STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Petition of GMP MicroGrid-Milton LLC for a Certificate of Public Good, pursuant to 30 V.S.A. § 248, authorizing the installation and operation of up to a 4.99 MW solar electric generation facility and 2 MW battery storage facility to be located off of Mears Road in Milton, Vermont and to be known as the "GMP MicroGrid-Milton Project"	))))))))	Case No. 17-5003-PET

SECOND SUPPLEMENTAL PREFILED DIRECT TESTIMONY OF KIRK SHIELDS

April 20, 2018

Summary: Mr. Shields' supplemental testimony provides additional Project information based on feedback received from the Department of Public Service.

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

A1. My name is Kirk Shields and I am Director of Development and Risk Management for Green Mountain Power Corporation ("GMP"). My business address is 2152 Post Road, Rutland, VT 05701.

Q2. Have you previously submitted testimony in this proceeding?

A2. Yes, I submitted prefiled direct testimony on behalf of Petitioner GMP MicroGrid-Milton LLC ("MGM") that was included with the petition for the Milton GMP MicroGrid-Milton Project ("Project") on November 22, 2017. I also submitted supplemental testimony on March 23, 2018.

Q3. What is the purpose of your supplemental testimony?

A3. The purpose of my testimony is to provide additional supporting information about the Project based on feedback received from the Department of Public Service ("DPS"). Since the Petition was filed and over the course of discovery, GMP has had several discussions with the DPS about the proposed Project. DPS staff have provided valuable and critical feedback about where my original testimony could be supplemented with more information in order to provide the best understanding of the Project. In response, GMP is now providing information about the following areas of the Project: a) Project location in relation to distribution grid attributes; b) alternatives for satisfying the Need criterion (section 248(b)(2)); c) Renewable Energy Standard (RES) compliance and potential for Tier II supply excess; and d) final updates to the Project's cost benefit analysis.

Q4. The Department has requested supplemental information concerning whether the location of the Project will provide discrete benefits GMP's distribution grid. Please respond.

A4. GMP collects operational data about each of its distribution circuits. This data is used to monitor the health of the distribution system and for anticipating future configurations of the system as the area being served by the distribution circuit changes or grows. The Project will interconnect to the West Milton substation via the WM-G91 circuit. The West Milton substation also feeds the WM-G92 circuit to the south. The attributes of both the WM-G91 and the WM-G92 circuits are relevant here since the Project will positively affect both circuits in ways I will describe further.

First, the WM-G91 and WM-G92 circuit peak loads are highly coincident with the time of GMP's overall system peak load hours. With such a high coincidence, load reduction measures taken during the overall GMP system peak hour also have a very high probability of reducing the local system peak load on the WM-G91 and WM-G92 circuits. Additionally, the WM-G92 circuit contains a higher saturation of commercial loads, relative to the WM-G91 circuit, and is experiencing some load growth. When the Project battery discharges energy during peak load times, less energy will need to be pulled through the substation transformer to serve local loads, thereby helping to unload the substation transformer during peaks. Thus, due to this coincident nature of local and system peaks, unloading the substation transformer will extend its life as growth continues to occur and ultimately delay the need for replacement. The West Milton substation currently peaks at about 8 MVA, with a top rating of 10.5 MVA. There are currently three new customers who have sought ability-to-serve determinations from GMP for a total new load of about 990 kVA on the WM-G92 circuit. While we are not yet at the operating limit of the West Milton substation transformer, we do anticipate some continued growth on the WM-G92 circuit which will eventually lead to the need to explore options for accommodating that growth. This battery system will have the ability to reduce the flows through the transformer by about 2MWs during peak times, extending the transformer's useful life.

Second, the WM-G91 is served by a radial transmission line (Line 125, Breaker B17) and has weak feeder backup to the adjacent substation. This means that the feeder backup scheme can only be used under a limited set of load conditions to assure voltage and line loading remain within reasonable windows while carrying one circuit from the other. The radial transmission line (Line 125) is over 2 miles long and feeds the West Milton substation from the Milton substation. Because this is the only source to the West Milton substation, if the radial transmission line goes out of service, all loads served by the West Milton substation go out as well. Historically, it has been challenging to use the feeder tie, but with the battery tied into the circuit, feeder backup can be used much more frequently, improving reliability in the area. This is because the battery storage can provide voltage stability as well as loading stability (acting as a load or a source as needed) during a time of feeder backup, which would expand the window of time that feeder backup could be performed reliably. The combination of the proposed solar and 2MW battery storage is expected to be capable of islanding the entire 2MW peak load on the WM-G91 circuit, so as designed the Project size and the feeder size match up very well. As previously alluded to, GMP concluded vendor selection for GMP's battery project in Panton by engaging with system protection partner Schweitzer Engineering Laboratories (SEL) to provide the detailed documentation and specifications to maintain system protection during islanding mode. We will be testing this design on our Panton Energy storage project and then repeating it for the Milton solar storage project.

During the October 2017 statewide wind event, all customers on the WM-G91 circuit experienced an average of 37 hours of power interruption, with a few customers experiencing over 4 days of no power. Additionally, following that event GMP discovered a broken insulator on one of the poles on the L125 radial transmission line. This finding required an emergency outage be taken on the transmission line in order to make the repair, which resulted in a four-hour power interruption to all the customers on the West Milton substation. With the solar storage project in place and the ability to island, we would have avoided the outage to at least the customers on the WM-G91 circuit or a total of about 1,800 customers. Table 1 below shows the Customer Average Interruption Duration Index (CAIDI) and System Average Interruption Frequency Index (SAIFI) statistics for the WM-G91 and WM-G92 circuits where the impact of the 2017 storm is evident:

TABLE 1			
WM-G91		**CAIDI (avg. outage hours)**	**SAIFI (avg. # outages)**
	2014	1.79	1.51
	2015	2.98	.96
	2016	1.07	1.79
	2017	11.1	2.12
WM-G92			
	2014	1.18	0.54
	2015	1.74	0.78
	2016	1.19	1.26
	2017	9.50	2.70

The islanding capability would not necessarily eliminate all of these customer impacts, but we are confident that it would have improved our system performance to many of the customers served by the West Milton substation. The customer impact of islanding capability depends on the actual location of a system fault relative to the location of the solar storage facility since electricity must remain physically able to flow between the solar storage facility and an islanded customer.

Third, site location for projects of this size matters for ease and cost efficiency of interconnection as well. A contributing factor for selecting this site was the large distribution conductor infrastructure already available at roadside, so no reconductoring or existing pole upgrades were expected to be required for interconnection. Wire size and ampacity is an important consideration since locations with small wire are most likely to require extensive reconductoring to make interconnection possible. Ampacity represents the amount of electric current (measured in amps) that a conductor can carry before experiencing deterioration. Referring to Figure 1 below, circuit ampacity over GMP's entire system is shown with varying degrees of wire size and ampacity shown. Much of GMP's system consists of wire that is rated below 250 amps, with fewer places on the map indicating ampacity of 600 amps. The proposed Project location is circled on the map as a blue highlighted section with high ampacity. The system impact study confirmed that no reconductoring is required for interconnecting the Project.

Figure 1

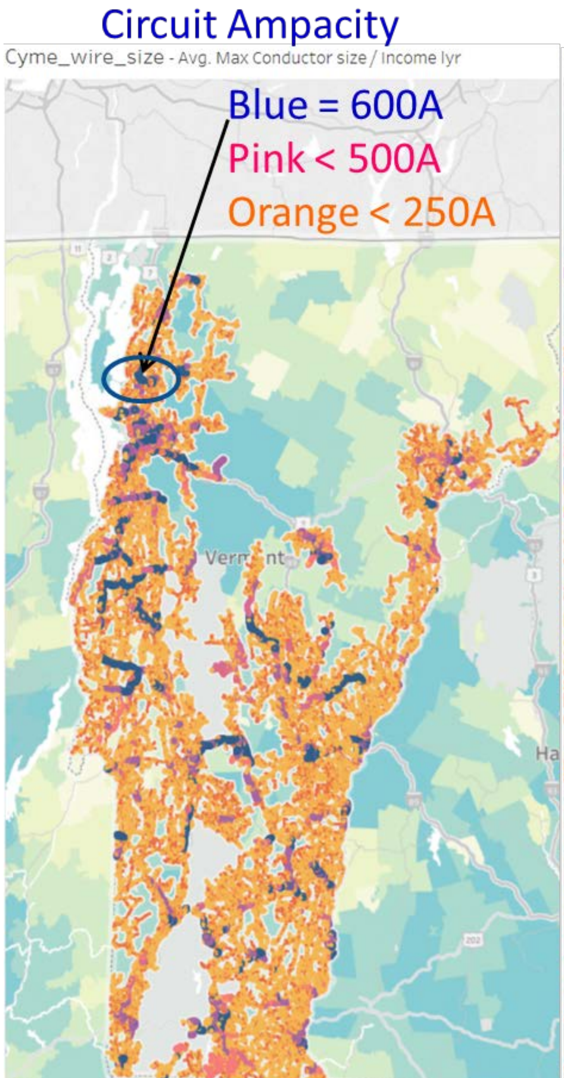
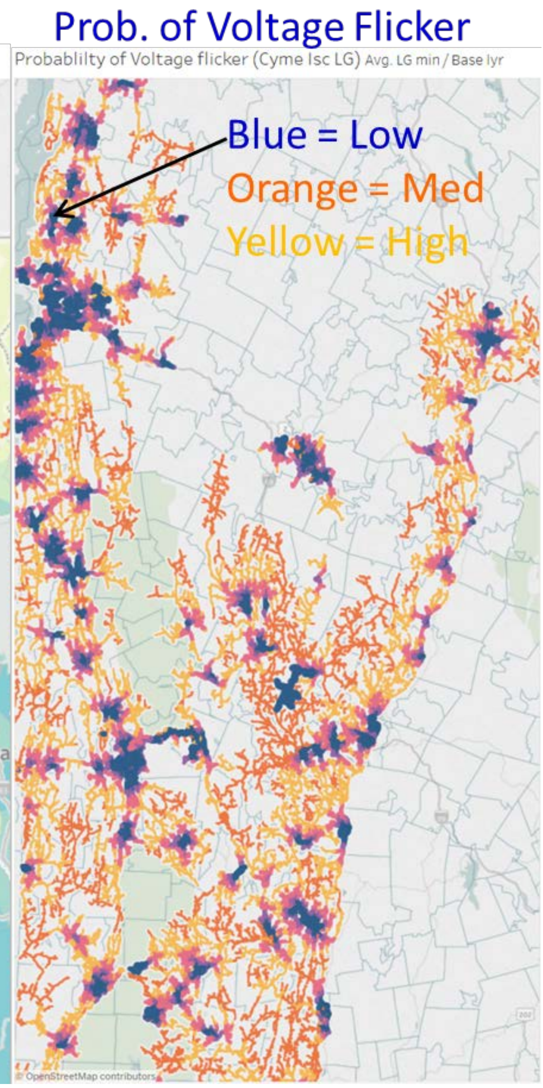


Figure 2



Similarly, a Project's interconnection to the distribution system is also dependent on the influence of voltage flicker that the new asset will have on the system. Figure 2 shows a similar map of GMP's system, graded for probability of voltage flicker. The Project location is connected to a part of the system that has a low probability of voltage flicker, as confirmed by the system impact study.

The takeaway from both of these maps is that the Project location is good from both grid and interconnection capability perspectives.

Q5. The Department has requested supplemental information concerning the alternatives to the Project that GMP identified and evaluated to deliver comparable benefits (i.e., load shaving, peak reduction, associated cost savings) to customers. Please respond.

A5. GMP currently employs various load management tools for pursuing peak shaving and load reduction benefits for customers, and has the ability to reduce demand of between 19 MW and 68 MW depending on response and season. None of the current load management methods, including the intended uses of the proposed Project, are mutually exclusive, meaning that GMP pursues multiple strategies simultaneously in order to reduce power costs for customers. Load management strategies currently being deployed by GMP include:

- Curtailable Load Rider (2 MW- 5 MW summer; 45 MW winter)
- Pilot Demand Response Program (5 MW-10 MW)
- Critical Peak Rider (2 MW)
- Water Heater program (6 MW-7 MW)
- Sonnen residential batteries (86 kW)
- Tesla Powerwall (ramping up to 1.5 MW)
- Sensibo Heat Pump controls (80 kW)
- Aquanta Water Heater controls (75 kW)
- IceBear load shifting (21 kW)
- Stafford Hill Battery (2 MW)
- EV Car Chargers (340 kW)

GMP's strategy for deploying demand and load management resources across the system hinges on a continuously evolving mix of resources depending on customer needs, with various costs, benefits, sizes, duration, customer requirements and technical feasibility. We believe the best approach is a portfolio approach, distributed mix of resources that includes small-scale, behind-the-meter and distribution-connected systems such as this project.

With that in mind, GMP is continually seeking out new opportunities to achieve cost beneficial and flexible load control for customers. Our initial development of flexible load resources mainly focused on the residential behind-the-meter space, however we have begun working with different parties and technologies for flexible, commercial-scale controls and load flexibility behind the typical tariff rate and rate rider approaches. We are currently partnering with third parties to explore commercial scale load shifting through building management systems and 'phase change material' such as ice and chilled water storage. The notion being that larger commercial customer locations with cooling loads can produce chilled water or ice during off-peak, overnight hours and then utilize this ice or chilled water to cool interior spaces during the day, moving load from day to night. Conversely, if an area were heavily saturated in solar it may make sense to make ice during peak solar periods and then utilize the ice for space cooling during the evening peaks in place of electricity-driven A/C compressors. We are engaged in the discussion around savings sharing ideas with the partner to make the concept work.

Notwithstanding everything above, there are additional value streams that this solar-storage facility will provide that are not easily obtained from other flexible resources described above including: frequency regulation, islanding, system power quality/voltage management. Frequency regulation is a part of the financial model for this project, providing revenues back to customers in exchange for providing ISO New England with a fast-response resource that is larger than 1MW in size. Islanding requires an actual power source that can re-energize the grid; this cannot be obtained solely from flexible loads or load control. Lastly, the distribution system power quality component relies on the power electronics that are coupled with the solar and battery storage systems to produce reactive power and voltage smoothing when helpful to the local distribution system. Flexible loads can play a small part in system quality but cannot provide the reactive power needed to shift the voltage substantially when needed. For these reasons, GMP concludes that a battery storage system is the appropriate load management solution at this location for the intended use cases.

Q6. The Department has requested supplemental information concerning GMP's compliance with RES requirements and the potential that it will have excess Tier II supply. Please respond.

A6. Tier II RECs are eligible to meet Tier III obligations and so are valuable hedges against the Tier III Alternative Compliance Payment (ACP) of $60/MWh. I start off with this statement because the explanation of the planning logic is rather involved.

To explain the thinking behind this hedge strategy, GMP acknowledges that its analysis indicates that it may have an excess supply of Tier II RECs, relative to its obligations under Vermont's RES program for at least several years into the future. Beyond the Tier II obligation, GMP also has an additional Tier III obligation for helping customers to move from fossil fuel to efficient electrification.

GMP exceeded its Tier III project targets in 2017. We expect to exceed Tier III targets again in 2018 based on our current pace of customer participation in our portfolio of programs. However, despite the initial success, the growth of the Tier III annual requirement is steep over the fifteen-year period of the statute. What began in 2017 as a target of 2% of retail MWh sales grows to 12% by 2032. We support these targets and also support the Tier III provision of RES fully, but as the annual targets steeply increase and the easier customer projects are completed in the early years, we see a need to hedge our future Tier III requirements with Tier II excess in order to manage ACP cost risk.

Figures 3 and 4 below illustrate two possible scenarios of future Tier III outcomes. Figure 3 illustrates a Low Tier III Case where initial years' requirements are met but subsequent years' Tier III projects fall well short of requirements. In that case, excess Tier II RECs are sufficient to satisfy Tier III compliance, except in the last 2 years where requirements are not met even after using all available excess Tier II RECs. Figure 4 illustrates a High Tier III Case where Tier III projects are sufficient to meet requirements for at least the first half of the program period, then require Tier II RECs to help meet requirements through the end of the program period.

Figure 3 – Low Tier III Case

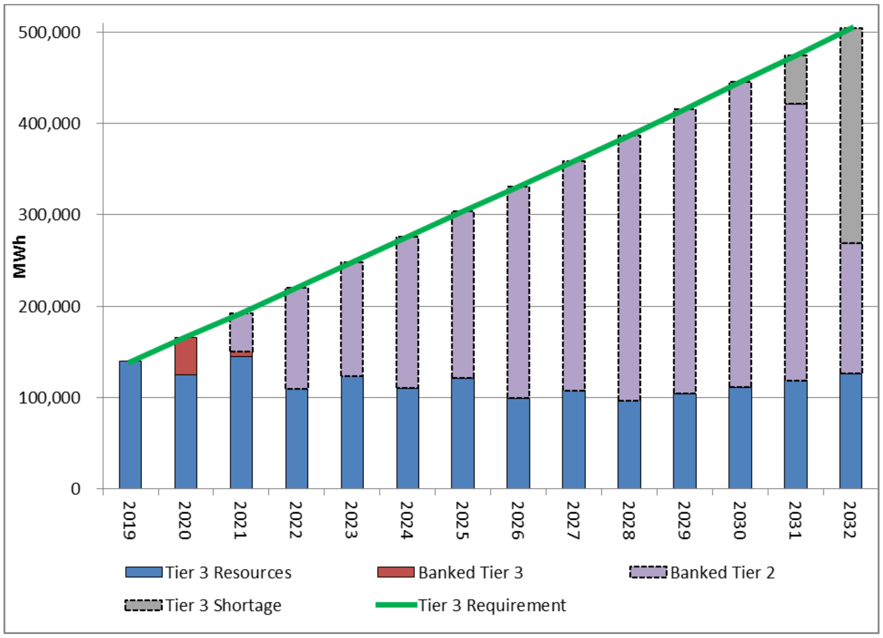
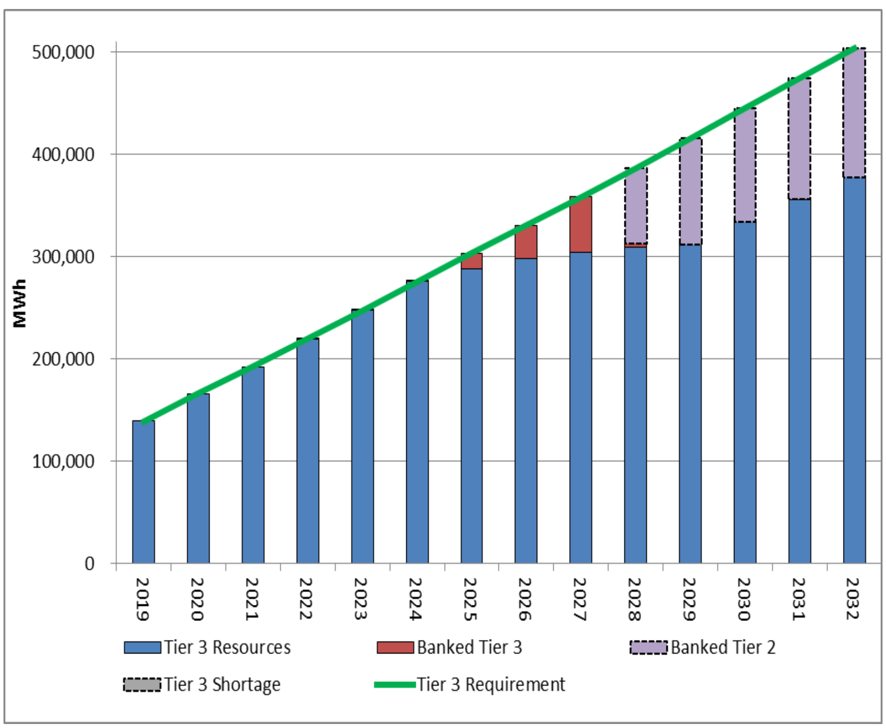


Figure 4 – High Tier III Case



At this early stage in the program cycle, while it is difficult to confidently predict which of the possible outcomes is most likely to prevail, a $60/MWh ACP in the Low Case is the outcome that GMP believes is appropriate to hedge against.

Q7. Please explain why the financial model has been updated a number of times, and provide the final updates.

A7. As with any project, we are continually looking for ways to reduce the cost of deployment which ultimately leads to updates in the financial model. GMP has made one last set of updates to the financial model, and can now confirm that the model is stable and locked down in final form.

In summary, the final updated model indicates that the battery storage value to be realized by customers will increase to $285/kW-year, versus the value of $233/kW-year reported in my original testimony. The estimated solar all-in levelized costs to customers is reduced slightly to $0.081/kWh versus the $0.083/kWh stated in my original testimony.

Andrew Quint provides additional detail about the updates to the final model in his supplemental testimony.

Q8. Since the original Petition was filed, a new module import tariff was levied. Will that have an effect on Project costs? If so, what are those effects?

A8. The International Trade Commission ("Trade Commission") received a complaint that cheap solar module imports were hurting domestic solar module manufacturers who produce solar modules at higher costs. The Trade Commission ruled in favor of the complainants and President Trump authorized a 30% import tariff be placed on certain imported solar modules (with the rate declining over a four-year period to 15%). Fortunately, GMP's contractor has insulated GMP from the financial effects of that new import tariff through bulk module purchases, so there is no resulting cost impact to the Project.

Q9. Does this conclude your supplemental testimony?

A9. Yes, it does.