STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Case No. 18-0974-TF

Tariff filing of Green Mountain Power Corporation requesting a 5.45% increase in its base rates effective with bills rendered January 1, 2019, to be fully offset by bill credits through September 30, 2019.

PREFILED DIRECT TESTIMONY OF

CHRISTOPHER C. DAWSON

ON BEHALF OF THE

VERMONT DEPARTMENT OF PUBLIC SERVICE

AUGUST 10, 2018

Summary: On behalf of the Department of Public Service, Mr. Dawson reviews Green Mountain Power's hedging program consisting of short-term purchases for energy and capacity requirements and sales of Renewable Energy Credits. Mr. Dawson also reviews Green Mountain Power's proposed Joint Venture Solar / Battery Projects as well certain of its ongoing Energy Transformation Projects. Finally, Mr. Dawson discusses Green Mountain Power's treatment and review of demand response resources.

Mr. Dawson Sponsors the Following Exhibits:

Exhibit PSD-CCD-1 – Resume / CV

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Direct testimony
Of
Christopher C. Dawson

I. QUALIFICATIONS AND SUMMARY

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

A1. My name is Christopher C. Dawson. I am a consultant with GDS Associates, Inc. ("GDS"). My business address is GDS Associates, Inc., 1850 Parkway Place, Suite 800, Marietta, GA 30067.

Q2. Please describe your education and professional experience.

A2. I have a Bachelor of Science in Industrial Engineering from the Georgia Institute of Technology and a Master of Business Administration from Georgia State University. I am also a registered Professional Engineer in the State of Georgia. I have worked at GDS since 1994 and my specific work experience includes integrated resource planning, economic feasibility analyses of long-term and short-term power supply alternatives (including new generation facilities, distributed generation, and renewable resources), transmission access and pricing, conducting solicitations and procurement of power supply resources, contract negotiations, reviewing formulary rate cost-of-service arrangements, financial planning and operating budget projections, managing technical and operational issues in RTO markets, financial analysis, and risk management assessments. My professional resume is included as Exhibit PSD-CCD-1.

Q3. On whose behalf are you testifying?

A3. The Vermont Department of Public Service ("Department").

Q4. Have you ever testified before the Vermont Public Utility Commission?

A4. No.

Q5. What is the purpose of your Direct Testimony?

A5. The purpose of my testimony is to review and discuss Green Mountain Power's ("GMP") hedging program, provide an assessment of GMP's evaluation of the Joint Venture Solar / Battery projects and the Energy Transformation projects, and discuss GMP's treatment and review of Demand Response resources.

Q6. Please summarize your conclusions and recommendations.

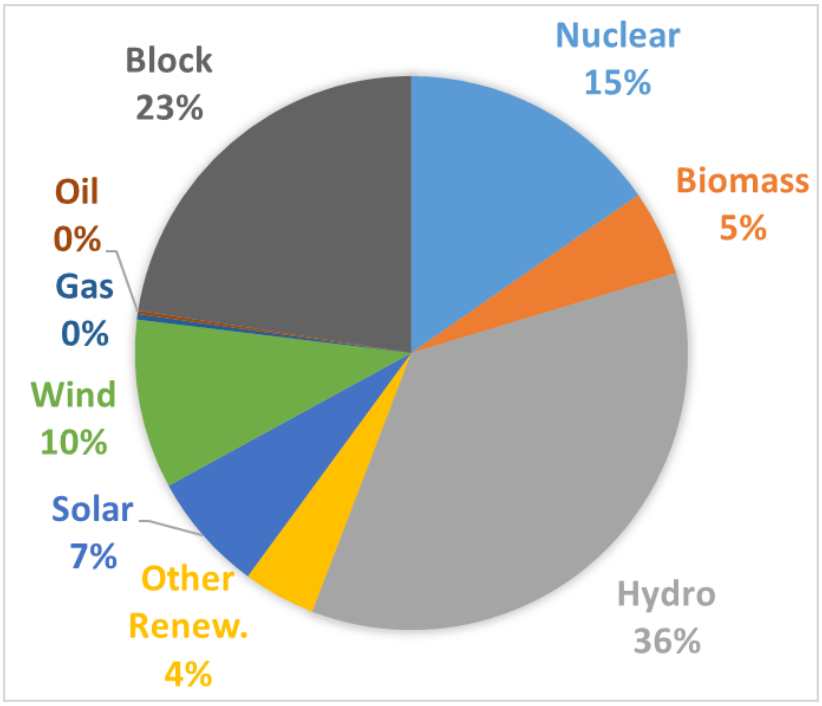
A6. With respect to GMP's hedging program, I conclude it is insufficiently documented and structured. GMP's hedging related activities should be codified in a manner that is transparent to outside parties. Regarding the Joint Venture Battery / Solar Projects and Tesla Powerwall 2.0 Program, I find that GMP's modeling and analysis is flawed or incomplete such that these projects may not produce the financial benefits that GMP projects. Finally, I conclude that GMP has not sufficiently evaluated or considered the potential for Demand Response as a resource alternative.

II. REVIEW OF GMP HEDGING STRATEGY

Q7. Please provide a brief overview of GMP's power supply portfolio.

A7. GMP, a vertically-integrated, non-public utility, is a Load-Serving Entity ("LSE") in the ISO-NE RTO market. As a LSE, GMP procures energy, capacity, and ancillary services from the ISO-NE market. GMP's power supply portfolio acts as hedge against the risk of market prices being much higher than the power cost from GMP's portfolio. The power supply portfolio consists of wholly and jointly-owned generation resources, long-term power purchase agreements and shorter-term bilateral contracts with market energy suppliers. There is also significant solar generation that is located behind the retail meter in GMP's service territory. Figure 1 summarizes GMP's power supply portfolio projected generation for the rate period.

Figure 1: GMP Rate Period Projected Generation[1]



Q8. Please summarize your review of GMP's hedging strategy.

A8. My review focuses on both the hedging strategy that GMP is following as well as the process that GMP is undertaking to implement the strategy. Specifically, I will be reviewing GMP's short-term energy, capacity and REC hedging processes, each of which are discussed in turn below. To be clear, my discussion does not pertain to GMP's decision to leave a portion of its energy and capacity unhedged by long-term commitments. Instead, my discussion pertains to how GMP manages that unhedged position through shorter-term commitments.

[1] See GMP energy model provided to the Department of Public Service on April 16, 2017 titled "6._Energy_Model_2019_RC.xlsx."

Q9. Please specify the documents you reviewed pertaining to GMP's hedging strategy.

A9. I reviewed the following documents:

i) GMP's discovery response to DPS2.Q.13 and accompanying attachments

ii) GMP's discovery response to DPS2.Q.14 and accompanying attachments

iii) GMP's discovery response to DPS2.Q.16 and accompanying attachments

iv) GMP's discovery response to DPS2.Q.17 and accompanying attachments

v) GMP attachment DPS1.Q.25.b1 and DPS1.Q.25.b2

vi) GMP's discovery response to DPS2.Q21 and accompanying attachments

vii) GMP's discovery response to DPS2.Q22 and accompanying attachments

Q10. Please provide a brief overview of GMP stated hedging strategy to manage its short-term energy requirements.

A10. GMP seeks to manage its market exposure to energy prices by procuring 60-70% from long-term resources and the other 30-40% from short-term resources[2]. GMP's stated energy hedging goals[3] are: (1) limiting customer risk of adverse rate impact and locking in favorable costs for customers, (2) maintaining a competitive rate position with New England utilities, and (3) recovering appropriate costs. These short-term resources are typically bilateral contracts with market energy suppliers of up to five years in duration.[4]

[2] See GMP Discovery Response Attachment GMP DPS1.Q25.b2.
[3] See GMP Discovery Response Attachment to GMP DPS2.Q13.3 and Attachment GMP DPS1.Q25.b1.
[4] See GMP Discovery Response Attachment GMP DPS2.Q13.8, Integrated Resource Plan, 2014, page 3-20.

GMP's strategy to manage short-term needs is to: (1) diversify timing of purchases, (2) reduce uncertainty in base rate filings by closing open positions leading up to the rate year, and (3) apply judgment for when to buy a portion of purchases.

Q11. Do you have any concerns with GMP's short-term energy hedging strategy and process?

A11. Yes, my concern is two-fold. First, there is a lack of centralized codification of GMP's short-term hedging strategy and process that specifically details procurement timing, procurement amounts, and authorized pricing targets. In response to a request for documentation detailing its strategy and process for procuring short-term energy needs, GMP provided a variety of documentation primarily consisting of stale presentation material that does not clearly outline the present and ongoing strategy.[5] Indeed, one of the clearest expressions of GMP's strategy was contained in a presentation made to S&P credit rating agency[6] rather than an internal corporate GMP document. Given the lack of codification, there appears to be an overreliance on a tacit, or implied, understanding of the strategy, which makes it difficult for an organization to effectively manage its strategy. Even in a connected, small company setting with little turnover, written procedures are helpful in serving as reminders and in guiding conversation. Further, such procedures would provide the benefit of making GMP's strategy and actions transparent

[5] See GMP Discovery Response DPS2.Q13.
[6] See GMP Discovery Response Attachment GMP DPS1.Q25.b2.

and understandable to outside parties.

Second, the process of implementing its strategy has a number of deficiencies and lacks rigor, namely regarding procurement timing, transaction price limits and quantity determination. Additionally, the competitiveness of the request for proposal process could be enhanced, such as ensuring that as many counter parties as reasonably possible are participating in both an indicative pricing round and a final pricing round.

Q12. Describe the process followed by GMP to determine the specific timing of short-term energy procurements and its reasonableness.

A12. GMP's strategy stresses the importance of making purchases regularly to diversify timing, to avoid having "all eggs in one basket,"[7] with the aim of closing open positions leading up to the rate period. GMP also stated in discovery that it "seeks to accelerate these short-term purchases during times when energy and/or capacity markets are perceived to be relatively attractive."[8] However, as mentioned above, from the material provided by GMP in discovery, it is not readily apparent what the current procurement plan entails. A GMP presentation dated December 2015,[9] outlines an energy procurement plan and an accelerated procurement plan that is labeled as 'proposed' but the presentation, or any other attachment or written responses, does not confirm if either plan

[7] See GMP Attachment GMP.DPS.Q13.3 and Attachment GMP DPS1.Q25.b1.
[8] See GMP response to DPS2.Q.13.
[9] See GMP Attachment GMP.DPS.Q13.6.

is currently in effect.

Also, a November 2017 presentation to the S&P crediting rating agency states that GMP accelerated its hedging program "to take advantage of favorable market conditions" and includes a chart that indicates on an annual basis the load over the period FY18 – FY20 is fully hedged with the unhedged load portion increasing to about 5-10% over the period FY21 – FY23.[10] Therefore, what remains is, as GMP describes it, "in the near term we are making smaller rebalancing transactions." No further evidence was presented that details how these actions fit in with an overarching layered procurement plan or how such a plan has changed due to the decision to accelerate purchases.

The stated goal of procuring short-term energy requirements on a regular and layered basis is consistent with industry standard and is certainly a worthy endeavor. However, beyond stating this goal, GMP has failed to provide robust documentation and clear evidence that it has an explicit plan in place.

Q13. Describe the process followed by GMP to determine the transaction price of short-term energy procurements and its reasonableness.

A13. GMP's hedging strategy states that it will apply judgement for when it will make energy purchases. GMP described its pricing decision making process as follows: "We assess the

[10] See GMP Attachment GMP DPS1.Q25.b2.

relative attractiveness of market conditions based on judgement of the power supply team, which is informed by our review of spot market prices, industry literature, and subscription publications that address the New England market, and review our findings with senior leadership at regular power supply risk meetings and periodically with Board of Directors and/or Audit Committee."[11]

As mentioned above, GMP accelerates short-term purchases if it perceives prices to be relatively attractive and has recently acted on this view when it accelerated procurement. However, it can be very difficult to "call the market" in any industry.

Generally, a layered procurement plan with diversified timing seeks to mitigate the need to make market price predictions and aims to capture a balanced overall price. For example, a utility may purchase 10% of its future needs on a quarterly basis for 3 years leading up to the actual year that the energy is delivered. Notwithstanding this, it can still be appropriate to act opportunistically. However, it is important that such action is taken in the context of wider plan to ensure a utility does not overextend itself with its opportunistic behavior. One approach is to determine, on an ex-ante basis, the quantity of energy that is available, according to the plan, that will be procured on an opportunistic basis if the utility determines that conditions for such action are appropriate.

[11] See GMP response to DPS2.Q.13.

Q14. Describe the process followed by GMP to determine the specific quantity of short-term energy that it will procure and its reasonableness.

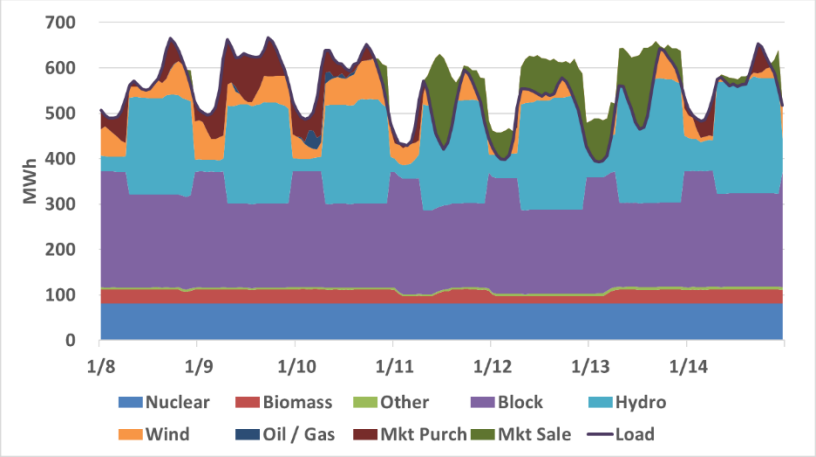
A14. GMP relies upon an in-house, proprietary spreadsheet energy model to determine the quantity of remaining energy required to be hedged.[12] At the model's core, it compares a load forecast against projected supply, on an average, monthly on and off-peak aggregates.

However, this analysis can be significantly improved by looking at requirements on an hourly basis. The average, monthly perspective misses many important dynamics which need to be considered in determining both the type of product and the quantity of that product that is required.

Figure 2 below details, on an hourly basis, the manner in which GMP's power supply portfolio provided a volume hedge for its customer load demands in the ISO-NE energy market for the week beginning January 8, 2017. This specific time period is arbitrary but provides a concrete, granular illustration. The black line indicates customer's load and the colored segments represent aggregated supply resources by fuel or type (e.g. wind, hydro and short-term energy blocks). Net-Meter solar and any other Behind-the-Meter generation reduces the level of load that is seen in the ISO-NE market and is implicitly represented in the black line. Market interaction of purchases and sales occur when the supply sources provide a greater or lower amount of energy than GMP's customer load.

[12] See GMP response to DPS2.Q.13.

Figure 2: GMP Hourly ISO Energy Hedging[13]



GMP's load and supply fluctuate on an hourly basis. Although no projection made for determining purchasing quantities will perfectly capture this level of fluctuation, there are two benefits from reviewing load versus supply at an hourly level of granularity. First, standard energy products are available for a variety of time periods beyond on and off peak. For example, GMP's current process may indicate an off-peak open position in January. However, that off-peak position may be concentrated in the weekend, midday period, suggesting a corresponding market product be purchased, or it may be concentrated in the overnight period on both weekdays and the weekend, suggesting a different market product purchase. Alternatively, the results of this analysis might suggest that standard market offerings are not suitable for effectively hedging GMP's requirements and a level of customization for specific products is required. The second

[13] See GMP Discovery Response Attachment to DPS2.A34.

benefit of hourly granularity would come from reviewing realized outcomes, such as those depicted for one week in Figure 2. Ongoing review of such outcomes could suggest improvements to GMP's purchasing or projection of supply. These improvements could be incorporated into GMP's future purchasing determinations.

Q15. Describe the transaction process followed by GMP in its procurement of short-term energy.

A15. GMP states that it follows numerous steps in its procurement of short-energy products from energy suppliers. These stated steps include[14]: (1) Receive trading authorization from senior management and board of directors, (2) make market inquires to assess the likelihood of achieving competitive responses to a GMP solicitation, (3) request binding offers at an established future date and time, (4) upon receipt of offers, rank them by least cost and compare to available broker indications to ensure they reflect GMP's understanding of generally available market conditions, and (5) make an award to the leading supplier that meets GMP's contracting requirements.

Q16. When transacting, does GMP follow all of the steps in this process?

A16. No, this process is not always followed or the action taken does not meet industry standards. I have reviewed the material provided by GMP regarding its July 7, 2015 transaction with NextEra,[15] which has a contract value of approximately $34.5m and

[14] See GMP response to GMP.DPS2.Q13.
[15] See GMP response to GMP.DPS2.Q14 and attachments GMP.DPS2.Q.14.14 through GMP.DPS2.Q.14.18.

provides 25 MW of around the clock energy power from 2017 through 2020, and make the following observations.[16]

Regarding trading authorization, through discovery GMP provided an undated presentation with the title "preapproval slides."[17] The information contained therein is vague and non-transparent. It sets out a trading plan where it states the typical volume / schedule will be purchased if forward prices are above $45 and if prices are lower, an increased amount of volume can be purchased. There is no specificity regarding the type of energy these prices relate to, which years they relate to, and how they are relevant to the NextEra transaction.

Based on the material supplied, on June 30, 2015 GMP made indicative pricing requests to three counterparties (GDF Suez, Macquarie and Shell), describing the energy product and delivery location and stated that they were "interested in putting together a trade…in the next couple of days."[18] GMP did not specify on which trading day to base the indicative pricing and the parties provided responses at different times either on that day or based on the next trading day, July 1, 2015. GMP only provided responses to its solicitation effort and therefore I cannot confirm whether GMP reached out to additional

[16] Please note, that in discovery, GMP provided the greatest amount of material pertaining to the NextEra transaction as opposed to the other transactions which are in effect during the rate year. I would require further material in relation to these other transactions in order to perform a similar review as was undertaken here.
[17] See attachment GMP.DPS2.Q14.18 .
[18] See GMP attachment GMP.DPS2.Q.14.14.

counterparties.

On July 7, 2015 there is correspondence between GMP and NextEra where GMP states they "are looking to try making a purchase tomorrow" and GMP requested indicative pricing from NextEra. Additionally, GMP requested pricing for a second product, in addition to the one described to other three counterparties. Ultimately the transaction was completed with NextEra on July 7th and not the next day, based on the transaction confirmation, and GMP procured this second product that was not sought initially in the first indicative round. From the material provided it appears that NextEra was not involved in the first round of indicative pricing GMP had received and that GMP did not request indicative pricing from the initial three counter parties that had provided pricing. There was no information provided that summarized the bids received[19] but GMP did provide a non-dated spreadsheet detailing broker market price indications which, according to GMP's stated steps, is reviewed to understand what the general market prices are currently.

Therefore, I conclude that there are times where GMP's practice deviates from the stated transaction process and that the material suggests that a more competitive and transparent process should have been followed in procuring the 25 MW energy block. In particular, it

[19] In respect of the other bilateral energy purchases which are in effect for the rate period, GMP did provide information summarizing the bids received. See attachments GMP.DPS2.Q14.1, GMP.DPS2.Q14.5 and GMP.DPS2.Q14.9.

would have been beneficial if GMP had undertaken the following steps and which complement its existing stated procurement steps:

1. Set a clear date to base indicative pricing to ensure full comparability between bidders.
2. Ensure all reasonably available counterparties that GMP has enabling agreements with or not, were asked to provide indicative pricing. Contacting parties that are not presently enabled can be informative in deciding whether an enabling agreement should be sought.
3. If GMP decides that a different product should be procured, as opposed to the initial solicitation, a reasonable effort should be made to receive indicative pricing from all available counterparties.
4. When GMP determines that indicative market pricing suggest that a transaction should be executed, a so-called "live pricing" event should be held and all appropriate counterparties should be notified and permitted to submit pricing to ensure a transparent and competitive procurement process is completed.

Q17. Please provide a brief overview of GMP's stated hedging strategy to manage its capacity requirements.

A17. GMP states that it is pursuing a long-term and short-term hedging strategy "to significantly reduce the identified exposure to volatile capacity market prices"[20] and to

[20] See GMP response to DPS2.Q16.

meet the goals of: (1) limit customer risks of adverse rate impacts and (2) maintain competitive rate position with neighboring New England utilities.[21] GMP further describes its strategy as reflecting "a balance of forward hedging and a strategic open position to take advantage of fluctuations in capacity prices."[22] This is achieved through pursuing "Rolling short-term forward purchases with varying duration" and "Long-term, unit-based purchases when cost are below long-term forecasts and cost of entry."[23]

GMP has long-term hedges from its generation resources that it owns, directly or jointly, and from long-term purchase power agreement contracts. It also entered into a long-term agreement from the Seabrook nuclear generation facility that provides capacity through the planning year 2034. This agreement received Commission approval in Docket No. 8445. Regarding short-term capacity hedging, it entered into bilateral contracts for additional capacity from the Seabrook facility and two separate agreements with Dynegy. Together these hedges result in GMP being fully hedged against exposure to ISO-NE market capacity prices through the planning year 2021/22 with significant hedging remaining in place thereafter.

[21] See GMP attachment GMP.DPS1.Q25.b2 at slide 37.
[22] See *id*.
[23] See *id.*

Q18. Do you have similar concerns regarding GMP's capacity hedging strategy and process?

A18. Yes, my primary concern, once more, relates to the lack of a centralized codification and specificity regarding GMP's hedging strategy. When requested to describe GMP's strategy and process together with providing supporting documentation, GMP did not point to a centralized internal corporate GMP document that clearly lays out these details.[24] The written response mentioned that for capacity hedging that GMP follows a number of the same internal review and evaluation steps that are utilized for energy hedging. Additionally, GMP stated that it relies more heavily on consultant market assessments and forecasts for market price evaluations to develop a GMP view of ISO-NE's Forward Capacity Auction ("FCA") capacity price expectations. In terms of its hedging transaction activity, GMP said that "GMP tends to focus on capacity hedging activity in the few months leading up to the FCA date."[25]

However, it is not clear, from the material presented in this proceeding, if clear guidelines have been set in terms of the amounts of capacity hedging that is required on a longer-term or shorter-term basis. For instance, in a presentation made to S&P credit rating agency,[26] it is stated that the strategy "reflects a balance of forward hedging and a strategic open position to take advantage of fluctuations in capacity prices" and that GMP is "maintaining a reasonable open capacity position going forward." It is not clear that

[24] See GMP response to DPS2.Q16.
[25] See *id.*
[26] See GMP Discovery Response Attachment GMP DPS1.Q25.b2.

GMP has specifically determined what this "balance" is or what constitutes a "reasonable" open position. GMP's strategy would be greatly enhanced through added specificity to provide greater structure and rigor to its decision-making process, especially when GMP's stated making decision process is to procure at a given price that is heavily reliant on GMP's own judgement. A defined structure would set clear guidelines on the level of opportunistic purchases available as well as a schedule for acquiring quantities of short-term capacity and long-term capacity blocks. This would limit the potential for procuring large quantities of capacity with pricing based on one point in time.

Q19. Do you have similar concerns regarding its hedging strategy and process for REC sales?

A19. Yes, once more, my concern relates to the lack of centralized codification and specificity of GMP's hedging strategy regarding its REC sales. GMP states its goals, approach, and review process is similar to that employed for short-term energy and capacity hedging.[27] GMP further states that its "hedging process relies primarily on layered forward sales with terms reaching out one to four years, with the goal that each of the upcoming delivery vintage year's revenue reflects average pricing conditions from the previous few years."[28] In support of this process, GMP provided a non-dated presentation slide

[27] See GMP response to DPS2.Q21.
[28] See *id.*

demonstrating a "typical targeted sales volume percentages"[29] as opposed to a formal strategy document that outlines the current volume targets that GMP is actively pursuing. Such documentation aids the decision-making process. For example, internal GMP correspondence[30] indicates there was internal deliberation of whether a larger volume of RECs should be pursued following interactions with a specific counter party. These types of internal misunderstandings can be avoided if concise hedging documentation is available that outlines specific current volume targets, as well as options for deviations from the stated strategy and what conditions are required to undertake such a deviation.

Q20. Please summarize your conclusions and recommendations.

A20. In summary, with respect to GMP's short-term energy, capacity and REC sales hedging I conclude it is insufficiently documented and structured. GMP's actions in this area should be codified in a manner that is transparent to outside parties. Also, I conclude that GMP's Current energy modeling tool used to determine its energy hedging requirements is inadequate to effectively manage GMP's dynamic power supply portfolio. Finally, I have identified a number of improvements to GMP's energy transaction practice that seek to ensure the most competitively priced product is secured.

I recommended the following action items:

[29] See *id.*
[30] See attachment CONFIDENTIAL - GMP.DPS2.Q22.6 (please note that this document was provided by GMP to the Department as allegedly confidential during discovery, but this testimony does not reference any of the allegedly confidential details included in the document).

1. GMP develops a corporate Risk Management Plan for its energy, capacity, and REC forward sales hedging. This document would, at a minimum, detail the specifics of the hedging strategy, procedures related to setting acceptable risk parameters and risk limits, policies for risk reporting and permitted transaction and product types;
2. GMP improves its analytical energy modeling tools to facilitate more granular data analysis, such as hourly simulation models;
3. GMP codifies its energy transaction process which would incorporate the improvements that I have identified above;
4. GMP contracts with an independent auditor to review its hedging practices and procedures on a triennial basis.

III. JOINT VENTURE SOLAR / BATTERY PROJECTS

Q21. Please provide a brief overview of the Joint Venture Solar / Battery Projects.

A21. As witness Mr. Shields describes, the Joint Venture Solar / Battery Projects include three proposed, utility-scale projects that would be located in Milton, Ferrisburgh, and Essex, Vermont. Each project is designed to include approximately 5 MW of solar and a 2 MW / 8 MWh battery and this combination of solar and batteries is designed to leverage Investment Tax Credit ("ITC") benefits. GMP is creating a wholly-owned affiliate company, through which GMP makes an investment and earns a return, and would be paired with a tax investor partner so that the ITC and other benefits may be monetized immediately. The ownership structure provides the benefits of the project to GMP in the form of a Purchased Power Agreement ("PPA"). These projects will be sited as Behind-the-Meter generation and will serve as load reducers and not have any interactions with the ISO-NE RTO market. Both the Milton and Ferrisburgh projects are the subject of pending Certificate of Public Good ("CPG") review before the Commission and have an expected commissioning date in late Spring of 2019 and early summer of 2019, respectively. A CPG has not yet been applied for in respect of the Essex project which is expected to be commissioned by the end of September 2019.[31]

[31] See GMP response to discovery request DPS1.Q115.

Q22. Please summarize your review of GMP's Joint Venture Solar / Battery Projects.

A22. I reviewed GMP's cost benefit analysis of its three proposed JV Solar/Battery Projects. For clarity, I will be specifically discussing the modeling GMP performed for the GMP MicroGrid-Milton Project ("Milton Project").[32] Because of the similarity of these three projects, in terms of technology and GMP's approach to the cost benefit analysis, the conclusions of my discussion can and should be applied to the other two MicroGrid projects as well.

My discussion of the Milton Project is divided into four sections. First, I describe GMP's overall modeling effort, the rationale, and the results. Second, I discuss GMP's modeling of avoided costs. Next, I discuss potentially beneficial analysis which GMP did not perform and, finally, I discuss key issues that are not addressed in the previous sections.

Although solar paired with battery storage is a promising, emerging technology with the potential for beneficial use in Vermont, I conclude that, due to issues with the analysis GMP did perform as well as the lack of analysis which should have been performed, it is not possible to deem that these projects are necessary or whether they will provide a financial benefit for GMP's ratepayers.

[32] GMP Discovery Response Attachment to GMP DPS1.Q116.

Modeling Approach and Results

Q23. What analysis did GMP perform to justify proceeding with the Milton Project?

A23. GMP performed a cost-benefit analysis of the Milton Project, with separate analyses for the solar and battery components. Based on fixed cost Engineering, Procurement, and Construction contracts, GMP has estimates of what each component will cost, which is represented as levelized PPA rates. Because GMP will effectively own the Milton Project via its affiliate and arrangement with a tax investor, GMP also models the impact of including the project in its rate base, by considering it as an "investment in an affiliate (similar to investments in VELCO),"[33] and includes that as a benefit.

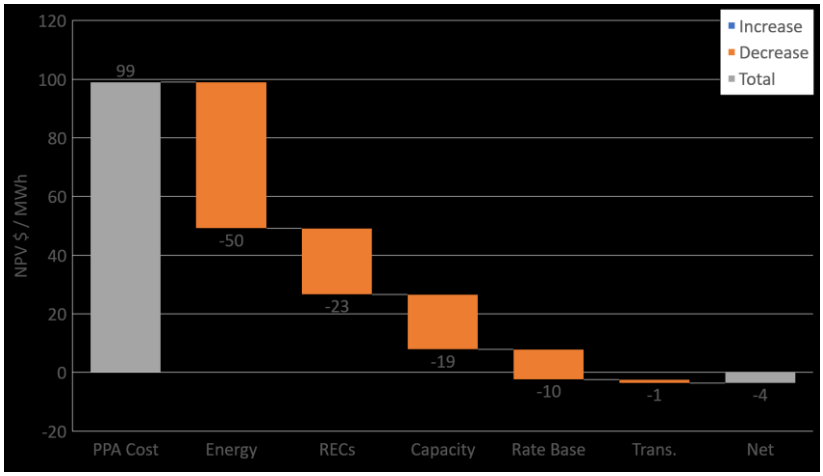
GMP calculates additional benefits for the Milton Project in two ways. First, GMP models what costs it would incur without the project (and absent any other actions by the utility) as well as the cost that are avoided by having the project. These incremental or avoided cost components are energy, capacity, and transmission from the ISO-NE wholesale markets or tariff and the VELCO transmission tariff. Second, GMP models direct benefits from the project, which include sales of RECs produced by the solar component as well as sale of regulation services into ISO-NE ancillary services market and energy arbitrage value from charging / discharging which are produced by the battery component.

[33] *See* Green Mountain Power witness Mr. Kirk Shields, Prefiled Testimony, page 5, line 23 and page 6, line 1.

Q24. Please describe the results of GMP's analysis for the solar component.

A24. Figure 3, shown below, depicts the results of GMP's analysis. Based on GMP's modeling assumptions, the results show that solar's benefits slightly outweigh its costs, with avoided energy costs as the primary benefit (approximately 50% of the benefits).

Figure 3: Summary of Solar Cost-Benefit Analysis[34]

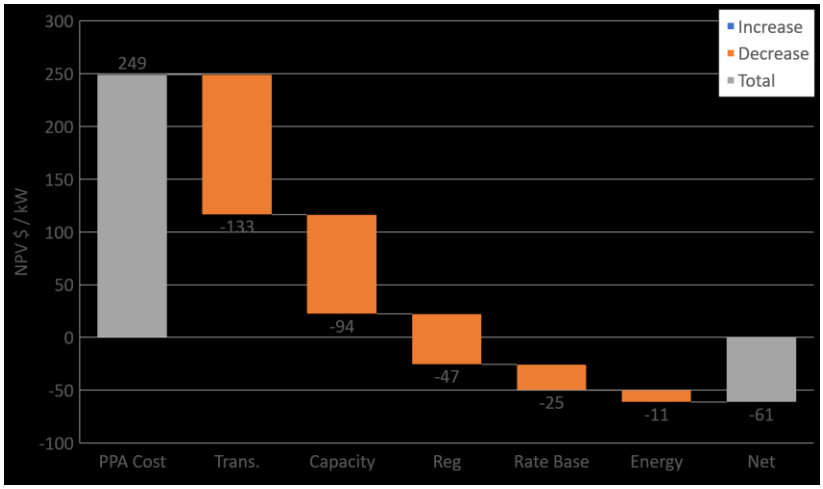


Q25. Please describe the results of GMP's analysis for the battery component.

A25. Figure 4, shown below, depicts the results of GMP's analysis. The battery's benefits outweigh the costs to a larger degree than that of the solar. Here, the avoided transmission and capacity costs are the primary benefit drivers.

[34] Shown for the 25-year term of the PPA. Does not include potential value from operating beyond that term.

Figure 4: Summary of Battery Cost-Benefit Analysis



Avoided Cost Modeling

Q26. Please summarize the avoided cost modeling topics you discuss.

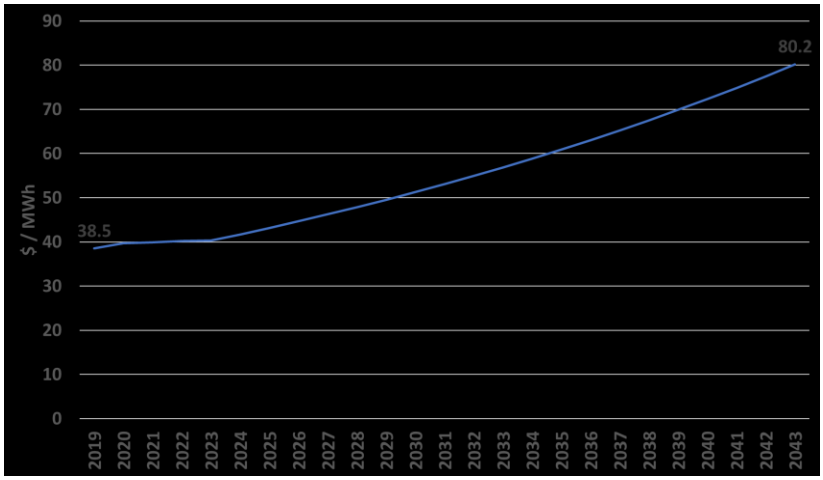
A26. I discuss GMP's price forecasts for energy, capacity, RECs, and transmission. In addition to the price forecasts, I also discuss GMP's assumptions for energy price arbitrage opportunities for the battery and energy price adjustments to account for timing of solar energy production. And finally, I discuss GMP's assumptions of the regulation quantity sold by the battery component, peak coincidence of solar with ISO-NE Forward Capacity Market ("FCM") peaks, and avoided losses during FCM and transmission peaks.

Q27. Describe GMP's forecast of energy prices and its reasonableness.

A27. Figure 5, below, illustrates GMP's forecast of 7x24 (i.e. around-the-clock) market energy prices that range from $38.5/MWh in 2019 to $80.2/MWh in 2043. The first five years of GMP's forecast has a very low escalation rate as compared to the remaining years, which includes a 3.5% annual escalation. Beyond the first five years, GMP provides no basis for

the assumptions underlying the energy price projections. GMP's projections are in contrast with the fact that energy prices over the past ten years have been in decline or stagnant. Furthermore, looking forward, today's natural gas futures have very low escalation in gas prices. GMP's energy price escalation can only characterized as aggressive or optimistic as a base case assumption. A more gradual increase, tied to an underlying driver such as natural gas futures, would be more appropriate.

Figure 5: GMP 7x24 Energy Price Forecast

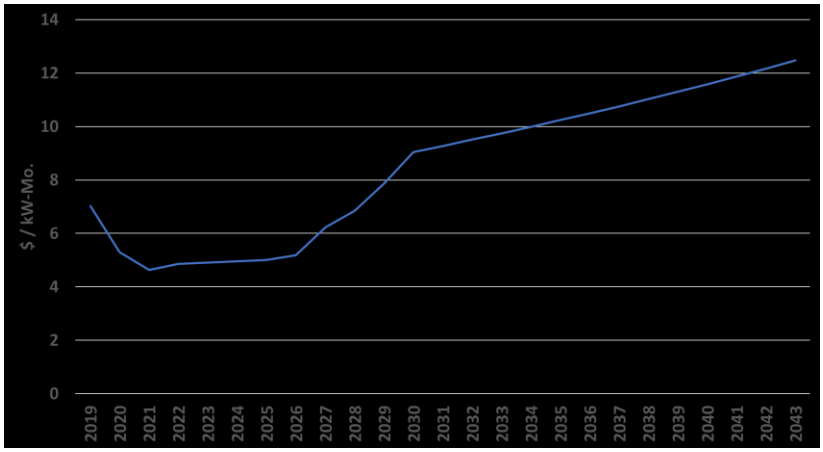


Q28. Describe GMP's forecast of capacity prices and its reasonableness.

A28. Figure 6, below, depicts GMP's forecast of capacity prices on an ISO-NE planning year basis with actual prices included through 2021 (i.e. for ISO-NE planning year June 2020 through May 2021). GMP's forecast is based on an assumed increase to the Net Cost of New Entry ("Net CONE"), which reflects an estimated cost to construct a natural gas-fired combustion turbine or combined cycle less estimated energy and ancillary services revenue, by 2030, with a 2.5% escalation thereafter. In order to achieve Net CONE by

2030, GMP projects steep price increases from 2026 to 2030. GMP provides no basis for their capacity price projections beyond 2021. Although Net CONE is a theoretical, marginal price point that should reflect a capacity market in supply / demand balance, the timing of reaching that point in 2030 appears arbitrary and not reflective of underlying supply / demand fundamentals. Further, prices below Net CONE may persist due to reasons outside of underlying market forces. That is, regulatory or policy factors are important components of a capacity auction administered by a federally regulated entity with auction participants subject to state policy and regulations. These factors continually fluctuate and have an important outcome on price alongside market supply / demand. Ultimately, a forecast that more closely resembles the growth and expectation from recent capacity auctions and market forecasts is more conservative than an aggressive increase to Net CONE.

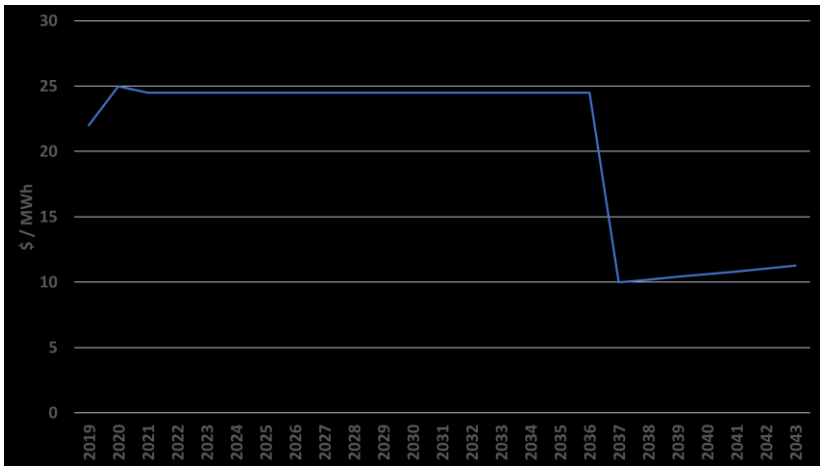
Figure 6: GMP Capacity Price Forecast



Q29. Describe GMP's forecast of REC prices and its reasonableness.

A29. Figure 7: below, displays GMP's forecast of REC prices, which include a near constant price until 2037 at which point the forecast decreases steeply. Despite GMP's information in discovery response DPS2.A43.b that there is some upward, near-term price pressure for RECs, GMP's forecast is not reflective of a declining market. REC prices are a function of market supply and demand for RECs. The expectation is that large increases in supply, brought about by policy support for distributed and utility-scale renewables throughout New England, will outpace limited increases in demand. The forecasted price for such a market should follow a steady decline. GMP's ability to obtain a constant mid-$20/MWh for 18 years is unproven and unrealistic.

Figure 7: GMP REC Price Forecast

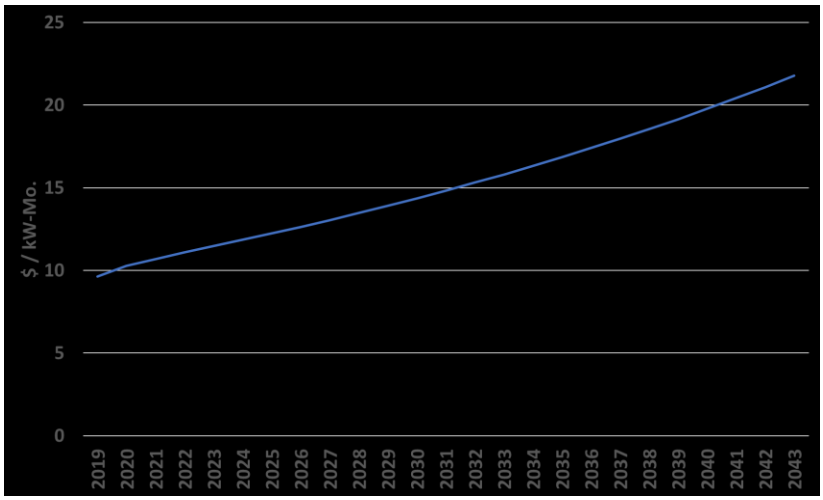


Q30. Describe GMP's forecast of transmission rates and its reasonableness.

A30. Figure 8, below, depicts GMP's forecast of transmission rates. The majority of GMP's forecast consists of 3.25% annual escalation. Transmission rates have been increasing rapidly in recent years due to increased investment for rebuilding aging infrastructure,

legislative and regulatory incentives, increased compliance and reliability standards, and other reasons. However, the ability for this trend to continue for a longer term is questionable. Long-term escalation in excess of inflation indicates an increase in size and investment of the transmission system that ignores the present realities of increased BTM solar and battery storage applications as well as better designed retail rates that discourage on-peak consumption. Such perpetual increase is unrealistic as at some point declining loads cannot support ever increasing investment. A transmission rate forecast which assumes inflation-based growth is more appropriate.

Figure 8: GMP Transmission Price Forecast

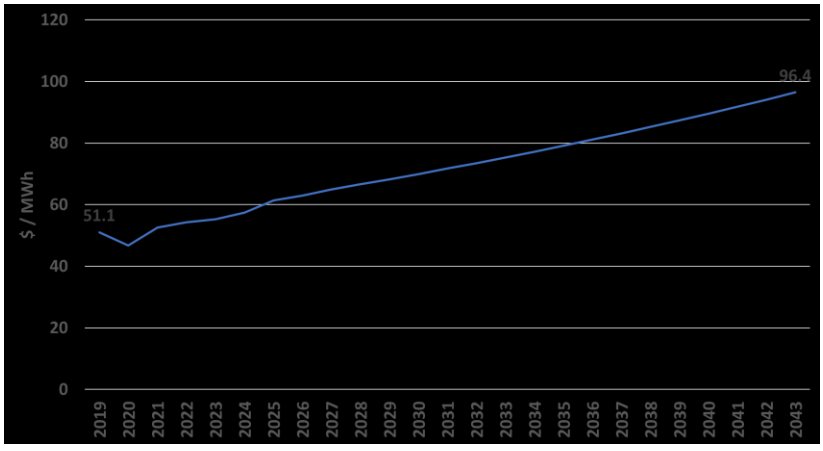


Q31. Describe how GMP forecasts energy arbitrage value for the battery and its reasonableness.

A31. Figure 9, below, shows GMP's forecast of the battery component's energy arbitrage pricing spread (i.e. the energy price during the battery discharge less the energy price

during battery charging). This forecast is developed based on historical 2016 Locational Marginal Prices ("LMPs") and battery operations optimized to that annual price curve. There are a couple of issues with this methodology. First, it relies on perfect hindsight. GMP may optimally fit battery operations to known, historical prices, allowing selection of optimal times to charge and discharge. In the course of actual operations, LMPs will be unknown and uncertain, introducing an element of risk whereby GMP would not always achieve the optimal outcomes. Second, the energy arbitrage pricing spread grows at a 2.5% annual escalation rate for the majority of the forecast. Even in an environment of steadily increasing average prices, the spread between on and off peak prices would not similarly increase. The spread between on peak and off-peak prices may increase but could also decline or remain constant. A more reasonable forecast would account for this as well as a degree of less than optimal charging / discharging timing. Although energy arbitrage is a small portion of the modeled value of the Milton Project, this methodology could be applied more broadly to inappropriately increase its value dramatically.

Figure 9: GMP Battery Arbitrage Price Spread



Q32. Please describe GMP's adjustment of energy prices to account for the timing of solar production and if such adjustment is appropriate.

A32. GMP utilizes a 6% reduction factor to its 7x24 energy price forecast to account for the fact that energy prices are slightly lower during times when solar energy is typically produced. The 6% figure is based on recent historical data. The overall concept of such an adjustment is appropriate, meaning that an average 7x24 energy price should be adjusted to account for the timing of the solar generation. However, GMP maintains its 6% reduction factor for the lifetime of the solar project which is overly optimistic. That is, as the amount of solar generation in ISO-NE continues to increase over time the degradation of prices during the solar production window would continue to increase (e.g. an extreme example of this occurs in California's energy market on a regular basis). It would be appropriate to include a forecast that takes into account the degradation of energy prices.

Q33. May generation located Behind-the-Meter ("BTM") provide benefits in excess of metered generation?

A33. Yes, BTM generation has benefits which transmission interconnected generation does not. One such benefit is the distribution and transmission system losses which are avoided by locating the generation locally on the system. That is, transmission interconnected generation incurs delivery losses on the transmission and distribution system that BTM generation does not. Another benefit is avoided reserves for capacity compliance if regulatory rules permit. Capacity or resource adequacy compliance

typically involves meeting a peak load requirement plus an additional amount of reserves, calculated as a percentage of the peak load. If BTM generation reduces the peak load requirement, the associated reserves may also be avoided.

Q34. Has GMP appropriately modeled avoided losses?

A34. GMP applies different loss factors depending on the use case: 8% for solar generation, 5% for battery transmission and capacity value, and 15% for solar transmission and capacity value. While average losses reflecting solar production timing should be different than the marginal losses at peak times, there should not be a difference between solar and battery transmission and capacity loss values at the same peak times. GMP states that the use of the 5% loss factor when applied to battery transmission and capacity value is conservative.[35] If a conservative loss value is appropriate for the battery then it should similarly be used for the solar. Further, the 15% solar value appears excessively high. As a reference, the ISO-NE utilizes an 8% factor when accounting for avoided losses in the treatment of capacity valuation for demand resources.[36] Note that this value also implies GMP's use of 8% for solar energy avoided losses is also excessive, following the reasoning that average losses over an entire year should be lower than marginal losses during peak conditions. The use of avoided loss factors should be consistent, based on studied actual losses, and comport with industry norms such as what

[35] Provided in DPS2.A42.c.
[36] ISO-NE Tariff, Market Rule 1, III.13.1.4.1.1.6.b.

ISO-NE uses.

Additional Analytical Approaches

Q35. Within the scope of the study GMP performed, what additional analysis could have been performed?

A35. GMP's modeled results rely on the forecasting of uncertain variables, most critically energy and capacity prices. However, GMP did not perform any analysis around the risk or uncertainty of those key variables, relying only on a base case set of assumptions.[37] A standard approach for treatment of key uncertainties is to subject them to sensitivity analysis, introducing lower and higher possible future outcomes. Such analysis allows projects to be reviewed more broadly and illustrates the inherent uncertainty of the key variables (e.g. a tornado chart illustrates the key variables that will affect the power cost or benefits of the project). The sensitivity analyses also allows for a better comparison between the various resource alternatives.

Q36. Given the nature of GMP's price forecasts would uncertainty analysis be beneficial?

A36. Yes, as I have previously discussed, GMP's price forecasts appear generally aggressive and the projects rely heavily on highly uncertain capacity and energy prices in order to justify proceeding with acquiring those resources. Because of this and the project's current projected benefit-to-cost ratio is close to break-even, consideration of a range of prices for just the key variables would show a range of outcomes, some of which would

[37] See GMP Discovery Response DPS2.A43.c.

show the project as having net benefits and some with net costs.

Q37. Is there analysis outside the scope of GMP's study that would be beneficial?

A37. Yes, a least-cost analysis, which considered alternative resources capable of achieving the same benefits, has the potential to identify lower cost options. Potential alternatives include Demand Response, discussed further in Section V, and conventional peaking power resources that could similarly be located BTM. Each of these alternatives has the potential to avoid transmission, capacity, and energy costs, which are the primary benefits for the Milton Project.

Other Key Topics

Q38. Are there other key areas concerning the Milton Project that you have not addressed?

A38. Yes, other areas of concern include compliance consideration under Vermont's Renewable Energy Standard ("RES") and regulatory risk around peak shaving allowance for capacity and transmission cost avoidance.

Q39. Is the Milton Project required for GMP to meet its short-term compliance requirements per the RES?

A39. No, GMP has excess Tier II-qualified RECs for the foreseeable future because of the RECs produced from Net Metering 2.0, Standard Offer program, and GMP's existing

solar installations.[38]

Q40. Will the Milton Project potentially be needed for GMP to meet its longer-term compliance requirements per the RES?

A40. It is unlikely that the Milton Project would be necessary. Tier II RECs may also be used to qualify Tier III requirements, so there is a potential need under Tier III even if GMP remains long on Tier II. However, energy transformation projects have been the preferred route for Tier III compliance and GMP is forecasted to be in an excess position for Tier III as well.[39] Given that, it is unlikely that the Milton Project will be useful for RES compliance except as a backstop. On its own, this provides little justification for the project. Further, justification along these lines, including the need to utilize Investment Tax Credit (ITC) benefits before they degrade, would need to be quantified and compared against lower solar and battery prices in the near future as is currently promulgated in the industry.

Q41. What is regulatory risk concerning capacity and transmission peak shaving?

A41. Capacity and transmission cost avoidance through utility-scale BTM generation inherently carries a level of regulatory risk in that the ISO-NE's tariff could be modified to disallow such treatment. This is a legitimate risk, especially over the 20-25 year term of the project, as demonstrated by the active discussion of this same topic at the

[38] See GMP Discovery Response DPS1.A87.
[39] See GMP Discovery Response Attachment to DPS2.A28.

Midcontinental Independent System Operator today.[40] If such a change were to occur during the life of the project, it would mean removal of transmission and capacity cost avoidance benefits through participation in the FCM, which would entail no reserve margin avoidance and performance penalty risk. This risk should be carefully considered and would be modeled as a reduction in benefits from the project.

Q42. What are your conclusions regarding the Milton Project?

A42. By itself, the cost benefit analysis of the Milton Project is predicated on several optimistic or questionable assumptions and calls into question the reasonableness of the project's marginal value. It also lacks any uncertainty analyses around key variables or rigorous comparison to reasonable alternatives. Without GMP revisiting a number of the key assumptions in the already completed analysis along with the completion of additional analyses, I cannot conclude this project is necessary or whether it will be able to achieve the financial benefits that GMP projects.

[40] See, for example https://www.misoenergy.org/stakeholder-engagement/issue-tracking/consistent-treatment-of-btmgbtmg-within-planning-processes/

IV. ENERGY TRANSFORMATION PROJECTS

Q43. Please describe GMP's Energy Transformation Projects?

A43. As described by witness Mr. Castonguay, GMP's Energy Transformation Projects involve utility investment and inclusion in rate base of customer-located, distributed energy technologies, primarily focused on electrification and storage. These programs are meant to provide easy access to new or improved technologies to participating customers while at the same time lowering GMP's costs, providing benefits to all customers.

Q44. Please summarize your review of GMP's Energy Transformation Projects.

A44. I reviewed GMP's cost benefit analysis of its Energy Transformation Projects. My discussion focuses specifically on the Tesla Powerwall 2.0 home batteries ("Powerwall Program") and the Cold Climate Heat Pump program ("CCHP Program"), the two largest programs in terms of cost under the Energy Transformation Project umbrella. Discussion of each is handled in separate sections.

Powerwall Program

Q45. What is GMP's Powerwall Program?

A45. As witness Mr. Castonguay describes, the Powerwall Program provides residential customers with a 5 kW / 13.5 kWh Tesla battery installed at their residence. Customers either pay $15/month for 10 years or a single up-front payment of $1,500. The primary benefit for participating customers is the battery performs as a source of backup power. GMP is responsible for the remainder of the battery cost and retains the right to operate

the battery to reduce overall system cost for the benefit of all retail customers.

Q46. Please summarize the topics you discuss regarding the Powerwall program.

A46. I discuss GMP's modeling approach, several specific avoided cost items, and battery operations and warranty issues.

Q47. What analysis did GMP perform to justify its pursuit of the Powerwall Program?

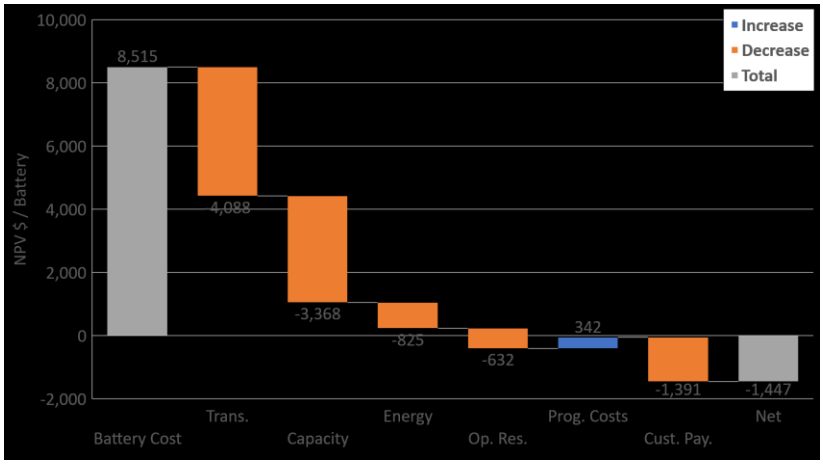
A47. GMP performed a cost-benefit analysis of the Powerwall Program with the same methodology as it used in the Joint Venture Solar / Battery Project analysis discussed in Section III.[41] Due to the overlap in technology and BTM siting, many facets of the analysis on the Powerwall Program are similar to the battery component of the Joint Venture Solar / Battery Project analysis. For brevity, references to Section III will be made when material discussed there also applies to the Powerwall Program.

Q48. Please describe the results of GMP's analysis.

A48. Figure 10, shown below, is a summary of the results from GMP's analysis. The results of GMP's analysis show the Powerwall is marginally beneficial when customer payments are excluded (i.e. customer contribution to Powerwall's cost paid to GMP). The primary benefits are from avoided transmission and capacity costs. When the benefit of customer payments is included in the analysis then the Powerwall's benefits noticeably outweigh the costs.

[41] Workpaper spreadsheet titled "PowerWall 2.0 Pilot – Financial Analysis 3.6.18."

Figure 10: Powerwall Cost-Benefit Analysis



Q49. Do the concerns of GMP's transmission rate forecast from Section III apply here as well?

A49. Yes, the concerns regarding GMP's transmission price forecast also apply to the Powerwall analysis and a more conservative forecast of transmission rates would reduce the stated benefits.

Q50. Does the concern of peak shaving regulatory risk from Section III apply here as well?

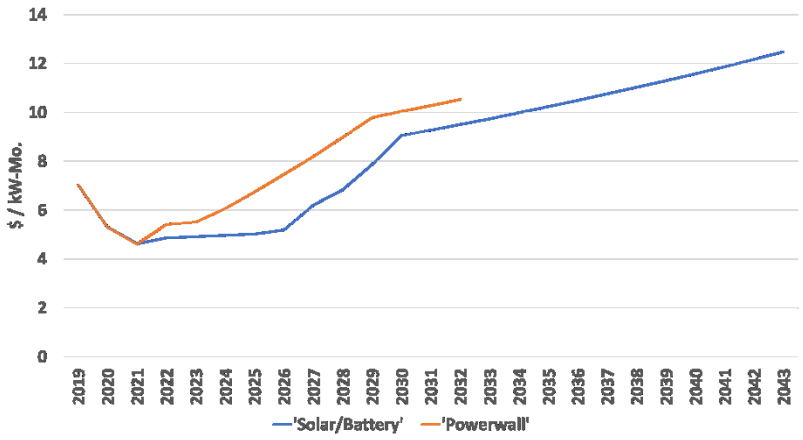
A50. Yes, but to a much lesser extent. That is, retail BTM resources (as compared to utility-scale) are less likely to be scrutinized from a transmission cost allocation perspective. The ability of retail BTM resources to shave transmission peaks for the foreseeable future is more certain. This is because of practical issues managing less visible and more numerous retail BTM resources as well as the reduced degree of control the utility has

over these resources.

Q51. Do the concerns of GMP's capacity price forecast from Section III apply here as well?

A51. Yes, with one notable addition. GMP utilizes a different and higher capacity price forecast for the Powerwall Program than was used for JV Solar / Battery Projects, as seen in Figure 11 below. The capacity price forecast across both projects should be consistent, as each project will avoid costs from the same capacity market structure.

Figure 11: GMP Capacity Price Forecast Comparison



Q52. Do the concerns of GMP's projected losses from Section III apply here as well?

A52. Yes, and there is an additional detail to add to that discussion. Namely, GMP uses an 8.9% loss factor for the Powerwall Program for transmission and capacity value as compared to a 15.0% and 5.0% loss factor for the JV Solar / Battery Projects, respectively, as discussed in Section III. The Powerwall Program might be expected to have a somewhat larger loss factor than the JV Solar / Battery Projects because of their

relative locations on the distribution system. However, GMP does not justify this relationship and the loss factors used do not purport such a relationship. With that in mind, the discussion from Section III applies.

Q53. Are there issues with GMP's modeling of degradation and warranty performance?

A53. Yes, although GMP does evaluate performance risk in the form of a reduction factor for transmission and capacity benefits, GMP does not appropriately account for battery degradation.[42] To be clear, GMP assumes 100% of the original rated capacity is available for capacity peak shaving for the first 10 years and 98% availability for transmission peak shaving during the first 10 years. Contrasting these assumptions is the 3% annual degradation which is explicitly codified in the performance guarantee and warranty agreements which GMP has in place for the batteries.[43] This level of degradation provides a reasonable expectation for the batteries' available capacity and power over time, as reflected in those agreements, and should be included in GMP's modeling. To be specific, the capacity and transmission avoided cost modeling should account for performance risk, as it does currently, and just as importantly, should also include degradation to the available battery capacity.

[42] See GMP Discovery Response DPS2.A61, which points to performance risk, not degradation.
[43] See GMP Discovery Response DPS2.A60, which describes degradation as related to the performance guarantee and warranty.

Q54. Does the discussion of alternative analytical approaches from Section III apply here as well?

A54. Yes, specifically GMP's analysis would benefit from sensitivity analysis performed around key uncertainties. Similarly, a least-cost analysis is needed that would compare the battery storage project to other non-battery alternatives. Thus far, GMP has only compared other residential-scale, BTM battery systems.[44]

Q55. What is your conclusion regarding the Powerwall Program?

A55. My conclusion is similar to the Joint Venture Solar / Battery Projects. GMP's analysis is both limited in scope (e.g. comparison to other technology alternatives), and the key assumptions have not undergone any sensitivity analysis. Due to this, I cannot conclude that the Powerwall Program is necessary or cost-effective.

Cold Climate Heat Pump Program

Q56. What is GMP's CCHP program?

A56. The CCHP program operates under the same general structure as the Powerwall program. However, due to the CCHP program involving electrification rather than storage, it provides additional electric sales and associated revenues (whereas storage represents a temporal shifting of sales rather than an increase in amount) to GMP as well.

[44] See GMP Discovery Response DPS2.A50

Q57. What benefits does GMP model for its CCHP program?

A57. GMP includes direct customer participant payments as well as some margin from additional energy sales. The latter is derived based on the assumption that the electric CCHP are replacing non-electric appliances. As a result, GMP's sales are expected to increase due to the fuel switching for the same energy service. If these additional sales can be served by GMP at an incremental cost that is lower than the retail rate being paid by the customer, the resulting margin may be applied to lower rates.

Q58. What incremental cost to serve load does GMP assume and is that assumption reasonable?

A58. GMP assumes a roughly $90/MWh incremental cost, which provides for approximately $70/MWh margin when compared to the retail rate.[45] Although this may represent a reasonable high-level approximation, GMP's incremental cost to serve load will depend on what hours of the year that load is served by GMP and it is not clear that GMP has performed any analysis to substantiate the $90/MWh incremental cost assumption. At various times during the year, GMP's incremental load cost can be well above its retail rate, resulting in negative margins or upward rate pressure, or well below GMP's average estimate.[46]

[45] See GMP Discovery Response DPS2.A62.
[46] See GMP Discovery Response DPS2.A63.

Q59. How can GMP ensure its CCHP and similar electrification programs benefit customers?

A59. One necessary step is that GMP effectively and consistently perform load control events for these programs such that peak cost periods are avoided. Without assurances to ratepayers or a proven track record of effective load control, GMP's incremental cost could be in excess of its assumed $90/MWh level if incremental load is incurred during high cost, peak times. This could occur due to a failure to effectively manage the additional load from electrification or because of load control during peak times is not possible due to customer requirements for electrical service (e.g. customer needs to use its CCHP during an extended cold weather period). Ultimately, the actual incremental cost to serve additional electrified load needs to be studied and validated. Lacking this, GMP's cost-benefit analysis of such programs is unfounded, and there is no certainty that these programs will not harm rather than benefit non-participating customers.

V. DEMAND RESPONSE ALTERNATIVES

Q60. What is the importance of Demand Response ("DR") as a resource alternative for GMP?

A60. GMP identifies key power cost drivers as increasing transmission and capacity costs, among others. In an effort to mitigate those costs, GMP is engaging in a variety of efforts, including investments in battery technology in its Joint Venture Solar / Battery Projects and Powerwall Program, which I discuss in previous sections. Making efforts to mitigate key cost drivers is a worthy endeavor, but one which requires a holistic review of alternatives to be done in a cost-effective manner. DR represents a real demand-side alternative which can effectively reduce transmission and capacity costs, along with providing other benefits.

Q61. Has GMP thoroughly considered and studied DR as a potential alternative?

A61. No, GMP has not appropriately considered DR resources on several fronts. First, GMP has not performed a holistic DR study to gauge the potential and cost-effectiveness of DR programs. Without such a study, it is impossible to gauge the extent to which effective DR programs exist and are untapped.[47] There could be DR programs, which could provide similar benefits at a lower cost, than efforts GMP is pursuing. To that point, GMP concludes that 10 MW of any one particular DR program is unfeasible and, therefore, DR is not an alternative to its Powerwall Program.[48] On the contrary, a

[47] See GMP Discovery Response DPS2.A66.f.
[48] See GMP Discovery Response DPS2.A65.

portfolio of DR resources may achieve capacities on the magnitude of 10 MW. DR is a real and proven resource, existing in significant quantities across U.S. power markets. Without a holistic DR study, the conclusion that 10 MW of DR is not possible is unfounded.

GMP does engage in a suite of DR programs. However, other than a suite of rate offerings and the eWater program, GMP's DR efforts are limited to battery storage and electrification efforts that fall under its Energy Transformation Program. In its comparison of the Milton Project to DR, GMP includes four rate programs, four electrification or storage programs, and the water heater control program (eWater).[49] Although these are worthwhile pilots, additional, more traditional DR programs exist and may have potential to be employed by GMP. Such programs would be evaluated under a holistic study.

Q62. Please summarize your conclusions and recommendations.

A62. GMP should sincerely consider and evaluate DR as a power supply alternative, specifically for capacity and transmission cost avoidance. As a first step, GMP should perform a holistic DR study which quantities the potential and effectiveness of DR programs. Without DR fully studied, a comprehensive least-cost analysis, particularly for capacity and transmission benefits, cannot be performed.

[49] See GMP Discovery Response attachment to DPS2.A64.d.

Q63. Does this conclude your testimony?

A63. Yes.