

**Unitil Energy Demand Response Demonstration Project Proposal**  
**October 12, 2016**

Fitchburg Gas and Electric Light Company d/b/a Unitil (“Unitil” or the “Company”) indicated in the 2016-2018 Energy Efficiency Plan filing that the Company would, following its review of the demand savings group report, determine the appropriate demand response strategy for its service territory. Pursuant to the Initial Report on Scope, Tasks, and Timelines for the Demand Savings Group (“Initial Report”), filed with the Department of Public Utilities on March 31, 2016, Unitil committed that it would determine, by the end of Q4 2016, whether it would implement demonstration project(s) in 2017. Initial Report at 9. Based on its research, taking into account its unique service territory characteristics and customer base, Unitil has determined that it is appropriate to implement both residential and commercial and industrial (“C&I”) demand response demonstration projects. Through this effort, Unitil intends to implement the demonstration projects in time to yield results for possible larger scale implementation in its 2019-2021 Energy Efficiency plan.

Unitil recognizes the importance of demand response for the Commonwealth and has developed demonstration projects that will advance the Commonwealth’s goals. In developing its demonstration projects, the Company considered the following: (1) the importance of achieving electric demand reduction to mitigate summer and winter peaks; (2) customer acceptance of demand response technologies coupled with customer-driven behavior to reduce and/or shift demand; (3) the reliability of demand response technology; (4) the cost-effectiveness of the proposed demand response demonstration projects; (5) the bill impacts associated with the demonstration projects; and (6) the potential to bring the demonstration projects to scale in the Company’s 2019-2021 Energy Efficiency Plan. Consideration and analysis of these data points resulted in the residential and C&I demonstration projects that comprise the Company’s proposal.

The total budget associated with the Company’s residential and C&I demonstration projects is \$146,000. The Company has determined that there is the potential for a 400 to 600 kW reduction during the ISO New England (“ISO-NE”) Installed Capacity Tag (“ICAP”) hours (often coincident with ISO-NE peak summer hours) associated with two hours of operation of the C&I demonstration project technology. Customers will also have the option of bidding into ISO-NE’s demand response program. There is also a potential of up to 30 kW reduction during

the ISO-NE Summer Peak and Winter Peak periods associated with operation of the residential demonstration project technology.

In exploring the potential to implement demand response in its service territory in 2017 and 2018, the Company determined that it was appropriate to develop and implement demonstration projects as an initial step, rather than a full-scale inclusion of demand shifting efforts into the Company's portfolio of energy efficiency programs. As an initial matter, the residential demonstration project is not currently cost-effective. At this point, it is unclear whether the C&I demonstration project is cost-effective and, in order to determine cost-effectiveness, the Company must assess the customer costs of those C&I customer(s) that ultimately participate in the demonstration project. The demonstration projects proposed by the Company will provide field data that the Company may be able to use to enhance the cost-effectiveness of the projects, thereby potentially enabling the Company to incorporate them into the 2019-2021 Energy Efficiency Plan for broader implementation across its customer base.

Additionally, using demonstration projects as an initial step to analyze and test new and innovative concepts is consistent with the Company's and other Massachusetts' Program Administrators' ("PAs") past practices. Demonstration projects enable the Company to gain insight into demand response efforts tailored to Massachusetts' and the Company's unique characteristics. While demand response research and project results from other jurisdictions is certainly informative and useful, Massachusetts has different load profiles, rate structures, avoided costs, market costs and climate than other jurisdictions. These state and Company-specific characteristics must be analyzed to provide the Company with the data necessary to design and implement cost-effective and impactful demand response projects and programs in the future.

The proposed demand response demonstration projects and their associated budgets do not meet the criteria for a mid-term modification ("MTM") as set out in either Sections 3.8.1 or 3.8.2 of the Energy Efficiency Guidelines ("Guidelines") promulgated by the Department of Public Utilities (the "Department"). However, the Company is seeking expedited Energy Efficiency Advisory Council ("EEAC") and Department review of its proposal and its estimated costs to confirm stakeholder support and minimize the risk of cost recovery. In order to expedite the Department's review, Until is seeking EEAC support, through a resolution, for both the

demonstration projects themselves, and Unitil's future request to the Department to provide an exception to the EEAC Guidelines in order to treat the EEAC's support as the equivalent of support for a mid-term modification under Section 3.8.1 of the Guidelines. The latter request will seek an exception under Section 5.0 of the Guidelines from the criteria for a mid-term modification under Section 3.8.1 in order to authorize any EEAC resolution supporting the demonstration projects to serve as support for prompt *implementation* of the projects under Section 3.8.1.1. This exception will allow the Company to expeditiously implement its demonstration projects and gather important information and data points about demand response in time to inform the development of its 2019-2012 Energy Efficiency Plan.

### **I. Residential Demonstration Project**

The Company intends to install up to six separate residential battery storage systems at customer homes that have previously installed solar photovoltaic ("solar PV") systems. These combined systems will be operated during ISO-NE summer peak periods and winter peak periods, and the Company has developed a budget of \$114,000 for this demonstration project. The battery systems will be charged by the solar PV systems.

The Company anticipates that this demonstration project will enable participants to shift their demand on the grid during peak periods to the battery storage system. Excess kWh will flow up the grid and be net-metered. Unitil projects that the storage systems will produce, on average, up to 5 kW over the course of the peak summer period (two hours) for the average customer. Coordination with solar PV system will allow for flattening of the solar curve so that up to 5 kW will be produced over the four hour summer peak period. Additionally, 5 kW will be produced over the two hour winter peak period.

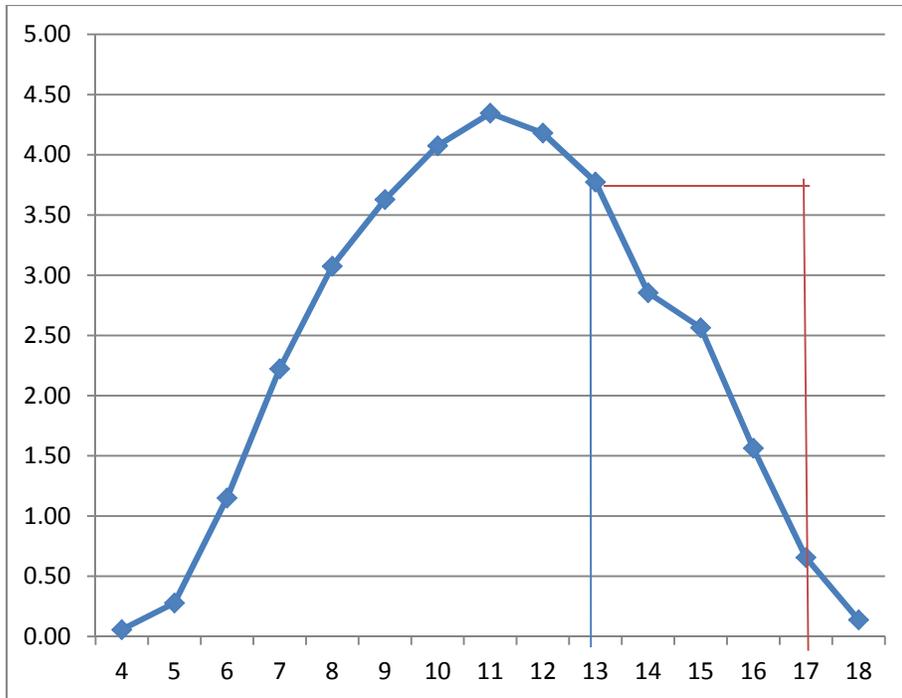


Chart 1 shows the solar curve (blue line) for a 5 kW solar PV system from [www.pvwatts.nrel.gov](http://www.pvwatts.nrel.gov) for June 15, 2016. The area between the red lines and the blue curve is the energy (kWh) supplied by the battery system that will flatten out the solar curve. The horizontal axis shows hours of the day. The hours 13 to 17 indicate the ISO-NE summer peak period.

In conducting this demonstration project, the Company seeks to determine the following:

1. Can the combination of solar PV and battery storage flatten out the solar curve such that there is a consistent production of kW across the summer and winter peak periods?
2. How will the systems perform if the ISO-NE summer peak shifted from 1:00 to 5:00 pm weekdays to a later time, such as 3:00 to 7:00 pm weekdays?
3. Are there significant differences in production and in flattening the solar curve when comparing south facing, west facing, and tracking solar PV systems?

In addition, the Company seeks to determine: (1) whether customers will accept the use of the technology and are willing to allow the Company to control the systems for several years into the future; (2) market acceptance and interest regarding the battery storage systems from the installers' perspective; (3) reliability of the systems; (4) performance of the systems; and (5)

cost-effectiveness of the residential demonstration project and whether cost-effectiveness can be enhanced.

In exchange for participating in the demonstration project, customers will receive the equipment necessary to utilize the battery storage system as a non-fossil fuel-based backup system that will operate in conjunction with their solar PV system in the event of a power outage. Customers will also be informed that, by using the combination system, they are helping to reduce strain on the electric grid and reduce the amount of emissions usually associated with running “dirtier” power plants during peak and critical peak periods. Customers will need to allow access to their homes during the installation process and in the event that the Company needs to repair or maintain the storage system. Customers must have WIFI in order for the Company to collect data during the course of the demonstration project in order to complete its assessment of the project. During the evaluation period, customers will be surveyed regarding their thoughts and experiences with the demonstration project and their interest in continuing to use the storage system going forward.

Implementation of a residential battery storage demonstration project is timely given the drop in battery prices in recent years. Additionally, a residential battery demonstration project is both appropriate and beneficial due to its potential for expansion in both the Company’s service territory and across the Commonwealth. Unitil developed this demonstration project due to the fact that based on the in-field results, it can be scaled to larger systems, e.g. C&I customers, or additional residential programmatic (municipal-wide) roll-outs.

The results of the Company’s findings will be used to inform the development and planning of its 2019-2012 Energy Efficiency Plan. Currently, no other PA in Massachusetts is implementing a demonstration project for small residential battery storage systems. Unitil has chosen to focus on residential battery storage systems given that there are over 1 million single-family homes in the Commonwealth, which translates to a significant number of available potential sites for small battery storage. As noted above, one of the main areas of assessment of this demonstration project is to determine whether battery storage system demonstration projects are scalable across Massachusetts. It is the Company’s understanding that Eversource is undertaking a similar effort, but is intending to employ an approach for C&I customers, and will therefore be installing larger systems. Unitil and the other PAs will be able to utilize lessons

learned and the analyses conducted under these residential and C&I battery storage system demonstration projects for potential incorporation into the 2019 to 2021 energy efficiency plans.

## **II. C&I Demonstration Project**

The C&I demonstration project will be implemented for up to two customers and has a budget of \$32,000. The demonstration project will employ a vendor-driven program that includes proprietary software that utilizes a customer's interval data profile to determine potential Installed Capacity Tag ("ICAP") hours on the ISO-NE energy grid, which are normally coincident with ISO-NE's critical peak hours during the summer, however, ICAP hours could occur any time of year (for example, winter), therefore, customers must be prepared to participate year round. Customers may bid into ISO-NE's demand response program, which require reducing load during ISO-NE summer critical peak events. ICAP refers to the hour of the year that has the highest MW demand for New England. Customers are charged annually based on their demand during this hour. Critical summer peak refers to approximately five to eight of the hottest weekdays between the hours of 1:00 pm to 5:00 pm when demand is at its highest. Under this demonstration project, the Company anticipates that the average customer will be able to shift between 200 kW to 300 kW over the course of two hours.

The purpose of the demonstration is to determine: (1) if customers will accept the project as a means to save money and create a revenue stream; (2) the kW's shifted during ISO-NE critical summer peak events and other critical periods such as extremely cold winter hours; and (3) the dollar savings and revenue stream created for each customer to the extent available. Lastly, the Company will examine the cost-effectiveness of this demonstration project, taking into account the customer(s)' costs associated with participation, and determine if cost-effectiveness can be enhanced.

In order to identify potential participants in the demonstration project, Unitil will identify those C&I customers with the most opportune load shape as well as the flexibility to shift load. The C&I demonstration project participant(s) will work with the vendor and Unitil to create a plan to undertake operational changes, such as changing set points in HVAC and lighting systems, delaying batch manufacturing processes and shutting down time insensitive processing, in order to reduce demand during these periods. The financial benefit to customers is that they

can reduce their ICAP charges and potentially bid into one of ISO-NE's economic programs, which would produce a revenue stream.

In exchange for participating, customers receive the metering equipment in order to participate and receive the expertise of Until and the vendor to set up a plan to reduce load. In addition to reducing their ICAP charges and potentially creating a revenue stream, customers also benefit from knowing that they are helping to reduce strain on the electric grid and reduce the amount of emissions usually associated with running "dirtier" power plants during critical peak periods.

Customers will need to be fully engaged in the demonstration and be prepared with the proper staffing to reduce load when notification of a potential ICAP period is forthcoming. Customers must commit to participating for three or four years with the vendor pursuant to the terms and requirements of the vendor's procedures. The customer's fee to be paid to the vendor is determined as a percentage of money saved and the revenue stream created. During the evaluation period, customers will be surveyed regarding their thoughts and experiences with the demonstration project and their interest in continuing to utilize the vendor's equipment and services going forward.

The results of the Company's findings will be used to inform the development and planning of its 2019-2021 Energy Efficiency Plan. It is the Company's understanding that Eversource is undertaking a similar effort however, the two companies will be using different delivery and vendor models. , Specifically, Eversource will be setting triggers for a third party to alert customers of potential ICAP hours while Until's approach will rely entirely upon a third party vendor to determine potential ICAP hours, set triggers and alert customers. Eversource is also considering setting triggers for distribution events. Until and the other PAs will be able to utilize lessons learned and the analyses conducted under these demonstration projects to assess their potential incorporation into the 2019 to 2021 energy efficiency plans. Given that there are multiple large customers across the state with the appropriate load shape, the available potential sites for load shifting strategies of this type is sufficient to scale this concept statewide.

### **III. Summary**

Given the importance of demand response to the Commonwealth, Until has developed demand response demonstration projects that are anticipated to provide in-field data that will

enable the Company to assess the effectiveness of demand response technologies and customer response and utilization of those technologies, including customers' willingness to undertake proactive steps to achieve demand response. The Company will utilize this information and other lessons learned to inform the development and planning of its 2019-2021 Energy Efficiency Plan.

2016 Demand Response Budgets						
Sector	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs
Residential	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Low-Income	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Commercial & Industrial	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Grand Total</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>

2017 Demand Response Budgets						
Sector	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs
Residential	\$ 15,000	\$ 2,000	\$ 80,000	\$ 2,000	\$ 6,000	\$ 105,000
Low-Income	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Commercial & Industrial	\$ 7,500	\$ 1,500	\$ 8,000	\$ -	\$ 4,000	\$ 21,000
<b>Grand Total</b>	<b>\$ 22,500</b>	<b>\$ 3,500</b>	<b>\$ 88,000</b>	<b>\$ 2,000</b>	<b>\$ 10,000</b>	<b>\$ 126,000</b>

2018 Demand Response Budgets						
Sector	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs
Residential	\$ -	\$ -	\$ -	\$ -	\$ 9,000	\$ 9,000
Low-Income	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Commercial & Industrial	\$ -	\$ -	\$ -	\$ -	\$ 11,000	\$ 11,000
<b>Grand Total</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 20,000</b>	<b>\$ 20,000</b>

2016-2018 Demand Response Budgets						
Sector	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs
Residential	\$ 15,000	\$ 2,000	\$ 80,000	\$ 2,000	\$ 15,000	\$ 114,000
Low-Income	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Commercial & Industrial	\$ 7,500	\$ 1,500	\$ 8,000	\$ -	\$ 15,000	\$ 32,000
<b>Grand Total</b>	<b>\$ 22,500</b>	<b>\$ 3,500</b>	<b>\$ 88,000</b>	<b>\$ 2,000</b>	<b>\$ 30,000</b>	<b>\$ 146,000</b>