



Craig Ferreira

Innovation Development

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Electronic and Hand Delivery

Holly Anderson, Clerk
Public Utility Commission
112 State Street #4
Montpelier, VT 05620

Re: GMP Innovative Pilot: Span

Dear Ms. Anderson:

This letter is to provide notice of Green Mountain Power's Span Smart Panel Innovative Pilot (the "Pilot"). Green Mountain Power plans to start offering customers the opportunity to participate in the Pilot after May 6, 2021.

Executive Summary

GMP is continuing to create a more dynamic, accessible and choreographed grid. Over the past several years, we have worked with customers to deploy numerous distributed energy resources ("DERs") ranging from water heater controls to Level 2 electric vehicle (EV) Smart Chargers and energy storage among a few. These devices help to lower cost and carbon and boost reliability for customers, with the benefits proven through our pilots and programs. As we continue to innovate on behalf of our customers, GMP is always looking for hardware, software and services that can deliver solutions to improve reliability, reduce carbon and reduce cost for all. As more devices in the home gain the ability to help with load management, creating a central gateway, or access point, will help to reduce the number of one-by-one integrations needed, providing greater ease and flexibility for both our customers and GMP. The first point of electrical connection, beyond the meter, into the home is typically the customer's main electrical panel. This key piece of electric infrastructure has often been overlooked when it comes to adding intelligence to the smart home. By adding connectivity to the customer's main electric panel, customers will be able to monitor, control, and even more easily integrate devices such as storage and solar in the future as well as be the central communications gateway to other intelligent devices in the home such as smart car chargers and water heater controls.

The Pilot will work with a small set of customers to provide and install the Span Smart Panel (“Span panel”) at no cost to the customer, and then test load management and metering capabilities, as well as integrating the Span panel with distributed resources like storage, EV chargers, and solar panels. Customers will benefit from information garnered by circuit-level data that will empower them to make smart energy choices in the home, while GMP and all customers will benefit by having additional resources available for grid needs, as well as by learning about how this new technology can be successfully leveraged in the utility space. As described in our recently-concluded Resilient Home pilot that tested an alternative metering option using energy storage system data, GMP believes it is beneficial to continue testing alternative devices that could serve as the next-generation metering solution for customers.

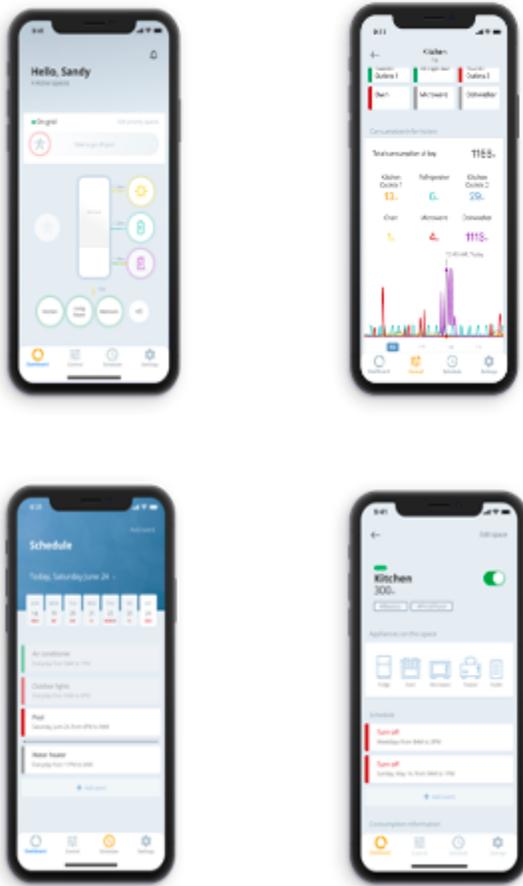
The Span panel provides all the safety features of a standard electrical panel with added functionality for the homeowner and GMP. The Span panel integrates various types of devices that GMP has deployed in partnership with customers over the past several years, such as energy storage, water heaters, heat pumps and EV Chargers. Importantly, the Span panel also allows for whole-home metering and load management by individual circuit in the home. For example, in the event of an outage where the home is running on a backup battery, a customer would be able to remotely disconnect certain circuits in the home extending the duration of the backup. This can even be automated to provide the longest duration of backup possible for the customer.

What is the Span Panel and Why this Pilot

GMP has been watching the smart electric panel space for years including conversations with various companies starting up in this space. Span is the first one to have developed and UL certified a fully integrated panel with controls, monitoring, metering and the ability to expand to include other devices such as storage and solar. With full UL listing for a 200 amp electrical panel, a service entrance and an energy management device, Span has created a full replacement of the traditional electrical panel that allows for the combination of both circuit level data as well as the ability to manage each individual load, which has been largely separated by available devices that strive to accomplish one or the other. With growing deployments of rooftop solar, energy storage, and EVSEs at the residential level, GMP wants to explore how this system can improve upon the installation process, as well as the user experience, of these resources. With the Span app, customers are empowered and can interact with, monitor and control their home energy usage all with their smartphone. It provides

customers greater visibility into the home’s energy consumption, from anywhere, at any time. It provides the capability of scheduling, control, and alerts so that customers know exactly what is going on in their homes at all times at the individual circuit level.

Testing a whole home approach will also potentially help GMP and our customers participate more easily in new markets that utilize load managed devices as they emerge, to help lower costs and carbon. In 2020, the Federal Regulatory Energy Commission (“FERC”) issued Ferc Order 2222 which essentially opens the Wholesale Energy markets managed by the various Independent System Operators to DERs. This means that more and more resources will be able to participate in these markets and will require a greater level of monitoring, control and metering to assure system stability, reliability and safety while producing as much value for customers as possible. Having a central gateway type device like this panel that can monitor every circuit as well as communicate with various devices would greatly simplify that work.



This same intelligence through the smart panel allows for more Distributed Energy Resource (“DER”) interaction directly with GMP. It provides a central point of communication that will allow for management of multiple devices within a home, without needing a separate communication channel with each distributed asset. With this type of intelligent load panel, GMP can work with customers to make any electrical load in the home a smart DER, driving down cost and carbon in a simple effective way.

The Span panel also provides an opportunity to simplify the installation of solar and energy storage by reducing the number of components needed during installation and will be an important type of configuration to understand.

When energy storage is installed in conjunction with the Span panel, customers will be able to maximize the backup duration during an outage utilizing the panel controls. The Span panel allows for intelligent switching of loads. In grid-outages, customers have the ability to seamlessly prioritize loads within the home, specify priorities for backup, and even create backup profiles that can be toggled to ensure the longevity of backup power from their installed system. For example, a customer could automatically curtail EV charging during a grid outage event in order to preserve the energy stored in the home battery for other purposes. Now, customers who wish to optimize the usage of battery storage during an outage have to take a more manual or more-planned approach; with the Span, they would have dynamic and flexible control based upon their needs at the time and the expected duration of the event.

GMP is aiming to test a variety of use cases with the Span panel. As described in further detail below, GMP will work with enrolled customers to review data, manage various loads and devices within each home, as well as determine if the Span panel can enable voluntary demand response actions or the installation of devices that customers may not have otherwise chosen. Additionally, GMP will work with installers to confirm that the installation of the Span panel is simple and feasible as a new alternative to a main electrical panel, and how it interacts with energy storage and/or a solar array. We will also test the metering functionality, in line with our previous testing to use alternative methods to meter the home energy consumption and other metrics such as power quality information compared to the AMI metering system.

Pilot Details

GMP will seek 100 residential customers who want to have the Span panel installed in their home at no cost to them, in exchange for collaborating with GMP on the objectives of the Pilot. GMP will own the panel and customers will not be required to make any payments to participate in this program. We chose to have the Pilot be for 100 customers because it allows for a large enough sample size to capture the cross section of customer segments we are interested in learning about, as well as providing for additional subsets that we may not currently have in mind. 100 customers will provide ample opportunity to achieve the pilot objectives while staying within a reasonable cost for testing this new technology.

Traditionally, the meter is the line between a utility and customers. We follow that model today: GMP owns the meter at our customer's home, and equipment beyond the meter is typically owned by our customer. This Pilot will help us explore whether, in this new era of electrification to combat climate change and distributed devices that are capable of load management, a Span panel should set a new line, where GMP provides the electrical panel as the main entrance point for electricity into the home to provide for a variety of potential opportunities in billing and load management to help cut costs and carbon, and improve reliability.

In this Pilot, GMP will purchase 100 Span panels from Span directly, and provide them to participating local installers to place them in participating customer homes. We will seek a variety of residential customer segments that will include customers in need of a main panel upgrade, existing and new solar installs, and existing and new battery installs. Additionally, GMP will be allocating a minimum of 30% of the systems for customers qualified for our Energy Assistance Program to ensure equity in participation.

In order to be sure that we get a good sample size for each customer segment, GMP will make direct outreach efforts to the following customer segments. GMP will do customer intake and assign spots in the program based on qualifications and customer segment needs. This does not necessarily mean that customers will be given spots on a first come, first served basis. For any segments that GMP cannot make direct outreach for, such as the New Solar Only group, GMP will rely on the installation partners to refer qualified customers into the program.

Customer Segment*	Description	Minimum # of Customers
Existing Solar Only Retrofit	Customers with a pre-existing solar array, but no energy storage. Span will be added to the existing setup.	10
New Solar Only Installations	Customers without energy storage, but adding a solar array. Span panel will be installed at time of solar array installation	10
Existing Energy Storage Only Retrofit	Customers with pre-existing energy storage, but no solar array installed. GMP Powerwall and BYOD customers are eligible.	10
New Energy Storage Only Installations	Customers with no solar or energy storage. Span panel will be installed at the time of installation of energy storage.	10
Solar + Storage (existing or new)	Customers with an existing or new combination of solar plus energy storage.	10
EV Customers	Customers with an electric vehicle and a Level 2 charging station. These customers may also fall into any of the above categories.	10
Span Only	Customers that do not have any solar, storage, or EVSE installed	10
Electric Water Heater	Customers with an electric resistance water heater. Customers may fall into this category as well as any others	50
Heat Pump Customers	Customers with mini-split heat pumps. Customers may fall into this category as well as any others.	10
EAP Qualified Customers	Customers may fall into this category as well as any of the above.	30

*Due to the small pilot nature of the program and installation requirements of the panels, all customers must be in single family homes; experience will teach us whether installations at multi-family homes, mobile homes, and other buildings will be possible.

The panel is compatible with three major manufacturers¹ of circuit breakers, and therefore should not be a limiting factor for customer participation, however we have built in some costs for replacement breakers for 15% of the participants.

System Installation and Pilot Mechanics

Span will certify local licensed electrical contractors to perform the installation of the total system. By doing so, GMP will again be partnering with Vermont installers to provide this program and service to customers in a collaborative way. GMP will purchase the equipment directly from Span, and will subcontract the installation component to any certified installer participants.

Becoming a Span certified installers will involve three main components.

1. Sign the Span Certified Installer Agreement;
2. Attend a 1.5 hour webinar about installing the Span system which occurs weekly
3. Pass an online test regarding proper installation

Once certified, installers will each be allocated an initial 10 customer installations, and thereafter we'll allocate remaining customers based upon how many installers become certified. Ultimately, the number of customers each installer will be allocated will be dependent on the number of participating installers.

GMP has included installation costs for a standard install that is defined by a straight-forward swap out of the existing panel with no additional work needed on the electrical situation of the Customer's home. If there is additional work needed, the customer may still participate, but will be responsible for any additional costs specified by the installer.

Each participating installer will be required to provide feedback about each specific type of installation to gain a clear understanding of the benefits or complexities of using the Span panel.

Participating customers will execute an agreement with GMP that will allow for data access, management of certain loads within the home, such as an electric water heater, and to relieve the customer from bearing responsibility for repairing the panel should any issues arise. As GMP will maintain ownership of the panel, the agreement will extend the panel's 10-year warranty to the customer and allow for GMP and its partners to physically access the panel if needed.

¹ SquareD HOM (including Homeline plug-on neutral style), Eaton BR, Siemens QP / Murray MP

Customers will also agree to share their experience with GMP regarding the installation process and the actual user experience of the Span panel itself. We will accomplish this through traditional surveys that will allow us to aggregate data to ensure quality installation partners, but also to understand if and how the Span panel works for the participating customers.

Demand Response

The Span panel allows for direct management of loads within the home, as well as increased ease of customers to respond voluntarily to peak event notifications by switching off loads with the smart phone app. GMP will aim to ensure that at least 50% of the customers who participate also have an electric resistance water heater that will provide a familiar asset for testing the ability of the panel to provide effective direct control of loads. The ability for customers to switch each circuit back on with the Span app provides opt out capabilities for the customer during any peak event.

Additionally, Span provides an opportunity for voluntary demand response from participating customers, by notifying them of a peak event with a request to use the Span app to manage their loads during the peak event window. GMP will be able to monitor how much, if any, action is taken during the event windows. To date our customers have wanted a more simple and hands-off management approach, but testing voluntary demand response again with customers receiving the request to lower usage in a new way with Span will help determine if customer demand response is a tactic worth deploying further.

To that end, GMP will send electronic notifications of peak events requesting that customers voluntarily reduce their energy consumption for a period of time, typically three to five hours. The Span data will confirm if customers have taken any action, and provide the data necessary to determine effectiveness of this portion of the program.

GMP assumes that customers will be able to reduce an average of 1kW during peak events, which has been factored into the overall financials of the Pilot.

Metering

GMP recently concluded the Resilient Home Pilot, which used energy storage systems as a source of metering instead of the traditional meter. The Span panel provides an opportunity to test an additional device for this same purpose. Not only does the Span panel provide whole-house consumption data, it also provides highly granular, circuit-by-circuit consumption data that can

potentially be used for future billing cases. For example, electric vehicles could be billed at a separate rate from a plugged load consumption without needing a specific GMP compatible charger. GMP will compare all Span panel data to that of the onsite AMI meter to determine the level of accuracy and ability to be potentially used as a viable alternative to the traditional utility meter. This data may prove useful in determining the level of viability for segmented billing, such as varied rates for flexible end uses like heating and cooling, or an enhanced water heating rate, as an example.

Data

GMP will also look at data points such as voltage, frequency, and power quality. This set of data may prove to be another tool for GMP to benefit customers by increasing the reliability of the grid by being proactive when circumstances require it.

Summary of Projected Costs and Revenues

This pilot will put our customers on the leading edge of technological advances in the utility space, partnering with GMP to learn what is, or isn't, possible with a smart electrical panel. Our installer partners will help us understand how having a Span panel installed interacts with the installation of solar and energy storage, two resources that continue to grow in GMP territory. And, as these types of resources, as well as Level 2 electric vehicle charging stations and heat pumps proliferate, we will be able to determine if adding a Smart panel can reduce customer costs in the long run by avoiding service upgrades in favor of allowing the Span panel to intelligently manage the total load of the home by switching and curtailing individual circuits to avoid over-taxing the system.

Including installation, each system will cost \$4,800-\$4,900 depending on whether or not new breakers and a surface mount are needed (see Appendix A). This translates to approximately \$500,000 of capital costs for 100 installations in the first year of the pilot, which we strongly believe is justified by the innovation this Pilot will support, as described above. GMP will own the Span panels with no cost to the customer, which will be covered by the included 10-year warranty. There are no regular expected ongoing expenses associated with this Pilot, however, it is possible that customers will need to have the panel removed and replaced due to potential equipment failure or desire to opt-out of the program. Any equipment failures will be covered by the warranty and allow for replacement of the system or a refund on the system. If the customer wishes to continue in the Pilot, the panel will simply be replaced, but if the customer chooses at this point to opt out of the program, GMP will request a refund from Span and use this money to replace the system with a traditional electrical panel. In the case where a customer simply

chooses to opt out of the program, the customer can simply shut down the communications of the panel and it will continue to operate as a traditional electrical panel. However, GMP has built in some additional costs for replacing the Span panel with a traditional panel should that be necessary. We would expect that no more than 5% of customers to opt-out of the program, needing a replacement panel. These costs are included in the table below.

The Span panel is designed to last well beyond the 10-year warranty, being designed to last for 25 years. As such, GMP has not included any costs for panel replacements at the end of the Pilot.

The Pilot is also expected to bring in some demand response value. GMP will learn how we can interact with a single point of entry into home devices, rather than linking to the various resources within the home that may all need a dedicated control device otherwise. For now, the following model uses an assumed 1kW of demand reduction for voluntary demand response events, and .35kW for water heaters (with 50% of customers having an electric tank that will be managed), GMP anticipates a power supply value of over \$150,000 (NPV) over ten years, reducing the overall impact of the Pilot.

Year	1	2	3	4	5	6	7	8	9	10	11	Lifetime NPV
Costs												
Equipment & Installation Costs	(\$93,632)	(\$88,218)	(\$82,647)	(\$77,790)	(\$73,485)	(\$69,344)	(\$65,203)	(\$61,239)	(\$57,934)	(\$55,010)	\$0	(\$553,629)
Total Costs	(\$93,632)	(\$88,218)	(\$82,647)	(\$77,790)	(\$73,485)	(\$69,344)	(\$65,203)	(\$61,239)	(\$57,934)	(\$55,010)	\$0	(\$553,629)
Revenues												
Power Supply Value	\$10,345	\$16,289	\$17,703	\$17,274	\$20,433	\$21,989	\$22,593	\$23,215	\$23,854	\$24,512	\$25,190	\$156,195
Total Revenue	\$10,345	\$16,289	\$17,703	\$17,274	\$20,433	\$21,989	\$22,593	\$23,215	\$23,854	\$24,512	\$25,190	\$156,195
Net Benefit	(\$83,286)	(\$71,928)	(\$64,945)	(\$60,516)	(\$53,052)	(\$47,355)	(\$42,610)	(\$38,024)	(\$34,080)	(\$30,498)	\$25,190	(\$397,434)

This Pilot Advances State Goals

The 2016 Vermont Clean Energy Plan (“CEP”) states,

“Distributed energy resources and communications capabilities are still evolving, but the path is relatively clear. Distributed energy resources such as solar and wind, combined with distributed storage, flexible loads (such as electric vehicles and controllable devices), and a centrally managed platform, offer great potential for improving the grid’s performance. The central question is: How do regulators, system operators, and electric distribution utilities need to evolve the system to remove barriers, enable the distributed grid to emerge, and motivate the DUs to function as a cooperating partner in facilitating these changes?”

This Pilot will aim to discover how this emerging technology can help improve the performance of the electric grid. With granular data and management to provide a high level of flexibility, this Pilot could show that entire homes can become distributed resources that allow for faster,

easier, and higher levels of integration of the renewable resources demanded under the State's and GMP's own goals.

Efficiency Vermont Non-Conflict and EVT/REV Collaboration Certification

GMP shared a draft of this Pilot with EVT, REV and the DPS on March 19, 2021, and appreciates the input and feedback to improve upon the pilot's structure.

Objectives and Evaluation

There are a number of objectives for this Pilot as described above. Appendix B synthesizes these into one location and describes how each will be measured or evaluated.

Status Updates

GMP proposes to provide status updates to the Board regarding the Pilot's progress on a six-month basis until the Pilot expires in 18 months. In the event GMP decides to terminate the Pilot prior to the passage of 18 months, it will provide prompt notice to the Board, the Department, Efficiency Vermont and Renewable Energy Vermont. If you should have any questions, please contact me at 802-747-6818.

Sincerely,



Craig Ferreira

Innovation Development

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

Appendix A

Assumptions

Number of Customers	100
Cost per unit	\$3,520
Install per unit	\$1,200
Shipping (per 20 panels)	\$1,775
Replacement Panel (200 amp)	\$300
# customers opting out	5%
Replacement panel install	\$1,000
New Breakers	\$595
Customers needing new breakers	15%
Surface Mount Bracket	\$52
Customers needing mount bracket	20%

Capital Costs

Equipment Costs	\$352,000
Shipping costs	\$8,875
Installation Costs	<u>\$120,000</u>
Replacement Breakers	\$8,925
Surface Mount Brackets	\$1,040
Total Capital Costs	<u>\$490,840</u>

Additional Costs

Replacement Panels	\$1,500
Replacement panel Install	\$5,000
Total Additional Costs	<u>\$6,500</u>

Total Pilot Costs **\$497,340**

Appendix B

Objective	Measurement/Evaluation Method	Metrics for Success
Determine how well Span integrates with energy storage and solar from both the customer and installer perspectives.	GMP will be able to determine if the data from energy storage and solar is sufficient through availability of data. Customer and installer surveys will provide insight into their perspectives	<ul style="list-style-type: none"> ● Does GMP receive accurate data from a PV system? ● Does GMP receive accurate data from an energy storage system? ● Do customers respond positively to their experience with the Span in conjunction with their systems? ● Do installers respond positively to their experience with the integration of the Span and DERs generally?
Quality of metering data.	GMP will perform the comparison between Span data and GMP AMI data in-house	<ul style="list-style-type: none"> ● Does the monthly data from the Span system remain within 4% of the GMP AMI data?
Compare DER installations between traditional electric panel and Span to determine if it provides simplicity and/or efficiency and cost savings.	Installer Survey	<ul style="list-style-type: none"> ● Do installers provide positive feedback about the installation process?
Determine customer engagement with Span features	Customer Survey and app data	<ul style="list-style-type: none"> ● Do customers use the features in the Span app? ● Do customers provide positive feedback about their experience

		and use of the Span system?
Determine if the Span panel can help avoid service upgrades	Simulate smaller service using Span system, and verify using Span backend data	<ul style="list-style-type: none">● Can we successfully show that home amperage can be maintained below a simulated threshold without issue?
Determine demand response capabilities	Data verification	<ul style="list-style-type: none">● Do the DR events scheduled with Span happen at the scheduled time?● Do the end devices respond to the DR events?● Do customers opt-out?