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VIA ePUC

January 22, 2020

Ms. Judith C. Whitney, Clerk
Vermont Public Utility Commission
112 State Street
Montpelier, VT 05620-2701

Re: GMP – Resilient Home Innovative Pilot – Final Report

Dear Ms. Whitney:

Please accept this as Green Mountain Power's ("GMP") final report regarding our Resilient Home Innovative Pilot ("Pilot"), which commenced on May 14, 2019 after notice to the Public Utility Commission and Department of Public Service. The Pilot provided customers with an opportunity to install a whole-home battery backup system directly through GMP or through another certified installer, while giving GMP the opportunity to test the data accuracy of the battery system's metering capabilities, as well as using the batteries to help reduce costs for all GMP customers.

Explanation of Resilient Home Innovative Pilot and Why it was Important

The Resilient Home Pilot was designed to provide up to 500 customers with a whole-home backup battery solution directly through GMP or another certified installer. Each system installed consists of two Tesla Powerwalls that were added to GMP's overall fleet of batteries and were actively used to reduce GMP's total peak demand and drive down costs for customers. Fifty spots were reserved for customers to participate through the Bring Your Own Device ("BYOD") program that was included in the original filing as an extension of the now concluded BYOD Pilot. In all cases, GMP tested the technology's capabilities to meter whole home consumption by utilizing the data from the Tesla Energy Gateway.

GMP also included an option for customers to participate in an innovative billing structure of fixed rate monthly bills for both the storage and power use, which placed customers into tiers based on their historical consumption. Customers choosing this option paid a set price each month. Tiers are re-evaluated every 12 months during participation, with customers placed in a new tier only if their power use exceeds or falls below the kilowatt hour allotment for their tier.

The program subscribed the vast majority of the Direct and Indirect lease spots, however there was less uptake on the BYOD slots. As described in more detail below, there was, and continues to be, a good level of success with the data being used for billing purposes. While there remains room for some

improvement, GMP is excited about the successful nature of this testing as a stepping stone towards utilizing different types of technology for metering consumption for GMP customers. It could lead to a future where instead of meters, which only measure usage, customers instead have seamless carbon-cutting backup battery power that also measures energy usage.

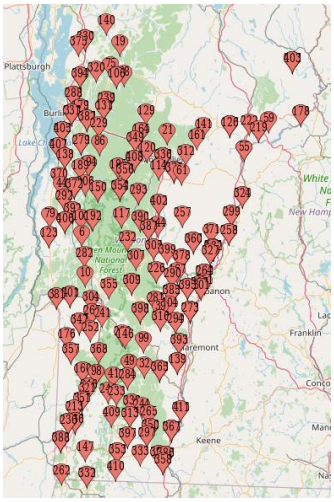
Participation in Pilot

As of January 22, 2020, there are 411 customers with completed installations through both GMP Direct and Indirect Lease options (see table below for breakdown). Of the remaining 39 lease spots, 28 are reserved by customers who either have a signed contract or are awaiting installation. Installations have been slowed by the COVID-19 pandemic as well as pandemic-related global supply shortages of batteries. GMP anticipates the remaining installations to be completed by summer when supply is expected to increase.

GMP Direct Lease Completed Installs	230
GMP Indirect Lease Completed Installs	181

At the 12-month mark, the 50 BYOD spots were all reserved, however, nearly all of these were still pending when the BYOD tariff went into effect and we expect any pending or new battery installations looking to participate in BYOD will join the newly tariffed BYOD program.

Customers are participating from all around GMP's service territory as seen in the map below:



The following table shows the participating installers and the number of systems installed and/or contracted.

Installer	Contracted and/or Installed
Catamount	4
Power Guru	22
SunCommon	173

There are currently 18 customers participating in fixed rate tier billing. More details are provided below.

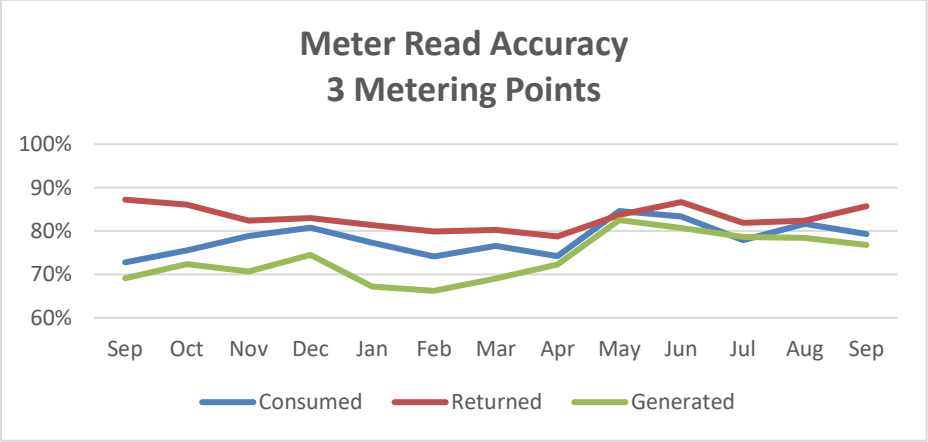
Goals & Measurement

As originally filed, GMP laid out several specific questions to ask and learn as part of this Pilot.

1. Determine whether the consumption data provided by the battery systems is as accurate or within a reasonable margin of error compared to the existing AMI meter data.

a. GMP will compare the data from both sources in retrofit installations to determine the accuracy of the battery metering data.

Appendix A provides a detailed breakdown of data accuracy since billing with the battery system data started in September 2019. Each of the measured data points, total consumed from grid, total returned to grid, and total generated, fluctuated in accuracy over the 18-month period. However, they remained on average 78%, 83%, and 74% respectively. The last 6-months of measurements show a slightly higher average for each of the measurements, due to some improvements made on the commissioning of the participating installs on Tesla's system.



Regular checks by the billing team were helpful in order to identify installations that were either not configured properly, or in some cases, in need of repair. This was an added benefit that was not anticipated and showed that when GMP and its partners work closely together, customer experience can improve. Just recently, GMP helped Tesla discover an area in need of improvement for the automatic provisioning of installations that would enable them to begin passing through data for this pilot. As the chart above shows, the last 6 months have driven the data points to a much steadier level of accuracy for all of the metered points.

GMP will continue to monitor the data over time, and similarly, continue to work with Tesla to put in measures that will increase and stabilize accuracy of the data.

2. Determine customer interest for Fixed Priced Billing and the impact, if any, on customer behavior as it relates to usage.

a. Because the rate will be optional, GMP will quickly determine the level of interest and engagement from customers.

There are currently 18 customers who decided to participate in fixed rate tier billing. As was the case at the time of the 12-month report, over half of the customers enrolled in the pilot are ineligible for tier pricing, either because of an existing solar array, enrollment in Rate 3 (which requires a separate meter), or lack of sufficient usage history to confidently assign a tier. Second, we have learned that there is a need for significant up-front conversation to determine whether this option is appealing to customers. GMP had many conversations with customers who ultimately decided not to opt for this aspect of the Pilot. In some cases, those customers were concerned about exceeding their tier limit and being locked into a high monthly price for the subsequent 12-month period. In other instances, customers did not look favorably on the possibility that they would pay more than they would have otherwise under a volumetric rate, despite the benefit of price stability. These have been extremely valuable lessons as we consider how to look at a tiered pricing offering for customers. We are thinking through other offer models to explore as we move forward while learning from the data provided by the Pilot.

b. *Over time, GMP will be able to look at the consumption behavior of customers who have elected this billing option to understand where they fall within their assigned tiers and if usage behavior has changed and how much variation exists within the tier.*

Each customer's initial tier was calculated using the historical average consumption from up to three previous years. Table 1 below shows the consumption for each customer over the past 12 months, compared with the adjusted upper and lower limits of their current tier. The adjustments here reflect the customer's historical usage pattern. Table 1 also shows the resulting billing difference: the amount paid to GMP compared to amount the customer would have paid under Rate 1, where negative values mean the customer paid less than Rate 1. The anonymized customer numbers have been preserved from the 12-month report. Customer 9 dropped out of tier billing as a result of installing solar and has been omitted from this table. Customer 19 recently enrolled in the Pilot and has only 1 month of tier usage data.

Customer Number	Tier	Number of Months of Data	Actual Consumption	Tier Minimum (Adjusted)	Tier Maximum (Adjusted)	Over/Under Tier	Percent Over/Under Tier Limit	Billing Difference (vs Rate 1)
1	2	12	7422	4,000	5,999	Over	24%	-$348
2	6	12	9946	12,000	13,999	Under	-17%	$606
3	3	12	6715	5,918	7,890	None	-	$131
4	1	12	5327	1	3,999	Over	33%	-$415
5	7	12	16235	14,197	16,224	Over	0%	-$94
6	1	12	5704	1	3,989	Over	43%	-$479
7	4	12	8819	8,000	9,999	None	-	$76
8	5	12	10181	10,000	11,999	None	-	$206
10	3	12	9171	6,000	7,999	Over	15%	-$283
11	5	12	9919	10,000	11,999	Under	-1%	$251
12	3	12	7360	6,000	7,999	None	-	$22
13	7	12	14011	14,146	16,165	Under	-1%	$281
14	1	12	3341	1	4,001	None	-	-$80
15	4	12	7545	8,000	9,999	Under	-6%	$291
16	1	12	6630	1	4,412	Over	50%	-$635
17	1	12	4166	1	3,999	Over	4%	-$219
18	1	12	24627	1	4,267	Over	477%	-$3,669
19	2	1	517	339	509	Over	2%	-$12

Total	-$4,372
Average per participant	-$243
Total (excluding errant)	-$703
Average (excluding errant)	-$41

Recognizing that tier pricing is a novel concept, we will not to adjust tiers until October 2021 when all rate changes normally go into effect. This will provide ample time to evaluate the impact of tier billing on customer behavior. We also recognize that the last 11 months have been anomalous and possibly a poor predictor of future usage given the higher residential usage since the pandemic started. The change in usage pattern complicates the assessment of tier billing, but the majority of customers were nevertheless able to stay within or very close to their tier.

As was discussed in the 12-month report, Customer 18 an extreme outlier; the assigned tier was based on insufficient historical data and actual usage has far exceeded the upper tier limit. However, because tiers were not reassigned for any pilot participant, we deemed it would be unfair to handle Customer 18 differently, and they have remained in the program. We will discuss with this particular customer their participation to ensure there is a smooth transition to another tier or out of the tiered pricing portion of the pilot, if preferable.

It is interesting to note that, when removing customer 18, participants have paid an average of just $41 less on the tier pricing plan than they would have paid under Rate 1 over the past 12 months. This small discrepancy would likely be even smaller if the pandemic had not driven usage higher on average among residential customers. There is natural variation among the participants, with some slightly ahead or behind, but on balance, the novel structure of tier pricing has not significantly altered consumption behavior in aggregate (excluding Customer 18). We believe overall that the tier reassignment process (with tiers recalculated based on the previous 12 months) is enough of a disincentive against overconsumption, which a truly unlimited subscription plan might encourage.

3. *Assess the value of connecting with the home builder market and create grid ready homes from the ground up including a battery storage system*

a. *This will be reflected in GMP's ability to successfully help builders integrate technology and resources into new homes that provide value to both the homeowner and all GMP customers.*

b. *The ability to repeat this process with multiple partners will also be a measure of success.*

There were no installs completed by a homebuilder during new construction. We had two planned new build installations but found that the logistics of installing the batteries in homes that were not already occupied proved to be challenging. GMP still believes that there is opportunity to work with home builders to make new homes ready and available for battery installations. We will continue to explore opportunities in this area and seek to find partners that will help us realize this goal through a Pilot structure or otherwise.

Updated Pilot Financials

Through the end of May 2020, the Resilient Home Pilot is experiencing a net gain of over $75,000. In addition to the Power Supply value as described below, each Tesla Powerwall is a prescribed Tier III measure based on shifting energy use away from emission-intensive peaks. With a total of 411 installs completed, there are 822 Powerwalls eligible for Tier III credit. Conservatively, GMP is calculating the Tier III value of the Resilient Home Powerwalls by multiplying $25, which is below the cost of a REC that could otherwise be purchased and retired to count toward Tier III, by the total number of Tier III MWh in the program. See table below for calculations based on 2019 and 2020 TIII Values prescribed to Powerwalls.

	2019	**2020**
Total Powerwalls	492	330
Cost per MWH	$25	$25
TIII MWH	8.79	7.50
TIII Value	$108,117	$61,875
Total TIII Value	**$169,992**	

It should be noted that this is a one-time benefit for each unit.

Resilient Home Pilot	
Cumulative Installs	411
Equipment Revenue	$504,726
Power Supply Value	$628,611
T3 Value	$169,992

Depreciation	($688,052)
Return on Rate Base	($559,168)
Net Gain/Loss	**$56,109**

Because all Powerwalls installed as part of the Resilient Home Pilot are aggregated with GMP's total Powerwall fleet for customers, a calculation was used to determine the value of Power Supply savings provided from these systems alone. The table below shows the proportion of GMP's total fleet that belongs to Resilient Home systems, as well as the total power supply value provided by GMP's total fleet. To determine the Resilient Home power supply value, the total fleet power supply value was multiplied by the proportion of total fleet installs that belong to Resilient Home.

FCM Peak	Resilient Home % of Total Fleet Installs	Total Fleet Power Supply Value	Resilient Home Power Supply Value
7/30/19	14%	$580,002	$81,200
7/27/20	24%	$683,441	$164,026

	RNS Peak	Resilient Home % of Total Fleet Installs	Total Fleet Power Supply Value	Resilient Home Power Supply Value
2019	May	1%	$65,822	$594
	June	9%	$49,025	$4,296
	July	14%	674655	$95,636
	August	16%	13122	$2,138
	September	18%	$88,456	$15,586
	October	18%	$315	$5
	November	19%	$111,698	$20,919
	December	20%	$102,098	$19,979
2020	January	22%	$104,710	$23,398
	February	26%	$108,040	$27,818
	March	28%	$106,244	$30,098
	April	29%	$204	$59
	May	29%	$114,341	$33,394
	June	24%	$111,176	$26,678
	July	24%	$9,582	$2,316
	August	24%	$104,299	$25,030
	September	24%	$109,771	$26,517
	October	24%	$94	$23
	November	24%	$119,556	$28,900

*Did not dispatch any systems from March 18 to May 4 due to COVID-19.

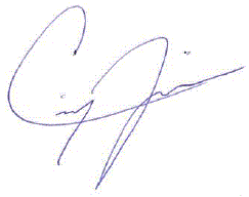
TOTAL POWER SUPPLY VALUE = $628,611

Going Forward - Applying Lessons from this Tariff to Future Programs

As noted, this Pilot has been very valuable in providing GMP lessons learned regarding subscription pricing through tiers and regarding utilizing the storage devices as meters. Based upon the experience in this program and the data discussed above, GMP does not plan to move forward flat or subscription pricing to a tariff; we do believe there may be other ways to test this pricing feature and will continue to look at this in future pilot planning. On the storage device as a meter, we are very encouraged by the results. Over the next several months, GMP will continue to monitor the Tesla data as compared to the GMP AMI meters. We will also continue to work with Tesla to improve the success rate, in order to make a decision before the expiration of the current storage tariff programs to determine whether this feature should be added in any future program. Similarly, we continue to investigate how GMP could incorporate other emerging devices, such as smart panels, as we look at how to move customers to more seamless, integrated energy services beyond the meter. GMP was pleased to partner with customers on this Pilot and believes there is a great opportunity to use storage as a meter to improve the resiliency for customers in the face of climate change.

If you should have any questions, please contact me at 802-747-6818.

Sincerely,



Craig Ferreira
Innovation Development

Enclosure
cc: Daniel Burke, Vermont Department of Public Service
Rebecca Foster, Efficiency Vermont
Olivia Campbell Andersen, Renewable Energy Vermont

Appendix A

	Sep-19			Oct-19			Nov-19			Dec-19		
	Net/House Meter		Solar Meter	Net/House Meter		Solar Meter	Net/House Meter		Solar Meter	Net/House Meter		Solar Meter
Performance	Consumed	Returned	Generated	Consumed	Returned	Generated	Consumed	Returned	Generated	Consumed	Returned	Generated
Within 4% Tolerance	72.78%	87.22%	69.12%	75.56%	86.11%	72.37%	78.85%	82.38%	70.65%	80.79%	82.97%	74.51%
Outside 4% Tolerance	20.56%	10.56%	22.06%	14.44%	7.78%	18.42%	11.45%	11.01%	9.78%	11.79%	9.61%	12.75%
No Data being returned	6.67%	2.22%	8.82%	10.00%	6.11%	9.21%	9.69%	6.61%	19.57%	7.42%	7.42%	12.75%
Counts	Sep-19			Oct-19			Nov-19			Dec-19		
Installed	180	180	68	180	180	76	227	227	92	229	229	102
Within 4% Tolerance	131	157	47	136	155	55	179	187	65	185	190	76
Outside 4% Tolerance	37	19	15	26	14	14	26	25	9	27	22	13
No Data being returned	12	4	6	18	11	7	22	15	18	17	17	13

	Jan-20			Feb-20			Mar-20			Apr-20		
	Net/House Meter		Solar Meter	Net/House Meter		Solar Meter	Net/House Meter		Solar Meter	Net/House Meter		Solar Meter
Performance	Consumed	Returned	Generated	Consumed	Returned	Generated	Consumed	Returned	Generated	Consumed	Returned	Generated
Within 4% Tolerance	77.33%	81.38%	67.23%	74.10%	79.86%	66.23%	76.54%	80.25%	69.07%	74.22%	78.75%	72.32%
Outside 4% Tolerance	22.67%	18.62%	32.77%	18.71%	15.11%	17.22%	18.83%	15.74%	19.59%	19.26%	16.43%	16.07%
No Data being returned	4.86%	2.43%	10.08%	7.19%	5.04%	16.56%	4.63%	4.01%	11.34%	6.52%	4.82%	11.61%
Counts	Jan-20			Feb-20			Mar-20			Apr-20		
Installed	247	247	119	278	278	151	324	324	194	353	353	224
Within 4% Tolerance	191	201	80	206	222	100	248	260	134	262	278	162
Outside 4% Tolerance	56	46	39	52	42	26	61	51	38	68	58	36
No Data being returned	12	6	12	20	14	25	15	13	22	23	17	26

	May-20			Jun-20			Jul-20			Aug-20			Sep-20		
	Net/House Meter		Solar Meter	Net/House Meter		Solar Meter	Net/House Meter		Solar Meter	Net/House Meter		Solar Meter	Net/House Meter		Solar Meter
Performance	Consumed	Returned	Generated	Consumed	Returned	Generated	Consumed	Returned	Generated	Consumed	Returned	Generated	Consumed	Returned	Generated
Within 4% Tolerance	84.59%	83.75%	82.53%	83.38%	86.70%	80.69%	77.87%	81.87%	78.60%	81.65%	82.43%	78.38%	79.28%	85.68%	76.81%
Outside 4% Tolerance	12.89%	14.29%	10.04%	13.30%	11.08%	11.59%	18.40%	15.20%	12.76%	13.95%	13.95%	11.58%	15.60%	9.72%	10.65%
No Data being returned	2.52%	1.96%	7.42%	3.32%	2.22%	7.73%	3.73%	2.93%	8.64%	4.39%	3.62%	10.04%	5.12%	4.60%	12.55%
Counts	May-20			Jun-20			Jul-20			Aug-20			Sep-20		
Installed	357	357	229	361	361	233	375	375	243	387	387	259	391	391	263
Within 4% Tolerance	302	299	189	301	313	188	292	307	191	316	319	203	310	335	202
Outside 4% Tolerance	46	51	23	48	40	27	69	57	31	54	54	30	61	38	28
No Data being returned	9	7	17	12	8	18	14	11	21	17	14	26	20	18	33