure 1 above?

A10. Yes, GMP expects modest growth in electric consumption in the near term, but expects electrification of vehicle transportation and other end uses likely will drive an increase in consumption during the 2030s and beyond. We utilize the two scenarios of possible future energy requirements shown above based upon the approach detailed in GMP's IRP (see IRP Appendix B).[3] Both the high and low scenarios assume that Vermont will continue to pursue a substantial package of cost-effective energy efficiency measures. The Low Demand scenario presented here starts with a reduction in energy sales of about 7 percent over the 7 years—which would be consistent with a near-term environment of economic downturn or discrete reductions in customer consumption—with possible modest economic growth and early electrification impacts. The High Demand scenario features faster and larger increases in electricity consumption, consistent with a more rapid conversion of most of the light-vehicle fleet to electric vehicles in the late 2020s and 2030s, combined with substantial ongoing electrification of the heating and cooling sector through adoption of heat pumps. This scenario is consistent with the high load scenario illustrated in VELCO's draft 2021 Long Range Transmission Plan,[4] and features

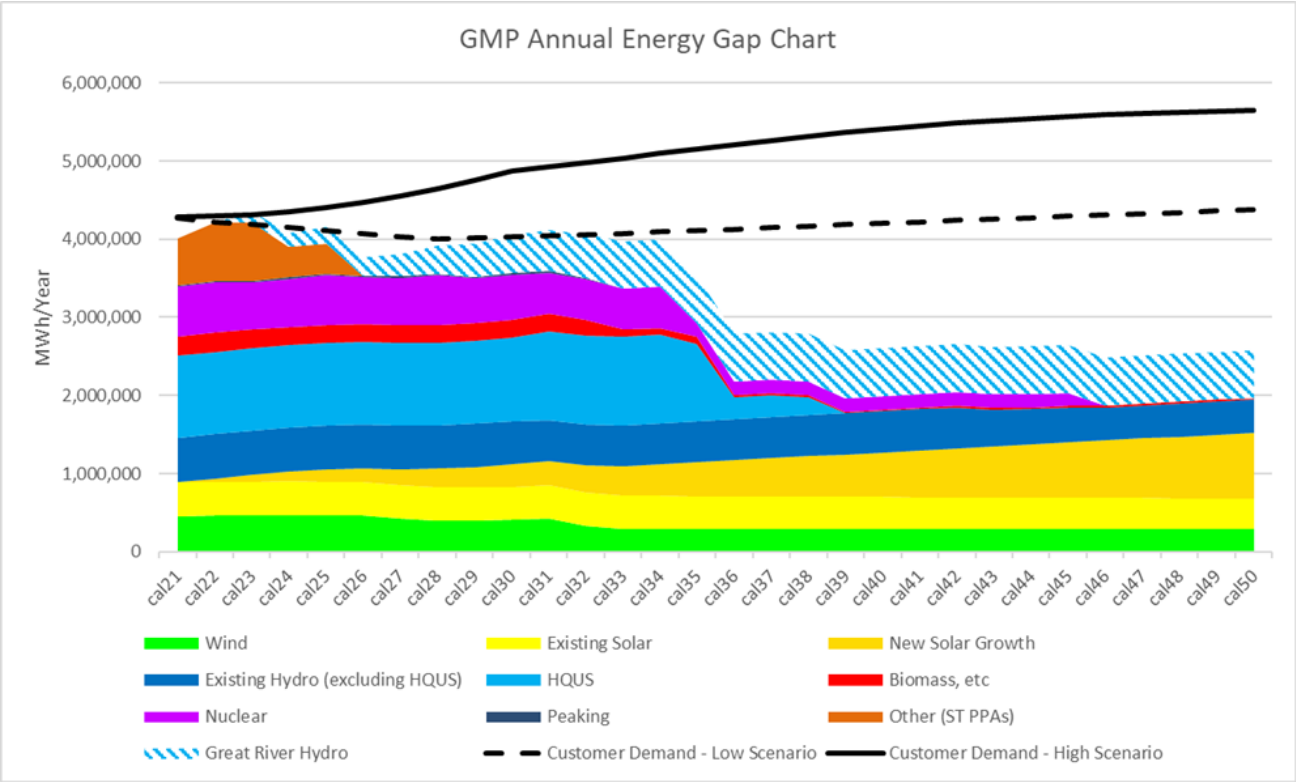
[3] https://greenmountainpower.com/wp-content/uploads/2019/12/2018-Integrated-Resource-Plan.pdf
[4] https://www.vermontspc.com/library/document/download/7206/2021Plan_draft_toVSPC.pdf

a cumulative increase of over 30 percent in annual electricity consumption over the next two decades. We chose a low/high approach in order to illustrate that under either scenario there is need for the PPA; bluntly, it is our hope and expectation that the Low Demand scenario is unlikely to occur given the strong push for electrification expected in the coming years to help meet climate goals.

Q11. How does the projected volume of energy deliveries under the PPA compare to the projected open energy position that you outlined above?

A11. **Figure 2 below** adds projected energy deliveries under the PPA (shown as the top supply source, with blue diagonal shading) to the annual energy balance shown earlier in **Figure 1.**

Figure 2



Under a Low Demand scenario, in the early years GMP's annual energy receipts including this PPA help fill GMP's projected annual open energy position; that changes rapidly in the 2030s to a substantial short position. Meanwhile, under the High Demand scenario, our energy deliveries including this PPA are meaningfully short even in the late 2020s and less than half of GMP's open energy position under the High Demand scenario. From the mid-2030s forward GMP's annual energy needs would exceed committed supply (including the PPA) by more than 1 million MWh in the Low Demand scenario, and by more than 2 million MWh in the High Demand scenario. Overall, regardless of where energy demand lands, we expect this PPA to provide an important slice of our energy needs while leaving open a meaningful portion of our supply to obtain from other renewable sources.

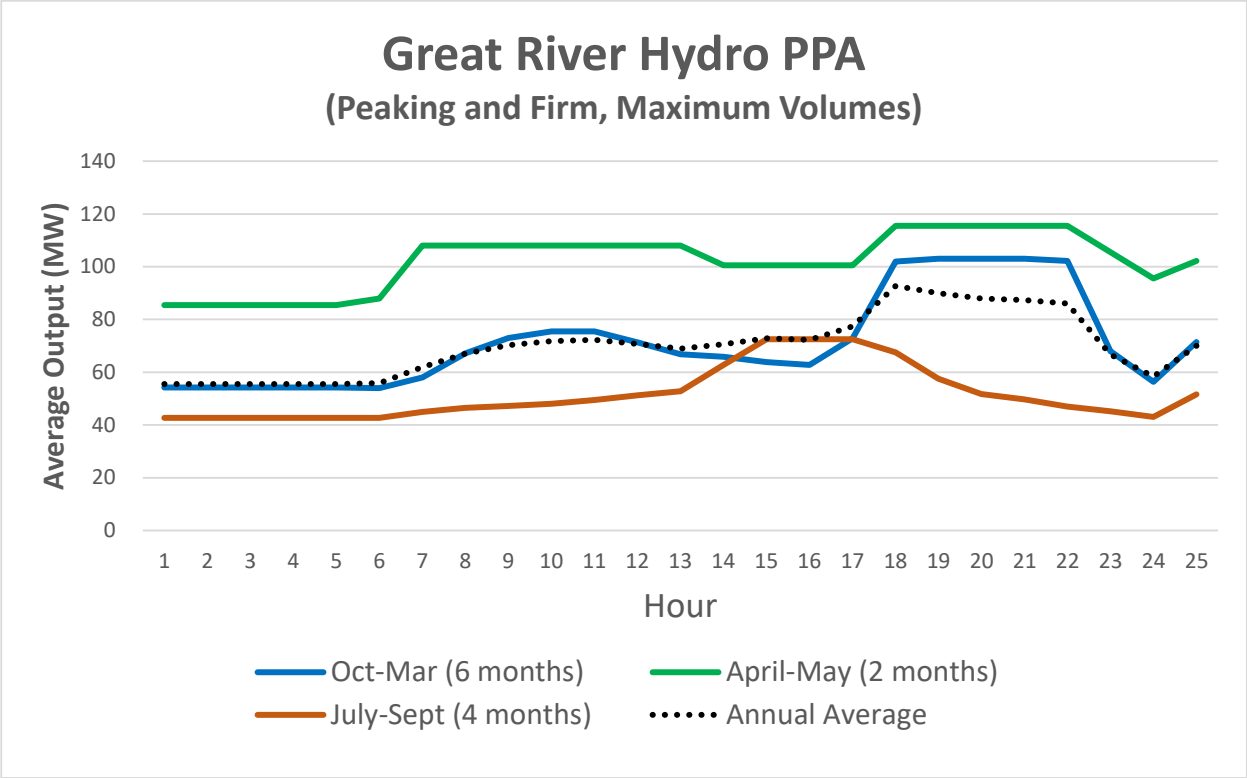
Q12. Does GMP's need for energy also vary over the course of the year?

A12. Yes, it does. **Figures 1 and 2** above present electricity supply and demand in aggregate over the entire year. GMP's needs for power can also vary substantially over the course of the year—by season, from day to day, and by time of day. These variations are driven primarily by characteristic seasonal and diurnal patterns in electricity demand and in the output of committed GMP generating sources (most notably the output of our intermittent renewable sources), along with short-term weather-driven fluctuations in electricity demand and renewable generation. As my colleague Andrew Quint and I will discuss further, the PPA's ability to deliver peaking energy in a pattern that is shaped to maximize the value of the output—along with firm energy in a steady pattern that fluctuates much less than many renewable alternatives—will tend to enhance its usefulness in GMP's power supply portfolio and its ability to help stabilize GMP's net power costs over time for customers.

Q13. Can you please provide an illustration of the anticipated pattern of energy deliveries under the PPA?

A13. Yes, **Figure 3** below illustrates representative hourly average PPA deliveries for each of three seasons. This includes both the peaking energy (based on long-term historical averages) and firm energy, after each of these components has ramped up to its maximum projected volume.

Figure 3



From a power portfolio perspective, these hourly profiles are attractive because they feature significant volumes of energy during evening hours (when electricity consumption and energy market prices tend to be high) and less during overnight hours when the opposite is true. It is also important to keep in mind that the average historical output profiles for the GRH peaking plants correlate with historical profiles of regional energy needs. To the extent that relative market needs and associated prices across the day evolve in the future (e.g., based on trends in regional electricity supply sources and consumption), GRH can flexibly adjust the timing of its output to some degree in response as further described in the testimony of Mr. Cole and Mr. Quint and addressed in the PPA.

In addition, the storage capability of the FMF Facilities and other GRH-controlled upstream reservoirs allows limited portions of the output to be shifted over a longer time period (e.g., between days, based on anticipated market prices) and over shorter periods (e.g., within a day, based on Real-Time market prices). These secondary flexibility features are not shown in the average output profiles above, but they would also tend to enhance the value of the peaking energy—as reflected in Mr. Quint's evaluation—and the anticipated robustness of that value in the future.

Q14. What types of sources are needed to meet GMP's future energy needs?

A14. GMP's **primary** need over the long term is renewable energy sources, to achieve not only the requirements of Vermont's RES but our own goals of a carbon-free supply by 2025 and a fully renewable supply by 2030. The RES establishes a set of mandatory requirements for Vermont's distribution utilities to obtain portions of their power requirements from two broad classes of renewable sources and to demonstrate compliance by the retirement of renewable attributes. The program also requires that Vermont's distribution utilities including GMP engage in energy transformation projects that lower costs and fossil fuel consumption.

The RES provision most relevant to the PPA is that Tier 1, which requires that by 2032 75 percent of retail electric sales be obtained from renewable energy sources of any vintage. The Alternative Compliance Payment ("ACP") for Tier 1 started at $10/MWh in 2017 when the program was adopted and escalates annually based on an inflation index. Tier 2 requires that by 2032, 10 percent of retail electric sales be obtained solely from

new distributed renewable generation sources defined as plants of 5 MW or less connected to the Vermont distribution system. This distributed generation requirement represents a subset of the Tier 1 total renewable requirement.

Q15. Will GMP need large volumes of additional renewables to meet the RES requirements and its renewable goals?

A15. Yes, **substantial** additional renewable supplies will be needed for GMP to achieve the RES requirements and our own goal of achieving a fully renewable power supply—and to keep the portfolio renewable over the long term. Considering the substantial magnitude of GMP's renewable needs under a wide range of potential future electricity demand—along with the tightening regional renewable market context that I will explain below—the PPA will be an important and needed step to help GMP achieve RES compliance, while also setting the stage for achieving our more aggressive goal of a fully renewable power supply.

Q16. How does GMP expect to meet its need for renewable resources?

A16. We know we must achieve these important renewable objectives and maintain them in the long term. **The** RES appropriately includes flexibility in the technologies and vintages of renewable generation that can be used to meet it. GMP plans to continue to utilize both existing and new renewable resources to meet needs in future years. Existing renewable sources provide important benefits to our portfolio—particularly a lower cost per kWh for customers and without potentially costly upgrades to the existing electric grid to accommodate their output. GMP therefore expects to meet some of its renewable

needs with existing sources—including the proposed PPA, which we view as a significant strategic resource for the GMP power supply.

We also know that the availability of existing renewable sources in New England is finite, and that neighboring states will be striving to achieve their own ambitious goals for an increasingly low-carbon and renewable energy supply. We expect increasing competition for those resources as neighboring states change their requirements[5] or procurement goals to value them more highly. New renewables also offer significant benefits (e.g., directly increasing the regional electric supply, spurring local economic activity, and ensuring a longer duration of supply) that existing renewables may not. It is clear that newly constructed renewables will also have a large and important role in meeting our future needs. For these reasons, GMP views the PPA as complementary to the acquisition of new renewables in Vermont and the region, not as a competitor to them.

3. PPA Features and Value

Q17. Why do the energy volumes that GMP will purchase under the PPA ramp up over the first decade?

A17. We sought to ramp up energy purchases over time to roughly follow the pattern of projected GMP net energy needs caused in part by the roll-off of existing resources shown above in **Figure 1**, reaching the maximum levels around the time that major

[5] For example, below I discuss the example of Massachusetts' new CES-E requirement.

existing GMP energy sources will expire. The pattern of gradually increasing purchases limits risk for our customers by avoiding the need to resell substantial volumes of purchased energy that would exceed GMP's needs in the early years of the PPA, enhancing the extent to which the PPA will stabilize GMP's net power costs.

Q18. Will the renewable attributes that GMP receives under the PPA help GMP to meet its obligations under the RES, and ultimately to achieve a fully renewable power supply?

A18. Yes. The **renewable** attributes are well-priced and helpful within our overall supply of Tier 1 resources now and into the future. They will be associated with output from GRH's existing hydroelectric plants on the Connecticut and Deerfield Rivers; the Commission has certified these plants as eligible for compliance with Vermont's RES Tier I requirement.

GMP will receive a stable quantity of 800,000 renewable attributes per year associated with GRH's hydroelectric fleet.[6] This is a favorable feature which should stabilize RES compliance costs over time and provide a tool to manage fluctuations in output of its renewable generation supplies including the GRH plants. The quantity of renewable attributes was chosen because our expected need for renewable attributes is somewhat earlier and more pronounced than for energy. In addition, considering the finite supply of existing renewables and other clean energy in New England and the prospect for

[6] GMP will not receive under this PPA energy or renewable attributes associated with generation from any future development projects that GRH might implement at its hydroelectric facilities.

increasing pressure on that supply, we believe that contracting for some of that supply on a long-term basis at affordable prices makes sense. Finally, a stable supply of Tier 1 renewable attributes at affordable prices provides flexibility to respond to state requirements and the regional market, and to plan to achieve carbon and renewable goals for customers.

4. Economic Benefit

A. Price and Value of Purchases

Q19. Is the pricing of energy and renewable attributes under the PPA attractive relative to most current sources of renewable and low-emission power?

A19. Yes, it is. The PPA was negotiated in late 2020, so its pricing is influenced by the current wholesale power market environment and future price expectations. As the Commission knows, while spot market energy prices in New England have exhibited substantial volatility in the past decade, prices are relatively low, and expectations have generally moderated. Some of the leading factors supporting this trend include an expansion of natural gas production nationally; moderate electricity demand growth in the northeastern U.S.; the development of substantial volumes of new renewable generation; moderate pricing of allowances in the Regional Greenhouse Gas Initiative ("RGGI") program; and limited attrition in the nuclear generation fleet. These factors have also supported a moderation of expectations for energy market prices for the foreseeable future.

The moderating energy price environment has tended to lower revenue expectations for wholesale generators, including hydroelectric producers like GRH, in the spot market

going forward and has led GMP to lower its price objectives for potential long-term PPAs. Consistent with these trends the pricing under the PPA—featuring a total initial price of about $45/MWh for the peaking energy and attributes, and an initial price of about $47/MWh for the firm energy and attributes several years later—is significantly lower than corresponding prices for current long-term sources that were acquired during the past decade at times of somewhat different market outlooks; these include the HQUS PPA and GMP purchases from NextEra Seabrook (nuclear) and Sheldon Springs (hydro). My colleague Andrew Quint presents the specifics of this price comparison.

Q20. Does the pricing of energy and renewable attributes under the PPA compare favorably to other major renewable alternatives?

A20. Yes, it does. The average price per kWh for energy and attributes under the PPA is much **lower** than the projected price of several large-scale renewable power sources—such as solar and offshore wind, and the proposed New England Clean Energy Connect ("NECEC"), which will deliver hydroelectric power into Maine—to which neighboring states have recently made major commitments. As my colleague Mr. Quint illustrates, the PPA will provide GMP a significant long-term supply of hydroelectric energy from GRH's fleet at prices that are substantially lower—in both the near-term and long-term—than these large-scale new renewable alternatives. The price advantage relative to current distributed scale renewable opportunities is also significant.

Q21. In addition to a price advantage, do you expect that the PPA will benefit GMP customers based on the relative market value of the energy that it provides?

A21. Yes. **The** relative cost-competitiveness of an energy source to GMP and its customers depends not only on the price paid, but also on the value of the energy in the market—which in turn depends on when that energy is delivered and potentially other factors.[7] In addition to a competitive price relative to many renewable power sources, the PPA will also likely have an advantage based on the relative market value of energy that it provides due to its overall fit to the shape of our load. This is a significant part of GMP's rationale for the purchase.

Specifically, the flexibility of the FMF Facilities that provide the peaking energy allows some of that energy to be weighted toward hours and days when system demand is greatest and the market value of energy is higher than average, and away from times when the value is lower than average. As Mr. Quint's testimony explains, this flexibility has historically resulted in the plants' energy output profile being noticeably more valuable than the simple average price of energy across all hours, on a monthly and annual basis. This premium value was achieved over a range of energy market conditions and streamflow conditions.

[7] As a simple example, a PPA priced at $50/MWh that provides energy during winter peak hours when market prices tend to be relatively high could be more attractive than one priced at $30/MWh that provides energy during off-peak hours in September when market prices tend to be relatively low.

Q22. If more attractively priced renewable energy sources were to become available, would the PPA prevent GMP from taking advantage of such opportunities?

A22. No. After the PPA is implemented, GMP will still have a significant need for additional renewable energy sources over most of the PPA's term, whether in a low- or a high-**load** scenario. For a sense of scale, in the high load scenario GMP's projected open energy position of over 1.8 million MWh in 2035 would be equivalent to the output of over 1,000 MW of solar PV generation at a 20% annual capacity factor, or about 600 MW of wind at a 35% capacity factor.

B. Evolving Regional Market

Q23. Can you please summarize the mix of electricity supply that presently powers New England?

A23. The largest share of New England's energy supply continues to be natural gas-fired generation—primarily from relatively efficient combined cycle plants, with lesser volumes generated by older combined cycle plants and less efficient steam cycle plants. Nuclear energy from the Millstone and Seabrook stations is presently the second-**largest** energy source. Coal and oil have largely been driven from the regional energy mix, as lower-priced natural gas has displaced oil- and coal-fired generation in the regional supply stack during most hours of the year and substantial volumes of older capacity have retired. Oil-fired plants play a significant role in meeting the region's capacity (resource adequacy) requirements at times of higher need, but they operate relatively infrequently in a peaking role. Hydroelectric energy provides roughly 7 percent of the regional supply, while growth of in-region renewables is led by wind (large scale) and solar (a mix

of distributed and larger-scale projects). Our region also receives a meaningful amount of energy from neighboring control areas (primarily NYISO and Québec) and this is expected to grow in future years based upon projects like the NECEC achieving commercial operation, as discussed below.

Q24. Do the New England states aim to substantially change that supply mix in the future?

A24. Yes, one of the most important trends affecting the regional power market is that the New England states—along with New York—seek to make the electricity supply much more **renewable** over time, and to greatly reduce the greenhouse gas ("GHG") emission profiles of their economies in the long term. These states are increasingly establishing specific requirements and goals and are working to identify more specific paths to achieve these goals. The following are a few prominent examples of this trend:

- Each of the five other New England states has established a long-term policy goal of reducing GHG emissions by at least 80%;

- Massachusetts recently issued its Draft 2030 Clean Energy & Climate Plan and has established increasing RPS Class 1 (new renewable) requirements along with Clean Energy Standards that include existing resources such as Hydro Québec.

Recent policy proposals have included increasing the pace of Clean Energy and RPS requirements and increasing wind procurement authority by 2,400 MW.[8]

- Connecticut has established a goal of zero carbon electricity supply by 2040, including nuclear and large hydroelectric sources, and recently issued its 2020 Draft Integrated Resource Plan.[9]

- Rhode Island recently issued its Road to 100% Renewable Electricity Report, working toward a goal of a fully renewable electric supply by 2030.[10]

These states are also taking significant steps in pursuit of these goals—including signing long-term power purchase contracts to support several thousand MW of renewables in the form of offshore wind, hydroelectric energy via the proposed NECEC transmission line in Maine, and other sources. Other programs are supporting growth of distributed renewable generation—primarily solar—which has already led to the growth of solar generating capacity in New England to over 3,000 MW, with more to come in future years.

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[8] https://www.mass.gov/info-details/massachusetts-clean-energy-and-climate-plan-for-2030
[9] https://portal.ct.gov/DEEP/News-Releases/News-Releases---2020/DEEP-Issues-Draft-Integrated-Resources-Plan
[10] http://www.energy.ri.gov/100percent/

Q25. To what extent would New England's electric generation mix need to evolve, in order to achieve the goals cited above?

A25. The volumes of new renewable sources needed to accomplish a transition of this magnitude will be very large—potentially on the order of 10,000 MW of additional wind capacity combined with 10,000 MW of additional solar generation—particularly if the region is successful at electrifying substantial portions of the economy like transportation and heating that are the top sectors for carbon pollution.

Q26. Will this evolution have significant implications for operations and prices in the New England power market?

A26. Definitely. The actual magnitude and timing of changes will depend on a range of factors, but regardless a transformation of this scale will have substantial implications for the supply stack of electric sources in New England and could substantially alter the profile of future energy market prices. In particular, looking to the 2030s and beyond:

- A decarbonized electric grid in New England will likely feature additions of solar and wind generation far beyond the present fleets for these technologies.

- The energy from these renewable sources would displace much of the current output from the fleet of natural gas-fired and oil-fired plants in New England,

potentially hastening the retirement of thousands of MW of existing fossil-fired capacity that presently operates in a load following or peaking role.[11]

- Changes like these in the regional supply stack will tend to put downward pressure on Locational Marginal Prices ("LMPs") during hours and days when output from new renewables like solar and offshore wind is high.

Output from the renewable generation fleet will sometimes be at much lower levels, and it seems likely that some significant volumes of existing load-following fossil fueled generation will be retired. It is reasonable to expect that during times when output from the renewable generation fleet is low, and in high-load periods like evening peak hours or during particularly hot/cold days that feature high electric demand, market prices may increase in relative terms.

The specific timing and magnitudes of these market trends are uncertain, and will depend on factors including the pace, mix, and location of new renewable sources that are actually added to the New England grid—along with the pace and location of energy storage that is deployed along with these resources, and the evolution of the bulk transmission grid and inter-regional power transactions over time.

[11] A substantial fleet of capacity with operational flexibility will likely be needed, to generate reliably on a more occasional basis, to ensure that the region can maintain resource adequacy and operating reserve requirements—particularly during periods when output from the core renewable fleet is unusually low. While existing fossil-fired plants could continue to serve this role, so too could new energy storage resources and demand side resources.

Q27. In this evolving market context, will the PPA's features of flexible peaking energy and steady firm energy be useful to GMP and its customers?

A27. Yes. These features support the PPA's robustness, enhancing the likelihood that the PPA will **deliver** value to our customers over time. The features of the PPA tend to enhance the PPA's effectiveness at stabilizing GMP's net energy costs, and its cost-competitiveness relative to some other types of renewable sources.

In particular, because a portion of the peaking energy can be shifted toward hours of high market prices and away from lower-priced hours, it is reasonable to expect that the average value of those deliveries compared to all-hours averages will be maintained over time—and could potentially increase to the extent the spread between the high- and low-priced hours increases over time. Similarly, the steady volumes of firm energy that GMP will receive across the year will provide a level of market value consistent with the all-hours average—including both the high-value and low-value hours that I mentioned earlier.

Q28. In addition to deployment of new renewables in the region, does GMP anticipate increasing competition for existing low-carbon generation sources like the GRH fleet?

A28. Yes, this does seem likely. A review of the supply and demand for "existing" **renewables** indicates that the supply of in-region existing renewables is limited. A significant portion of these resources are likely to be utilized to meet requirements in neighboring states (e.g., MA Class II, MA Class II Waste to Energy, and New Hampshire

Class IV) leaving a supply of well under 10 million MWh of in-region plants—primarily hydroelectric plants—potentially available to serve the RES Tier 1 needs of Vermont utilities. Projected growth in the requirements of Vermont RES Tier 1 and other state programs has the potential to absorb much of the existing in-region supply by the end of the decade, even without considering the potential for one or more states to implement policy changes that puts additional demand on this pool of renewables. These supply/demand trends indicate the potential for upward pressure on the market price of existing renewable resource attributes, particularly considering that ownership of in-region hydro is relatively concentrated.[12]

Q29. Is competition for attributes from renewable and low-carbon generation sources already emerging?

A29. Yes, neighboring states are looking toward these sources to help achieve their portfolio goals. For example, Massachusetts recently established a Clean Energy Standard – **Existing** ("CES-E") requirement, for which eligible compliance sources include a portion of New England's nuclear and hydroelectric generation (including the GRH plants), along with hydroelectric imports via Phase 2 of the Québec/New England Interconnection. By the mid-2020s the volume of the CES-E requirement is estimated to reach almost 9 million MWh per year—or about twice GMP's entire current annual energy requirements. Meanwhile, Connecticut has purchased significant portions of the

[12] Two owners of in-region hydro, one of which is GRH, are estimated to control plants that provide roughly half of New England's in-region conventional hydro generation.

energy output from the Millstone and Seabrook plants under multi-year PPAs and has purchased all of the generation attributes from the Millstone nuclear plant—which could exceed 15 million MWh per year, or almost four times GMP's entire annual energy requirements—through the 2020s.

Together, these initiatives will greatly reduce the volume of generation attributes from renewable or zero-emission generators that will be available in the region. It is also possible that other initiatives from the neighboring states—each of which is much larger than Vermont in terms of electricity demand and potential purchasing power—will emerge in the future, further tightening the supply for renewables from non-emitting sources including the GRH plants. This PPA provides GMP with significant protection against future potential price increases for renewables from existing resources, which will help GMP to meet its RES obligations in a cost-effective manner for customers.

Q30. During a regional supply transition toward new renewables and increasing competition for existing renewable supplies, does GMP anticipate that the structure of the wholesale markets may also evolve over the course of the PPA?

A30. Yes, the current market backdrop suggests changes may result. Due in part to **moderate** price outcomes and moderate expectations for future energy and capacity prices, it appears wholesale energy and capacity market prices will not be sufficient to support the total cost to develop and operate many types of new renewables that will be needed to decarbonize the New England grid—such as offshore wind, distributed solar, and

renewable projects that require grid upgrades—at least in the near future.[13] In this market context, the New England states have generally turned to supporting the deployment of new large-scale renewables through long-term power purchase agreements to support construction at prices that are significantly higher than wholesale energy and capacity market price expectations. New distributed renewables are often supported through state-specific net metering or other programs that offer relatively stable revenue streams in the way that Vermont's Standard Offer Program does. This means that a substantial and potentially increasing fraction of the costs of new renewables are being supported through mechanisms other than the regional wholesale markets, which signals that changes to the markets over time are likely to emerge.

Q31. Is it clear exactly how New England's market structure will evolve, and when?

A31. No. Regional forums have begun to address the implications of the transition toward **renewable** power that I summarized above, from perspectives that include system planning, operations and market design. That dialogue is presently at an early stage; my understanding is that it will address potential market paths for market design that include (but are not limited to) the following:

- A Forward Clean Energy Market construct, in which states could meet their needs by procuring clean energy supplies through periodic regional solicitations. Depending on the design details, this path could entail a shift of market value

[13] The RGGI will put upward pressure on energy market prices over the next decade, but the price range will likely not change these relationships in a fundamental way.

away from the energy market and toward clean energy attributes and could potentially lead to a higher market value for attributes associated with existing large hydro sources like the GRH plants.

- A large increase in the price of GHG emissions that is reflected in the energy market, to more closely approximate estimates of the societal cost of such emissions. This path would almost certainly increase energy market prices in the near term and reduce the fraction of new renewable costs that need to be supported through out-of-market mechanisms. In the longer term, if New England makes substantial progress on building out the renewable generation fleet, this path could tend to put upward pressure on market prices during hours (e.g., high electric demand, low renewable production in the absence of significant long duration storage) when fossil-fired generation still needs to operate, compared to hours (e.g., low demand, high renewable production) when most or all of the region's power needs can be met with low-carbon sources. This path could increase the value of the peaking energy delivered under the PPA relative to other renewables that are less able to shift significant volumes of output in response.

- If little or no structural changes occur and New England's renewable transition is supported primarily by long-term state sponsored PPAs, then the ISO-New England energy market would likely serve primarily as a balancing market to choreograph the output of the region's sources in a cost-effective way, but not a

primary mechanism to incent the development and operation of new renewables or low-emission generation.

- Federal legislation to support decarbonization efforts could also emerge, with consequences for the wholesale electricity market structure and/or the profile of market prices; some of these potential changes could increase the value of energy and/or attributes that GMP receives under the PPA.

Q32. Does the PPA's structure mitigate uncertainty with respect to future market structure?

A32. Yes. During the term of long-term purchases like the PPA, changes in market structure could potentially lead to a shift in the relative value of market products (e.g., environmental attributes increasing in value compared to energy) or to the development of a new **market** related to clean energy. Buying GRH's energy and attributes in this PPA—and defining those attributes broadly in the PPA as Mr. Cole explains—is a significant protection for our customers against this risk.

Q33. Describe how the factors you mention above informed GMP's decision to proceed with the PPA.

A33. Our decision was based primarily on the considerations discussed above regarding the PPA's features (size, location, competitive pricing compared to alternatives, dispatch flexibility and firmness, and robustness); GMP's portfolio needs for energy and renewable attributes; and the market context in which GMP operates. These considerations indicate that the PPA is an appropriate resource to acquire and that this is

an appropriate time to acquire it. I note that we relied on these factors more than a strict comparison of potential future market forecasts given the uncertainty and range of such forecasts at this time, and the fact that energy market price forecasts of this type may not reflect the total cost of the renewable resources entering the market.

A current forecast of future market prices for spot market or short-term transactions can shed only limited light on this resource choice due in part to the uncertainty around the wholesale market design that will apply over the term of the PPA. This structural uncertainty is in addition to more traditional uncertainties that also drive potential outcomes in electricity market prices—such as electricity demand growth, the pace and timing of generator additions and retirement of existing generators, and the availability of energy from neighboring regions. This PPA helps provide some certainty, especially considering the lack of clarity regarding how quickly the region will be able to scale up and then maintain the pace of renewable generation additions that will be needed to accomplish the goals of the New England states that I discussed above. Those needs for renewable power sources will be even greater when electricity demand increases, potentially substantially, due to wide adoption of electric vehicles and other clean electrification trends.

It is also important to keep in mind that a long-term forecast of future spot market prices may not reflect a path that GMP could actually pursue to acquire the output of this particular resource in the future. As I discussed earlier, competition for low-carbon New England generation sources is likely to continue and to increase. The GRH hydro fleet

represents about a quarter of the regional supply of conventional hydroelectric generation, and it has some unique positive features that distinguish it from many other renewable sources as already discussed. We feel strongly that the value of this PPA will be responsive regardless of future market changes.

Q34. Has GMP compared the cost of power under the PPA to a range of potential future market price outcomes?

A34. Yes, despite the limitations of this approach noted above, we have done so. Mr. Quint's testimony explains three plausible long-term paths for future energy market prices in New England and compares the projected costs under the PPA to the estimated value of that output under each scenario. Mr. Quint's comparison indicates that under a range of energy market price outlooks, the effective cost of power under the PPA would be equivalent in present value terms to paying the prevailing price of energy in the spot market plus environmental attributes priced at between 30% and 75% of the ACP for RES Tier 1.

Q35. Can you please put Mr. Quint's illustration into context?

A35. Yes, my primary observation is that the future energy market price paths that Mr. Quint presents are intended to be a fairly stringent test—featuring long-term average prices much lower than the scenarios presented in GMP's most recent IRP. In fact, what Mr. Quint presents today as a potential high market price outcome for the purpose of testing the PPA is much lower in the long term than the base energy market price scenario from

GMP's 2018 IRP, while Mr. Quint's base and low cases are each lower than the IRP low market price scenario.

The primary reason for the lower assumed price paths is that for the purpose of screening the PPA's value, we have assumed that the New England states will deploy significant volumes of new renewable generation—on a much more rapid scale than in recent years—to largely accomplish their goals for greatly reducing the carbon intensity of the electricity supply. This is assumed to drive down winter natural gas price differentials in New England, and to generally drive down electricity market prices relative to natural gas fuel over the course of the year. This general path for the transition of New England's electricity market is a plausible one but the specifics and timing are not certain, as already described. The other key reason I called these price paths stringent is that they reflect the low end of potential outcomes with respect to the wholesale market structure. Specifically, we have assumed here that the current market design will remain in place, with no structural changes such as those I mentioned earlier—like much higher carbon pricing in the electric market, or some designs of a Forward Clean Energy Market or a Clean Energy Standard—that have the potential to significantly enhance the value of energy and/or attributes that GMP receives under the PPA.

Although GMP is only placing limited weight on current market price forecast comparisons with respect to this unique resource, Mr. Quint's work shows that under a range of potential energy market price outcomes, GMP would effectively be paying well below the RES Tier 1 ACP for a renewable resource that has a number of unique and

favorable characteristics. This supports GMP's view that the PPA is reasonably priced, particularly considering the price paths that Mr. Quint tested are conservative in a number of respects.

C. Mitigating Risks Associated with the PPA

Q36. What are some of the potential risks associated with entering into this PPA that GMP considered?

A36. We considered a number of risks associated with this PPA, including the possibility of lower alternative renewable supply pricing, seasonal surplus, and lower than projected attribute **pricing**. With regard to lower priced alternative renewable supply, the risk of the PPA becoming an above-market renewable source is mitigated by significant factors—some of which I discussed earlier—which collectively make this risk an acceptable one:

- The price of energy and attributes under the PPA—starting at about $45/MWh—is much lower than most new renewable power options, and in fact lower than many of our existing sources. To overcome this gap, improvements in new renewable technology and costs would have to be very substantial and they would likely require many years—greatly limiting their impact in present value terms for our customers.

- The PPA's non-price features (partial dispatchability, steady volumes of firm energy, and attributes) enhance the value of the energy that GMP will receive and enhance the robustness of that value compared to other leading renewable options.

This increases the value gap other renewables would need to overcome through improvements in cost and performance.

- Achievement of the renewable power and decarbonizing goals of Vermont and neighboring states will require extraordinary volumes of new renewable generating capacity. It is reasonable to expect that the required levels of renewable development will increasingly require grid upgrades—on the bulk transmission, distribution, and/or subtransmission levels of the grid—which will impact the total cost to develop them.

- Finally, if new renewables on a broad scale become cost-competitive compared to this PPA in the long term then it will be a good problem to have—and our customers will benefit greatly through access to those cost-competitive renewables to fill the remaining parts of GMP's substantial long-term energy needs as previously described.

Regarding seasonal surpluses, we recognize that the peaking energy will have relatively high output during the spring. However, we have taken the potential excess and resale risk into account in Mr. Quint's analysis of how energy from the PPA fits with GMP's power supply needs on a seasonal and hourly basis. The receipt of energy during spring months is inherent in a long-term purchase from a hydroelectric supplier; GMP views it as acceptable in this case for a few reasons. First, output from other leading renewable options in the region like solar and wind also tends to be fairly high during spring. The flexible output profile of the FMF Facilities will also allow some of the peaking energy to

be shifted toward hours where it is most valuable and away from hours when regional supply is ample. Finally, it is also important to keep in mind that the firm energy component of the PPA will deliver a substantial supply of hydroelectric energy in a steady pattern across the year—without the characteristic seasonal surges and declines associated with plant-specific renewable sources including hydroelectric.

With regard to renewable attribute pricing, we recognize that attributes from existing hydroelectric plants in the region have typically been available at modest prices in recent years—although typically only for short purchase terms. While it is possible that a low-price environment like this could persist for a long time, this seems unlikely considering the New England states have all established strong goals for decarbonizing the electric supply mix and the economy as a whole. Neighboring states are already shifting their qualifications to consider all potential sources—including existing renewables and low-carbon generation like the GRH fleet—to meet those goals. This trend seems likely to put upward pressure on market prices for renewable attributes associated with existing hydro plants including the GRH fleet. In any case, the risk of overpaying for the GRH generation attributes is limited, since the starting price for the attributes is modest and will escalate at a fixed, moderate rate over time.

Q37. Are there any other risks GMP identified associated with the PPA, and if so, how did you address them?

A37. Relicensing is a risk we identified, and as Mr. Cole's testimony summarizes, we found it to be limited. A key observation from GMP's perspective is that the FMF Facilities were

relicensed relatively recently and are expected to retain their operational characteristics—and their unique value in the context of GMP's portfolio of supply sources—for most of the PPA term.

Another identified risk is the delivery point for energy. The financial value that GMP receives for its energy under the PPA will be determined by LMPs for energy at the prescribed delivery points. The delivery point for the firm energy will be the Vermont Load Zone (#4003), the location at which GMP purchases almost all of its load requirements. For this component of the purchase there is essentially no risk that changes in regional congestion or losses will disconnect the value of energy that GMP purchases from the cost of energy that GMP must purchase to meet its load requirements. The peaking energy component of the purchase will be delivered at the market nodes where the energy is produced by the individual FMF Facilities at the Moore, Comerford, and McIndoes stations. As Mr. Quint explains, these locations have featured only limited congestion and loss differentials relative to the Vermont Load Zone. While future congestion could develop, GRH will have an aligned incentive to operate to avoid negative consequences and the PPA terms support this outcome. On the whole, the basis differential risk associated with energy purchased under the PPA is limited and is comparable to or less than the basis differential risk associated with many leading renewable energy options in the region due to their location and/or scale.

Q38. Recognizing the risks that you have discussed above, is the PPA an appropriate supply source for GMP and its customers?

A38. Yes. The proposed PPA is a reasonably priced long-term renewable resource that extends well past most of GMP's existing energy supplies, bringing characteristics that are not **available** from many other renewable power options. The PPA's shaping and firmness features will help GMP achieve and sustain a fully renewable power supply in a cost-competitive way over the long term, and they are complementary to the acquisition of substantial additional new renewable sources locally and regionally that GMP expects to need in the future.

5. <u>Section 248 Criteria</u>

Q39. Does the PPA meet a need for present and future demand for service that could not otherwise be provided in a more cost-effective manner through energy conservation programs and measures or energy efficiency and load management measures, as required under (30 V.S.A. § 248(b)(2))?

A39. Yes. As I discussed earlier GMP has a substantial long-term need for energy and renewable attributes, based on electric demand forecasts that incorporate estimated reductions from **ongoing** energy efficiency in GMP's territory. The proposed PPA would provide only a limited portion of those needs, leaving a large fraction to be met with future supply- and demand-side resources.

It is possible that some additional amounts of energy efficiency or demand response resources (above the levels already reflected in GMP's current forecast) might be

obtained at a cost that is lower than future supply alternatives. It is not realistic, however, to expect that cost-effective energy efficiency or other demand-side resources could meet close to the magnitude of GMP's projected resource needs.

Q40. Will the PPA result in an economic benefit to the state and its residents, as required by 30 V.S.A § 248(b)(4)??

A40. Yes. As explained in detail above, the PPA will benefit GMP and its customers in several ways, **most** importantly as a significant long-term source that supports the development of an affordable, renewable, and reliable power supply. The PPA will be beneficial in the following ways:

- The PPA will help GMP maintain competitive and stable electric rates through its pricing, profile and flexibility of deliveries, and other favorable characteristics. This will benefit Vermont by promoting affordability of electricity for our customers, supporting the economic competitiveness of Vermont businesses and Vermont's ability to attract new businesses, and supporting cost-effective electrification of energy sectors like transportation and heating that are presently mostly supplied by fossil fuels.

- The products and volumes to be purchased are appropriate to the needs of GMP's resource portfolio. The combination of affordable pricing and a useful output profile makes the PPA complementary to the acquisition of other renewable sources that will be needed to achieve and maintain a highly renewable power supply.

- The profile of deliveries under the PPA—a combination of flexible peaking energy and steady firm energy—enhances the value of those deliveries in the wholesale energy market and enhances the robustness of that value over time in an evolving regional electricity market. The profile of deliveries also tends to supply significant amounts of renewable energy during times when GMP is likely to need it the most like during evening peak hours of high electricity demand, or times when output of other renewable sources is relatively low.

- The PPA does not impose substantial collateral requirements on GMP, which ultimately benefits our customers.

Q41. Is the PPA consistent with GMP's procurement strategy and with principles for resource selection contained in GMP's IRP as required under 30 V.S.A § 248(b)(6)?

A41. Yes, it is. As discussed in the 2018 IRP, GMP's power supply goals and evaluation focus on how to achieve Vermont's RES requirements in a low-cost way, while managing considerations of portfolio diversity, flexibility, and stability. The IRP observes that GMP's portfolio features large energy needs in the 2030s forward as major existing **sources** expire, and that to the extent GMP makes long-term portfolio additions they would likely be associated with strategic goals including meeting renewable requirements in a cost-competitive way. The IRP observes the increasing role of intermittent renewable resources in GMP's supply, with intermittence being a potential differentiator between sources that are similar in other respects. We also noted that the development of flexible resources like battery storage and controllable loads would be complementary to

a portfolio containing sources that are increasingly renewable and intermittent. Based in part on these observations, the IRP outlines an Illustrative Future Portfolio that includes long-term additions of plant-contingent existing hydro power and firmed hydro purchases, among other resources.

The proposed PPA is a long-term hydroelectric purchase that is consistent with these IRP observations and themes, and it will move GMP significantly toward the Illustrative Future Portfolio. The peaking energy component of the PPA will deliver plant-contingent energy from the FMF Facilities shaped in a flexible pattern that benefits from those plants' significant storage capabilities, providing significant energy during winter months and evening peak hours. The firm energy component will leverage the diversity of GRH's fleet to deliver a steady volume of renewable energy across the year, without the seasonal profile and intermittence associated with other in-region hydro resources. The ramp-up of annual energy deliveries over time is designed to address the pattern of GMP's energy needs over time. In total, the PPA's components provide a hydroelectric source that is similar to the illustrative plant-contingent and firmed long-term hydro purchases from the IRP, with a more favorable output profile and noticeably lower pricing.

Q42. Please explain how the PPA complies with the Comprehensive Energy Plan under 30 V.S.A. § 248(b)(7).

A42. This PPA is directly supportive of Vermont energy policy goals including energy adequacy, **reliability**, security, and affordability. As I discussed in detail above, the PPA

will provide a well-priced long-term source of renewable energy. This supply will be backed by a fleet of hydroelectric plants that provide reliable supply and an output profile that is favorable for GMP's customers. The PPA is consistent with the Comprehensive Energy Plan's strategic recommendations of planning carefully to meet all three tiers of the RES in a least-cost manner and securing additional stable long-term hydropower supply potentially available regionally. The PPA's favorable pricing and complementary output profile also support other important Comprehensive Energy Plan goals—including strategic electrification of energy uses that are presently supplied by fossil fuels, and continued development of instate renewable resources.

Q43. Can the PPA be served economically by existing or planned transmission facilities without undue adverse effect on Vermont utilities or customers and without adversely affecting system stability and reliability, as required by Sections 248(b)(3) and 248(b)(10)?

A43. Yes. The power will be sourced from a fleet of existing generating plants in New Hampshire, Vermont, and Massachusetts that are already interconnected with the New England transmission grid. No new transmission facilities are needed in Vermont for GMP to take advantage of the PPA, nor will there be an adverse impact on the Vermont transmission system.

Q44. How will the electricity purchases under the PPA promote the general good of the State, as required by Section 248(a)?

A44. The PPA promotes the general good of the State because it will meet a portion of our customers' long-term need for renewable power in an affordable, reliable, and robust way, through cost-**effective** pricing and useful output profile. For the reasons discussed above with respect to need, economic benefits, and resource planning, the PPA will support GMP's progress toward building and maintaining a highly renewable power supply.

6. Conclusion

Q45. Does this conclude your testimony?

A45. Yes.

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