Unitil Energy Systems, Inc.

Time-of-Use / Smart Grid Pilot Program Evaluation Plan

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I. Introduction

This evaluation plan outlines the objectives and methodologies for performing an in-depth evaluation of Unitil's proposed smart grid pilot program. Key among the objectives are to evaluate and compare the impact and cost effectiveness of three distinct program segments (i.e., Simple TOU, Enhanced Technology, and Smart Thermostat), to evaluate the process and technologies from both the perspective of the customers and the Company, and to make recommendations for further testing or deployment of smart grid technologies throughout Unitil's electric distribution territory in both Massachusetts and New Hampshire. These objectives will be met through implementation of a combination of impact, technology, process and cost effectiveness evaluations as discussed in more detail below.

Unitil's smart grid pilot program was designed in part to fulfill the requirements from Section 85 of the Green Communities Act, which requires Massachusetts electric distribution companies to establish a smart grid pilot program that achieves reductions in peak demand and average load of at least 5 percent for all customers participating in the program. Unitil's smart grid pilot program was also designed to implement a New Hampshire Time-Of-Use (TOU) pilot program in support of the Commission's TOU rates policy. The Company's pilot includes three separate and distinct program segments (treatment groups) as follows:

- *Simple TOU Program* – Enrolled customers will be set up on a time-of-use rate structure and will receive basic educational materials only, with no additional enabling technology.

- *Enhanced Technology Program* – Enrolled customers will be set up on a time-of-use rate structure and will receive the same educational materials, but will also receive an in-home ZigBee-based wireless energy management system that includes an in-home display of near real-time cost and energy consumption data, a customer web portal, and flexible control devices (smart thermostats and outlets). This package allows for both utility and customer-automated load control and demand response. The Enhanced Technology Program will not include direct demand control by Unitil through the customer's thermostat.

- *Smart Thermostat Program* – Enrolled customers will stay on the existing fixed-rate billing structure. Unitil will provide a Honeywell UtilityPro™ digital programmable thermostat. Unitil will have the ability to cycle the customer's heating and cooling load during critical peak periods using a 900 MHz paging network. Thermostat cycling will be accompanied by local notification at the thermostat unit. Customers are able to override the changed setting on the devise itself or through a web interface.

The program structure will allow Unitil to evaluate and compare these three separate and distinct approaches to achieving reductions in peak demand and average load. The Simple TOU program is a low cost option for Unitil to implement through its territory, given the existing system-wide AMI endpoints. The Enhanced Technology utilizes the

same TOU rate structure but also includes a higher cost home energy management system – the evaluation will seek to compare impacts of both program segments as well as the projected cost effectiveness of the two options. Lastly, the Smart Thermostat program uses a different communications technology (900 MHz paging network), is utility controlled and is another low cost program that can be evaluated for cost effectiveness and compared with the other program segments.

The Simple TOU and Enhanced Technology Programs leverage the Company's AMI investments and provide the opportunity to test the time-of-use capabilities of the existing systems, including integration with the Company's back-end systems. The pilot evaluation will review and report on the Company's experience in testing these technologies, integration with existing back-end systems, and the process of conducting the program. The evaluation will also report on the Company's experience with the specific smart grid technologies, including cost and ease of installation, compatibility with existing systems, reliability, and customer acceptance, including the elasticity of customer response to different price points.

A final objective of the evaluation is to assess the experience of customers participating in the program. The evaluation will seek to identify what types of actions were taken by customers to reduce or shift load from peak periods, motivating factors for effecting change, and whether the customers would be interested in participating in a continuing program. Customer reaction to the in-home technologies and web-portals will be assessed and will be used as a tool to help develop recommendations for future program development. Customer feedback will be sought as to how the program could be improved.

The over-arching objective of the evaluation is to provide useful recommendations for the Company, State Regulators, and other distribution Companies on the question of whether to proceed with expanded smart grid initiatives that reduce peak demand and average load. This plan presents the Company's methodology for conducting the evaluation.

II. Experimental Design

A. TARGET POPULATION

The customer population that the Company wishes to study is residential customers with central air conditioning systems, therefore each of the three treatment groups plus a control group will consist of residential customers with central air conditioning. It is the Company's intention to study both market rate and low income rate customer behavior, however no specific quota for low income customers has been established.

B. SAMPLING

The sampling plan is designed to provide measurable results with a precision of 90% confidence with 10% sampling error for each of the three treatment groups and a control group (four sample groups in all). A sample requirement of 68 customers is estimated for

each of the four sample groups to achieve the necessary level of precision.[1] A sample size of 76 customers has been proposed to account for expected drop-outs and still achieve the desired confidence levels. If the number of drop-outs in any one sample group exceeds 8, replacement participants will be recruited to maintain the high level of precision.

Four samples will be selected, one for each of the three treatment groups and one for a control group that will be used as a basis of comparison to the treatment groups. Each sample will contain customers from both New Hampshire and Massachusetts. The purpose of developing samples using customers from both states is to accurately represent Unitil's entire service area while minimizing costs to customers. Therefore, final estimates of demand savings and the corresponding confidence bands will represent the total Unitil system.

It is also the Company's intention to evaluate program results and present statistically valid findings between demographic categories where applicable, albeit at a significantly lower level of precision with a higher range of sampling error due to limited sample sizes. Total sample sizes are presented in Table 1 below.

TABLE 1: TREATMENT GROUP SIZES AND DISTRIBUTION BY STATE

Sample Group	Massachusetts		New Hampshire	
Simple TOU	24	25.0%	52	25.0%
Enhanced Technology	24	25.0%	52	25.0%
Smart Thermostat	24	25.0%	52	25.0%
Control Group	24	25.0%	52	25.0%
Total Received	96	100.0%	208	100.0%

The confidence intervals developed on the final estimated demand savings will be based on the mean and standard deviation of the respective samples. The standard deviation in the measured demand savings typically decreases as the sample size increases, which tightens the confidence interval about the estimated average demand savings.

Stratified random samples will be selected for each of the three programs as well as for the control group. A systematic sampling approach will be used to select the customers for each sample. This method is commonly used in the utility industry as it ensures representation of a total population with respect to geographic location, peak demand, energy consumption, or other key elements.

[1] Sample size computation based on mean kW savings of **1 kW** with a corresponding standard deviation of **0.5 kW**. The actual sample statistics may vary, but these estimates are reasonable and based on previous DR Studies.

C. *MARKETING AND RECRUITMENT*

The Company will utilize an "opt-in" enrollment model. Customers will be recruited using a multi-media approach. First, customers with characteristics representative of central air conditioning usage[2] will be targeted using mailers that include a program brochure and a letter from the CEO inviting them to participate in the program. A total of 5,000 mailings will be sent to randomly selected customers derived from this pre-screened list. In deriving the mailing list from the pre-screened list, the Company first identified and selected all customers on low-income rates (196-MA, 191-NH), then randomly selected from among the remaining residential customers until the target quotas were reached. The enhanced low-income sampling was done in accordance with the Company's Settlement Agreements included as part of Unitil's TOU pilot proceedings in both Massachusetts and New Hampshire. Email marketing may also be used as a low cost option to supplement the mailers if an insufficient number of participants are recruited through the mailers alone. Email marketing will be targeted towards a random selection of customers who have accessed their online accounts in the past 12 months.

The program will be branded as "Energy Savings Management" and marketed as an opportunity for customers to save money on their monthly electric bills and protect the environment. It is important to note that the initial marketing materials will not describe any of the three program segments in any detail, rather just the program as a whole. This has been done to mitigate self selection bias in the various treatment groups.

Interested customers can register by signing and returning a post card, calling an 800 number, or entering their information on-line. Interested customers are screened for qualification on the basis of having a functional central air conditioning system, owning their home, not having any plans to move within the pilot period, and not planning any extended vacations during the pilot period. Qualified customers will then be randomly assigned to one of the three program segments which will be described in detail over the phone by a program representative. Once a customer has been qualified and expressed an intention to participate in the program, an installation contractor will arrange a time to visit their home and install analysis meters and the technology components. The contractor will then review the program in detail with the customer again and provide them with educational materials that further describe the program and offer tactics for reducing peak demand and average load.

D. *CONTROL GROUP*

The control group will be comprised of the Company's existing load research sample and supplemented with newly recruited residential customers as needed to fulfill the control group sample quota. The newly recruited customers will be customers who opted in and qualified for the pilot program (e.g. over enrollment) but were not selected for an active treatment group. Upon further review of the Company's existing load research sample and after conducting phone surveys to this group, it was determined that there is an

[2] Screening criteria is a ratio of maximum summer month (August, September, 2009) to minimum shoulder month (April, May, November, December, 2009) of 175% or higher, AND a maximum summer peak usage of 1,000 kWh or higher. This approach was developed based on results of the Company's initial marketing survey which helped identify actual central air conditioning customers.

insufficient number of load research sample customers with central air conditioning systems to support the 76 customer control group sample size, therefore approximately forty (40) additional customers will be recruited to supplement the existing load research sample to comprise the control group.

E. ATTRITION MITIGATION

The Company seeks to mitigate sample attrition through a combination of customer education, customer service, monetary rebate for the smart thermostat program, and oversampling, as follows:

- *Customer Education:* The Company intends to clearly explain the program to customers so that customers understand what the program involves and how they can take advantage of the program. The program segment they are enrolled in will be explained in detail at the time of recruitment and at the time of the on-site installation; at both times the customers will be asked to confirm that they understand the program and continue to wish to participate. Additional educational material will be provided to the customers at the time of installation and through the customer web portal explaining the program and how customers can take advantage.
- *Customer Service*: A dedicated, experienced customer representative will be assigned to the program and will undergo training on the program design and how to help resolve customer issues. Customers with questions or concerns will be directed to this "live" CSR who will help resolve problems such as high bill complaints or technology defects. Customer drop outs will be permitted if requested by the customer but will be a last resort.
- *Rebate:* For the Smart thermostat program, a peak time rebate incentive will be offered to customers who permit the Company to control the thermostat set point during critical peak days and do not override. The rebate will only be provided if customers remain in the program throughout the entire pilot period.
- *Oversampling:* While every attempt will be made to mitigate sample attrition, the Company understands that some attrition is unavoidable. Thus, approximately 10% oversampling will be conducted so that a small number of drop outs can occur with impacting the level of precision of reported results.

F. CRITICAL PEAK PERIOD SELECTION METHODOLOGY

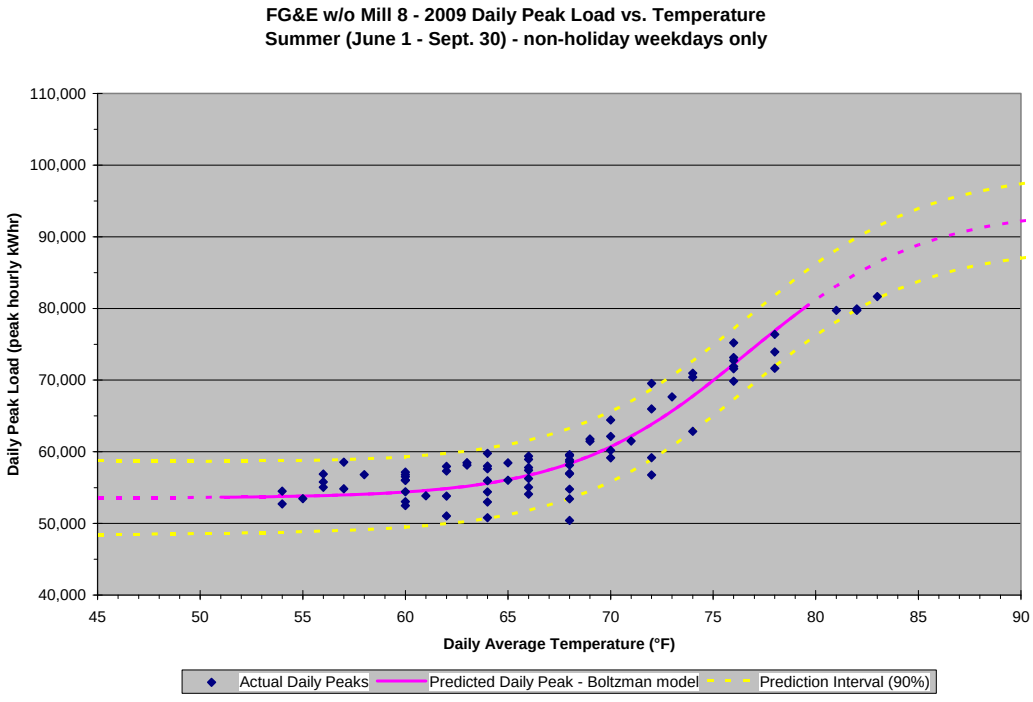
The Company plans to utilize a 2010 temperature vs. load model as a means to schedule demand reduction events on a day-ahead basis. Temperatures corresponding to peak load levels greater than 97% of previous system peak conditions (for either NH or Massachusetts Levels) will be considered as a demand reduction trigger. The Company receives a daily seven day weather forecast which will be monitored for the potential of higher temperatures providing plenty of notice for consideration and communication to customers of planned events. Over the past 10 years, this load level has not occurred more than eight times in a given year, ensuring this trigger represents an appropriate yet extreme condition. This trigger will be reviewed at least every 30 days during the period

of the Pilot Program and may be adjusted to ensure that a minimum of two events and a maximum of eight events are called during the test period.

This temperature vs. load model is developed as a function of the Company's normal planning process. Unitil develops a temperature vs. load model for each of its operating areas. The basis for each model is a series of yearly regressions that are developed to correlate daily loads to daily temperatures in that season. Once a model is established, an estimated peak load can be derived for any given temperature. The probability distribution for annual highest temperatures is assumed to follow the discrete distribution of past historical highest temperatures. The random possibilities of peak load outcomes for any specific temperature are assumed to follow a standard probability distribution model with a mean centered on the point estimate of the peak load at that temperature and varying based on its individual standard deviation according to the fit of the seasonal model to the actual historical values.

To establish load projections, a Monte Carlo simulation is run to produce random annual highest temperatures and random peak load estimates at those temperatures from each year's seasonal model that makes up the historical basis. Each trial in the simulation is projected forward using linear trending. This results in a range of peak load possibilities for each future year assuming linear growth, and varying due to annual highest temperature possibilities and variability in loads versus temperature. The likelihood of specific peak load levels occurring in any particular future year can be estimated from an assumed probability distribution using the mean and standard deviation of the trial results for that year.

The graph below depicts a 2009 version of this temperature vs. load model for the Fitchburg area. 2010 versions will be developed for both MA and NH service areas.



III. Impact Evaluation

A key objective of the Smart Grid Pilot Program ("pilot") is to measure the peak demand reduction and energy usage savings achieved during on-peak ("OP") and critical peak periods ("CPP"), and evaluate the potential for load rebound immediately following these periods. The challenge of measurement and verification ("M&V") is estimating what the load would have been had the control or dynamic pricing not been active. There are several valid statistical methods available for such an evaluation. This section of the plan will outline the objectives, data requirements, and methodology for the impact evaluation.

A. OBJECTIVES

The quantitative evaluation of the pilot program will seek to measure the impact on peak demand (kW) and energy usage (kWh) for each of the three program segments. Impacts will be estimated for the CPP rate for participants with and without enabling technologies. Eight major impacts will be estimated as listed below.

- Overall reduction in total energy usage
- Energy reduction during on-peak periods
- Energy reduction during critical peak periods
- Demand reduction during on-peak periods
- Demand reduction during critical peak periods
- Energy and demand shift to off-peak hours (impact on load shapes)
- Price elasticity of demand (energy changes in response to price changes) for customers on TOU rates only
- Demand response during each of the hours of a critical peak period

B. DATA REQUIREMENTS

Measurement and verification is a data intensive evaluation, especially for the large number of objectives in this pilot. Interval data must be collected for pilot participants, both with and without enabling technologies, and for a control group of customers not on dynamic pricing. Further, data must be collected during non-peak and peak periods and across a number of critical peak periods. Interval data will be collected for the targeted 76 Simple TOU customers, 76 Enhanced Technology customers, 76 Smart Thermostat customers, and the 76 customer control group.

The AMI analysis meters will be set up to collect data in 15-minute intervals. However, the M&V evaluation will convert the interval data into hourly increments. Consumers are typically unlikely to make changes in as little as 15-minute time blocks, rates and billing will be on hourly bases, and the voluminous output from analysis on such a short interval would be cumbersome and of little practical use for interpretation.

Along with the interval metered usage data, hourly and daily weather data will be collected. At a minimum, the statistical models will include temperature or a derivative

of temperature such as degree days. However, the impacts of other weather variables, such as heat index, wind chill, and relative humidity will be collected and tested. Other household characteristics that are collected during the surveying process may also be available for use in the analysis (e.g., size of home, type of home, and number of people in the household).

Additionally, the Company will seek to recruit participants early in 2011 so that analysis meters can be installed before the pilot period and pre-treatment data can be collected.

C. EVALUATION METHODOLOGY

During on-peak and critical peak periods, load is reduced from a level it would have reached without the price signal or demand response measure. The Company conducted a review of ISO New England demand response M&V protocols[3] and other estimation methodologies to instruct its proposal for baseline estimation of this program. A summary of the literature review is included as Attachment A to this plan.

The research literature on comparing the various methods generally reaches the same conclusion that no one baseline method works best for all types of consumers and demand response measures[4]. Prior-day averaging is computationally simple compared to statistical methods, but the method has not been formally shown to be statistically unbiased. Statistical approaches are unbiased and consistent, but less intuitive and more computationally costly.

Unitil will use a statistical method to estimate the energy and demand reductions from the critical peak pricing pilot, even though ISO New England relies on a prior-day averaging methodology for its demand response M&V. For the purposes of the pilot, Unitil plans to provide statistical rigor and use models that are provably unbiased. Furthermore, statistical models are required in order to estimate price elasticity of demand. Both regression and ANCOVA models will be tested, and the impacts of several independent variables will be evaluated during the model specification process. Variables tested will include various weather indicators, pricing levels, and any demographic or customer-specific data that may be available through the surveying process. For the regression approach, a fixed-effects model will be implemented to allow the model to control for those characteristics that Unitil cannot measure that are specific to individual consumers.

[3] A key goal of this program is to utilize an estimation method that is sufficient to satisfy ISO-NE.

[4] See: Coughlin, Katie, Mary Ann Piette, Charles Goldman, and Sila Kiccote. *Estimating Demand Response Load Impacts: Evaluation of Baseline Load Models for Non-Residential Buildings in California*. Ernest Orlando Berkeley National Laboratory, Environmental Technologies Division, January 2008.

Goldberg, Miriam L. *Measurement and Evaluation of Demand Response Resources*. Demand Response in Wholesale Markets Technical Conference, Federal Energy Regulatory Commission, Docket No. AD07-11-000. April 23, 2007.

Woo, C.K. and K. Herter. *Residential Demand Response Evaluation: A Scoping Study*. Ernest Orlando Lawrence Berkeley National Laboratory, June 2006.

A constant elasticity of substitution ("CES") demand model will also be evaluated[5]. A CES model uses two regression equations to constitute a system for predicting electricity consumption by time period. The first equation would predict changes in the load shape caused by changing peak to off-peak price ratios and the second equation predicts change in daily electricity consumption. Price elasticity of demand will be estimated using the statistical approaches because the price differential between time of day and critical day prices will be included as an explanatory variable in the models.

Selection of the final model used to evaluate the pilot program will be made based on examination and comparison of several diagnostic statistics among the various methods and models tested. A list of selection statistics is provided below.

- Signs of all coefficients – The signs of the coefficients indicate whether the relationship between the independent variable and the dependent variable is direct or indirect. The relationship must be theoretically sound in order for the model to be valid (e.g., price should have a negative coefficient since energy usage goes down as price goes up).

- R^2 and Adjusted-R^2 – A measure of how much variation in the dependent variable can be explained by the model. The adjusted-R^2 takes model parsimony[6] into account as well, ensuring that the selected model does not include independent variables that provide relatively little explanatory power. R^2 ranges from 0.0 to 1.0, with higher values indicating a better fit. An acceptable R^2 is not well defined and depends upon the application. Therefore, many other statistics are reviewed as shown in this list.

- F-test – the F-test tests whether the model taken as a whole has any explanatory power. A model that does not pass an F-test should be rejected (a model passes an F-test if the p-value of the F-test ≤ 0.05)

- T-tests on individual independent variables – the t-tests determine whether there is a statistically significant relationship between the single independent variable and the dependent variable. A variable is considered significant if the t-value is ≥ 2.0 or the p-value of the t-test is ≤ 0.05.

- In Sample Mean Absolute Percent Error (MAPE) – a measure of the average absolute percent modeling error. This calculates the average percent error the model has when predicting the historical data used for developing the model coefficients. As with R^2, this value is highly dependent on the application. Typically, projections of shorter intervals and less aggregated data will have higher MAPEs. When comparing two models predicting the same dependent variable, the model with the lower MAPE is generally preferable.

[5] A CES system was used by the Brattle Group to evaluate a pricing pilot for Baltimore Gas and Electric in 2009. Faruqui, Dr. Ahmad and Dr. Sanem Sergici. *BGE's Smart Energy Pricing Pilot Summer 2008 Impact Evaluation*. April 28, 2009.

[6] Parsimony is the statistical theory that it is best to have as simple a model as possible with the fewest number of explanatory variables that will provide an adequate interpretation of the dependent variable.

- Durbin-Watson coefficient – measure of the extent the model exhibits first order serial correlation. This coefficient helps determine if the model needs to include an autoregressive parameter to correct for serial correlation. A Durbin-Watson coefficient between 1.7 and 2.2 typically indicates no problem with serial correlation.

- Residual plots – residuals will be examined to make sure they are independently and identically distributed with mean zero and constant variation, criteria that ensure the model is unbiased.

- Bayesian Information Criterion (Schwarz Criterian) – a statistic to measure the trade-off between model parsimony and model fit. It can be used to select the more parsimonious model if two models otherwise have nearly the same predictive abilities.

- Residual analysis will also be conducted to identify any potential outliers in the data. If an outlier is identified and can be justifiably removed from the analysis, it will be removed and the model will be re-specified. Any outliers removed will be noted in the final report

The final model will be used to estimate the impacts of the program segments on peak demand (load shape) and energy usage. The Company contemplates that the analysis will include comparisons of both treatment to control groups during the pilot period, and comparisons of pre-and post treatment data from within individual treatment groups.

IV. Technology Evaluation

An important goal of the pilot is to test and evaluate new smart grid technologies. The pilot evaluation will assess the TOU capabilities of Unitil's existing AMI infrastructure as well as the ability to integrate a TOU program with existing back-end systems such as billing. Other aspects of the evaluation include the evaluation of distribution automation capabilities, reliability of the new technologies, ease of installation and the customer experience – all of which will factor in the Company's future smart grid investment decisions. Specific study areas that will be reported on and methodologies for the assessment are presented in this section.

A. TOU CAPABILITIES OF EXISTING AMI SYSTEM

The Company initially viewed its AMI system as a strategic platform that would facilitate additional technological, management, and evaluative capabilities including but not limited to the ability to offer TOU programs to customers at low to no cost. The TOU elements of the pilot program provide the Company with the opportunity to test and report on the following TOU capabilities of the AMI system:

Remote Configuration of TOU Meters: The Hunt TS2 endpoints currently deployed throughout Unitil's electric service territory have the capability to record energy usage in up to four pre-defined registers that can facilitate TOU billing. The Company will experiment with the ability to remotely configure endpoints from the

command center to capture TOU usage information. The ability to register customers for a continued simple TOU program and to remotely configure their endpoints without the need for a site visit is an important factor in estimating costs of a continued program.

Issuance of Critical Peak Period Events: Critical Peak Events must be issued from the command center to the specified endpoints so that energy usage during Critical Peak Periods can be effectively captured in a separate register [separate from on-peak register] so that it can be properly billed. The Company will assess the functionality and effectiveness of these critical communications components.

Scheduling the Retrieval of Data Packets: The AMI system is bandwidth limited with respect to the volume of data that can be retrieved from the meters daily. Due to these limitations, TOU data cannot be retrieved every single day. The Company will evaluate options for scheduling the retrieval of daily data packets from the meters that will allow for effective billing, presentation of next day daily reads on the customer web-portal, and retrieval of necessary diagnostic data

Accuracy of TOU Meters: The ability of meters to accurately capture energy usage in TOU registers and report this information for billing purposes is extremely important to any program development involving TOU rates. The Company will utilize the interval analysis meter data to validate and report on the accuracy of the TOU billing data obtained through the pilot

Ability of TOU Meters to Estimate Program Impacts: The Company will seek to determine whether its existing AMI meters provide sufficient information to evaluate load impacts of the pilot program. The existing AMI meters are capable of capturing daily peak readings only. This data will be analyzed with the interval data to determine whether the Company could conduct subsequent pilot experiments that yield statistically valid results without the need for analysis meters.

The pilot program is an excellent venue for the Company to test and report on the TOU capabilities of the existing AMI system. A summary of activities and recommendations will be provided. The recommendations will be focused on the future development of TOU programs given the lessons learned and barriers encountered.

B. ENABLING TECHNOLOGIES

The pilot involves two additional enabling technologies that will be assessed as part of this plan: the Tendril home area network (HAN) and the Honeywell UtilityPro™ thermostats. A secondary technology that will be evaluated is the customer web portal developed by the Company that will provide customers with access to previous day daily usage reads and tools for incorporating energy efficiency and load shifting activities.

Key objectives of the pilot are to evaluate the reliability of the equipment, ease of installation, and customer acceptance and experience with the technology[7].

Equipment Reliability: The reliability of equipment will be assessed using two metrics. First, all customer problems and concerns will be routed through the Company's customer service department. Any calls relating to technical equipment problems will be recorded and tracked. Any problems that necessitate a follow up site visit from the installing contractor will also be tracked. The occurrence of both customer service calls relating to technical issues and additional in-home contractor visits will be reported on in the final evaluation plan for each program segment.

Second, post pilot surveys will be administered to participants to assess their experience in the program and with the enabling technologies. A draft survey instrument is included as Attachment C. Unitil anticipates that the final post-pilot survey will be refined based on guidance from the MA Statewide Evaluation Process and from NH stakeholders and on customer feedback received during the pilot program.

Ease of Installation: The Company will monitor the level of effort required to install and set up the enabling technologies. Time spent on site will be recorded by the installing contractors and will be used to project total installed costs that would be incurred for a full program. This cost information will be utilized in the cost effectiveness analysis of each program.

Another component to this evaluation is the tracking and reporting of any technical barriers encountered. Such potential barriers may include physical distance from the meter to the broadband router, technical issues arising from the installation of dual meters for the Enhanced Technology group, or other factors influencing the strength and communicative abilities of the enabling technologies. Identification of these barriers will allow for more efficient screening of applicants for future program development.

Customer Experience: The experience of the pilot participants with the enabling technologies will be assessed through the use of the post pilot surveys; a draft version of which is presented as Attachment C. The surveys will capture whether customers generally liked or disliked the technologies and will seek to answer the following study questions:

- How easy was the technology to understand and use?
- Did the technologies make them more aware of the energy use habits?
- Did they utilize the technologies to reduce energy usage, or to shift usage to off peak hours? If so, how?
- How would they rate their overall experience with the program and the specific technology?
- Would they participate in a permanent program?

[7] See also Section V.A for evaluation of the customers overall program experience.

- Did they use the Unitil web portal?
- What enhancements to the web portal or instructional material would be helpful?

Direct customer feedback will be solicited from pilot participants during the program period using several methods. First, Unitil will track all calls from pilot participants to customer service by recording the time and date of the call, the program segment that the customer is participating in, and the nature and content of the call. Second, the web portal will include a module that allows pilot participants to post questions or comments regarding the program. Unitil anticipates that the final post-pilot survey will be refined based on guidance from the Statewide Evaluation Process and on the customer feedback received during the program.

V. Process Evaluation

The Company will perform an evaluation of the pilot process that will focus on two key areas: the customer's experience from initial recruitment through pilot completion, and the Company's experience in delivering the program. The process evaluation will help to inform decisions regarding future smart grid investments.

A. CUSTOMER EXPERIENCE

Ensuring a positive customer experience is a key objective of the pilot. The Company will assess the customer experience through the use of pre-pilot, post-pilot and drop-out surveys, in addition to direct customer feedback received through customer service calls and online postings through the web portal. For the pre and post pilot surveys, a census approach will be used (i.e., where responses will be solicited from the entire population of participants). In cases where only a percentage of participants respond, care will be taken to identify and address any potential self-selection and/or response bias. The pre and post pilot surveys will seek to assess the following study topics:

- Was their experience in the program positive or negative?
- What did they specifically like or dislike?
- Would they participate in a continuing program?
- What actions did they take to reduce on-peak usage?
- Did they discuss energy usage and conservation with their families?
- What actions did they take to reduce overall usage?
- Did their monthly bills go up or down during the program?
- Were the bills easy to understand?
- How many critical peak periods did they think were called during the course of the pilot?
- How did they respond during critical peak periods?
- For smart thermostat program participants:
    - Did they notice an appreciable change in comfort during critical peak periods when their central air conditioning systems were cycled?
    - Did they override any events?
    - Were they aware that a control event was taking place?

- Do customers have a better understanding of energy usage in their home after participating in the pilot?
- Are customers more conscious of energy use and conservation after participating in the pilot?
- Will customers continue to incorporate energy efficiency and conservation in their homes?

Pilot participants that wish to drop out of the program will be handled by dedicated customer service representatives with knowledge of the program. The customer service representatives will first try to work through the source of the customer's complaint (e.g. higher bills are likely related to high on-peak usage) and offer suggestions on how the problem could be resolved. If a resolution is not reached and the customer wishes to be removed from the program, the customer service representative will administer a drop out survey to assess why they were dissatisfied and how their experience could have been improved. The following study topics will be assessed in the drop out survey

- What percentage of the overall population in each program dropped out during the pilot period?
- What are the primary reasons for dropping out of the program?
  - Moved
  - Issues with technology
  - Issues with Billing
  - Other (changed mind, illness, no reason, etc.)
- What changes to the program would they recommend?
- Would they participate again if those changes were made?

B. BILL PRESENTATION

The Company will explore options for modifying the CIS/billing system to accommodate TOU rates, and the subsequent presentation of TOU bills to customers. The Company will report on the approach for integrating TOU readings into the billing system, any barriers encountered, and recommendations for how billing could be best conducted for the future development of a full program including estimates for full program implementation.

Another key aspect of the bill presentation to be evaluated is the customer reaction to the TOU bills. Post pilot customer surveys will attempt to capture feedback from the customers as to whether the bills were easy to understand and how they could be improved. A sample of the post pilot customer survey is included as Attachment B.

C. COMPANY EXPERIENCE

As part of the evaluation, the Company will perform a self assessment of our experience in administering the pilot program from initial marketing and recruitment through field installations, customer education, customer service, billing, and pilot termination. The intent of defining the Company's experience is two-fold; first to inform the cost and expected level of commitment should a future program be developed under an expanded pilot or full program. Second, to report on the successes and shortcomings of the pilot

program design and execution so that lessons can be learned by other regional electric distribution companies and applied in subsequent pilots or programs.

The Company will attempt to quantify the cost and time commitment of the various components by evaluating employee time records and charges from consultants and vendors associated with the development of the program. From this baseline of cost and time spent on pilot development, the Company will estimate the time and cost associated with the administration of a full program.

The Company's methodology for self-assessing the overall process will be through an internal focus group comprised of key Company personnel involved with the development and administration of the pilot program. The focus group will be moderated by the Company's consultant representative, GDS Associates, who has assisted with the development, implementation and evaluation of the program. The Company anticipates that the following individuals will partake in the focus group:

- George Gantz, Senior Vice President, Distributed Energy Resources
- Justin Eisfeller, P.E., Director, Energy Measurement and Control
- Mark Lambert, Director, Customer Services
- Michelle Gamble, Senior Customer Systems Analyst
- Lisa Desrochers, Manager, Customer Service
- Carol Valianti, Vice President, Communications
- Sean Baker, Director, Web Development
- Thomas Palma, Esq., Manager, Distributed Energy Resources
- Mary Jane Cleveland, Manager, Billing and Collection
- Karen Asbury, Director, Regulatory Affairs
- Doug Debski, Senior Regulatory Analyst II

The discussion will focus on each group's experience in conducting the pilot and what improvements could be made if an expanded program were offered. A summary of key discussion points and recommendations will be compiled and included in the final evaluation report.

A final aspect of the Company's experience to be evaluated is the process for identifying and declaring critical peak days. The Company will evaluate whether the proposed methodology of using the temperature vs. load model to forecast CPP days is sufficiently robust to translate into an operating model. Specific study questions include but are not limited to:

- How many CPP days were declared using the 97% load threshold?
- Did the Company have to adjust the CPP load threshold to meet the minimum (or maximum) target number of CPP days?
- Did the Company experience any high-load days that were not forecasted using this methodology? If so, what refinements to the forecasting methodology would have been necessary to capture these high load events?
- Did the Company declare any CPP days and subsequently experience lower than expected loads? If so, what factors contributed to this result? What refinements to the forecasting methodology would have been necessary to prevent this occurrence?

- How did system loads vary by operating area (FGE, Seacoast, and Capital) during CPP days?

VI. Program Cost Effectiveness

The Company's smart grid pilot was designed specifically to compare and contrast the cost effectiveness of three separate and distinct approaches to residential demand response. Comparisons of the modeled cost effectiveness for each program will help inform decisions for future smart grid investments. Program cost effectiveness will be evaluated using the Total Resource Cost (TRC) Test and the three-step approach outlined below:

Step 1: Prior to pilot initiation, project the cost effectiveness of each program segment using estimates for equipment and installation costs, and program savings (kW and kWh)

Step 2: At the conclusion of the pilot period, revise the initial estimates of costs and savings to reflect the actual costs and savings witnessed during the pilot. Retrospectively calculate the cost effectiveness of each program segment

Step 3: Project the future cost effectiveness of each program segment assuming full programs were offered to all eligible customers. Assumptions will be made regarding the number of participating customers per year and program costs.

The projected cost effectiveness of each program segment will be instructive to the Company as to which program segments or combinations of program segments should be studied further or fully developed. The Company intends to evaluate the benefits associated with the program utilizing the benefit cost models approved by each State. The models account for the incremental costs of the equipment, most recent avoided energy supply costs, measure life, and other key variables. The Company will disclose all assumptions and screening tools and work cooperatively with regulators in both states to produce mutually agreeable outputs.

ATTACHMENT A

Impact Evaluation Literature Review

During on-peak or critical peak periods, load is reduced from a level it would have reached without the price signal or demand response measure. The actual metered data includes the demand savings. Therefore, to measure the amount of demand reduction, Unitil must estimate the level the load would have reached and then net the metered data from the estimate to determine the load response. The estimated load is called the baseline.

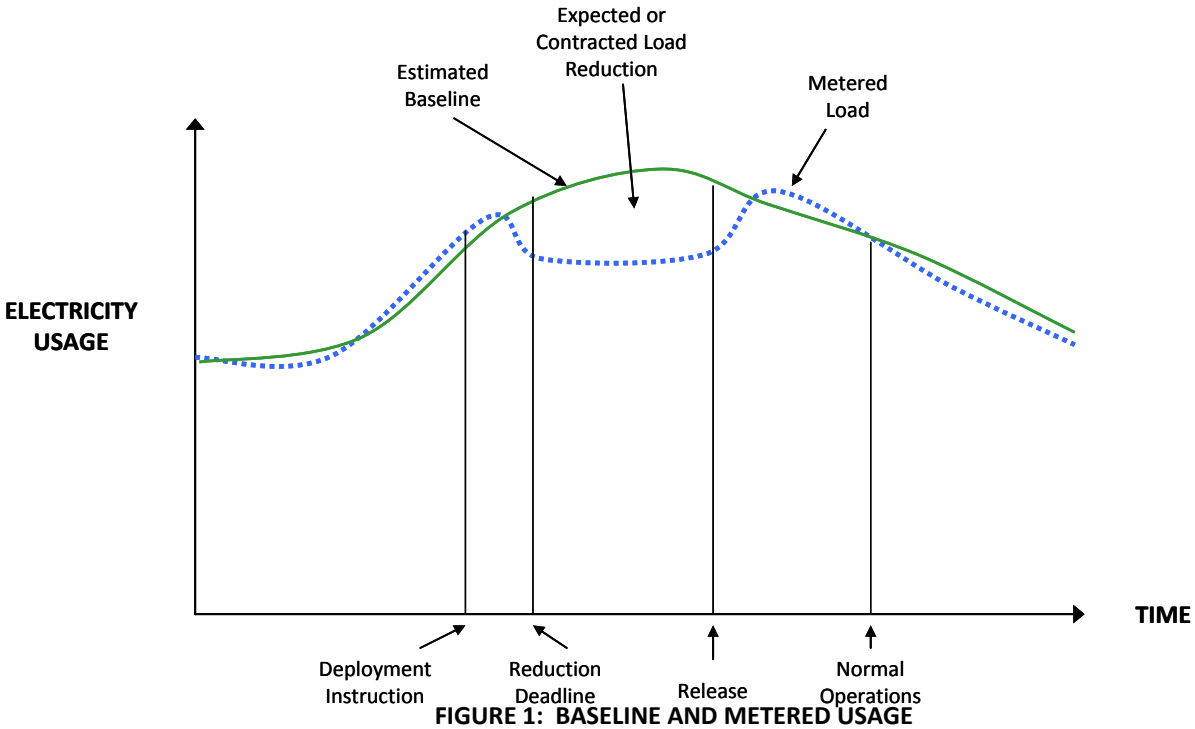


FIGURE 1: BASELINE AND METERED USAGE

There are competing criteria that must be balanced when selecting a baseline estimation methodology. Simplicity is desirable because it increases ease of use and understanding, and it provides for lower costs for evaluators to implement on a large scale. Accuracy is another important component, which includes lack of bias[8] (no systematic tendency to over- or under-state the demand reductions), appropriate handling of weather-sensitivity if applicable, and verifiability. In programs where advanced notice is given prior to a control event (e.g., interruptible rate program), there exists the potential for customers to game the system by adjusting their loads that would impact the baseline. Finally, an important macro goal is consistency within the industry.

[8] A statistical definition of bias is the amount by which the expected value of an estimate of a parameter θ is higher or lower than the true value of the parameter θ. $\text{Bias} = E(\hat{\theta}) - \theta$

There are two basic approaches to estimating the baseline, with variations on both. All these methodologies attempt to balance the criteria of simplicity, accuracy, minimization of gaming, and consistency. The simpler approach is to look at some average of prior days' loads. The more complex approach is a statistical modeling approach that accounts for characteristics that impact load such as weather and takes data collected from the control group into account.

Prior Day Averaging - These techniques assume the existence of one or more "non-event" days whose hourly load values can be averaged to provide a baseline load profile. The goal is to collect a set of data for which: i) the actual loads without control are known; and, ii) the days are similar in some sense to the actual days during which control was implemented. Usually, a set of admissible days is selected from the set of many recent days. In most methodologies, admissible days exclude weekends, holidays, and days with control events. Some selected number (e.g., three, five, or ten) of the most recent admissible days are then averaged for every hour to create a 24-hour profile. This profile becomes the baseline for the day of the control event. This simple methodology ignores what could be differences in weather or other operating conditions between the admissible days and the day of the event. To correct for this shortcoming, Goldberg and Agnew recommend applying an adjustment to the baseline based on the morning hours of the day of control[9].

The prior day averaging approach is easy to implement and provides intuitive results for a single event day. However, evaluation across a season would require more complex calculations. Furthermore, with advanced notice, pre-cooling strategies or other pre-event baseline adjustment behaviors by the customer can increase the bias in the estimate. This potential bias can be corrected by using prior-day baselines that exclude any hours after notification; however, this approach sacrifices simplicity and intuitiveness.

Statistical Modeling – There are two basic statistical models employed for estimating the baseline. Regression modeling is the simpler technique and easiest to interpret. Analysis of covariance (ANCOVA) is a more advanced model that can also be used.

Using the regression approach, a statistical model is developed to quantify a relationship between historical loads, weather conditions, price of electricity (where applicable), and a series of calendar identifiers. Weather data and calendar variables representing the day of the event can be input into the model to project the baseline. A single regression model can be estimated for aggregated load, or individual models for each residence can be constructed. When possible, the individual models are preferable because the coefficients capture the high degree of variability in customer behaviors and demographics. For a single model, it is preferable to include demographic information,

[9] Goldberg, Miriam L and G. Kennedy Agnew. *Protocol Development for Demand Response Calculation – Findings and Recommendations*. Consultant report to California Energy Commission. Report # 400-022-017F. February 2003.

but such information is usually missing for some or all of the accounts. Missing demographic data may lead to bias in the model estimate if those accounts are excluded from model estimation[10]. A fixed-effects model can also be estimated that includes an indicator variable for each individual consumer in the aggregated model. This indicator variable would control for unknown individual load characteristics.

Although more complex than the prior-day averaging method, regression estimation is relatively straightforward using a least squares procedure that is available in all statistical software and spreadsheets. Second, regression is theoretically less biased than prior-day average for weather-sensitive loads because weather is explicitly quantified, as are differences in calendar day load shapes. The relationship is measured without the somewhat laborious process of identifying historical matching weather days for the weather-based matching technique. Finally, the regression techniques produce estimates that are statistically unbiased and consistent[11], which is desirable for a statistical estimator[12]. Consistency is especially important because it means the estimate's validity increases over time as more data is collected. The major drawback of regression modeling is the cost and time associated with developing the models. The underlying statistics are less intuitive and building a good regression model is part science and part art. Furthermore, it has been noted that time series data such as hourly loads tends to have first order serial correlation[13]. This can be corrected with the use of autoregressive parameters at a cost of increasing the complexity of calculating an estimate.

Analysis of covariance combines some of the features of both regression and analysis of variance. It is a more powerful model than the regression approach because it allows for the control of a variable other than the variable of interest (called the concomitant variable or the covariate). For instance, ANCOVA can be used to generate a single model to account for the average reduction per house but still control for each home's individual behavioral characteristics.

ANCOVA has the same benefits as regression, and it automatically controls for individual consumer characteristics. However, the procedure is more complex and less intuitive than regression. Developing ANCOVA estimates usually requires special statistical software and training for model development and interpretation.

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[10] For instance, if higher-usage customers tend not to report their income and customers without income are excluded, the coefficient for income would exhibit sample selection bias.

[11] Estimates are unbiased when the difference between the estimate and the true but unobserved value has an expected value of zero. A consistent estimate converges to its true but unobserved value as the sample size increases.

[12] Woo, C.K. and K. Herter. *Residential Demand Response Evaluation: A Scoping Study*. Ernest Orlando Lawrence Berkeley National Laboratory, June 2006.

[13] Serial correlation is when the errors associated with observations in a given time period carry over into future time periods. In other words, if the model is over-predicting in period 1, it is highly likely to over-predict in period 2 as well.

ISO New England[14]

As a member of ISO New England, it is instructive for Unitil to understand how the ISO measures demand response impacts for the purposes of transacting in their market. ISO New England has detailed standards on their demand response program, dating back to December 2002. Their program includes both day-ahead and real time demand response programs. The day-ahead program allows Real-Time program participants to offer energy reductions (100 kW minimum) of curtailment concurrent with the Day-Ahead Energy Market, paid at the Day-Ahead Zonal Price. The Real Time programs allow real time response for either 30 minutes notice or for 2 hours notice. The Real Time participants receive payment at the Real-Time Zonal Price. Load aggregation is allowed in all of the programs offered, as long as the ISO can treat the aggregated load as a single entity (i.e., they all must be able to respond in 30 minutes on that Real Time plan).

For estimating a baseline, ISO New England uses the prior day-averaging with morning adjustment methodology. The most recent five admissible days are used to estimate the baseline, and then an adjustment is made based on the two hours prior to the interruption. Holidays and prior load response event days are excluded from the list of admissible days in the calculation.

[14] This section based on *ISO New England Load Response Program Manual*. 12th Revision. October 1, 2007. This was the most recent version of this manual available on ISO-NE's website.

ATTACHMENT B

DRAFT Pre-Pilot Survey

ENERGY$AVINGS MANAGEMENT

Customer Survey

Unitil

Thank you for participating in Unitil's *Energy Savings Management* Program. Please fill out this survey which will help us gauge the impact of the pilot program. The information collected will be used to compare answers to other program participants and will not be used for any other purpose. We will also be asking you to complete a brief survey at the conclusion of the pilot which will help us to better understand your experience and how it could be improved. Thank you for your time and for participating in the pilot.

_____
Name

_____
Date

_____
Address

_____
Unitil Account #

How aware would you say your household is of energy usage and the impacts of energy use on the environment? **On a scale of 1 to 10, please circle the number that best represents your answer.**

1 = not at all aware; 10 = extremely aware

1 2 3 4 5 6 7 8 9 10

How would you rate your household in terms of Energy Conservation *(e.g turning off lights when leaving a room, unplugging phone chargers when not in use, etc.)?* **On a scale of 1 to 10, please circle the number that best represents your answer.**

1 = needs improvement; 10 = excellent

1 2 3 4 5 6 7 8 9 10

How would you rate your household in terms of Energy Efficiency *(e.g. replacing incandescent lights with CFL's, purchasing high efficiency appliances, etc.)?* **On a scale of 1 to 10, please circle the number that best represents your answer.**

1 = needs improvement; 10 = excellent

1 2 3 4 5 6 7 8 9 10

Prior to hearing about this program, how aware were you that the cost to generate electricity varies throughout the day, peaking in the early afternoon? **On a scale of 1 to 10, please circle the number that best represents your answer.**

1 = not at all aware; 10 = extremely aware

1 2 3 4 5 6 7 8 9 10

On a typical summer weekday (Monday-Friday), how frequently would you say someone is at home during the day?

- ❑ almost never
- ❑ occasionally
- ❑ almost always

Approximately how many days during the summer would you say you run your central air conditioning system?

- ❑ never
- ❑ just the hottest days
- ❑ several days a week
- ❑ almost every day
- ❑ every day

continued, page 2

In the summer, what temperature do you typically set your thermostat to when you are home?

- ❑ 66°F or lower
- ❑ 67°F - 69°F
- ❑ 70°F - 72°F
- ❑ 73°F - 75°F
- ❑ 76°F or higher

What is the approximate range of your household income?

- ❑ less than $50
- ❑ $50K - $80K
- ❑ $80K - $120K
- ❑ $120K - $150K
- ❑ more than $150K

What is the highest level of education you have completed?

- ❑ Did not graduate high school
- ❑ High School / GED
- ❑ Some College
- ❑ College Graduate
- ❑ Postgraduate degree

In regards to your motivations for participating in the pilot program, **please rank the following on a scale of 1 to 10:**

1 = very unimportant; 10 = very important

◢ Saving money on your electric bill

1 2 3 4 5 6 7 8 9 10

◢ Conserving energy

1 2 3 4 5 6 7 8 9 10

◢ Environmental benefits, including greenhouse gas reductions

1 2 3 4 5 6 7 8 9 10

◢ Interested in the technology

1 2 3 4 5 6 7 8 9 10

For each age group below, please identify how many people are currently living in this household

◢ 5 yrs old and under

❑ *0* ❑ *1* ❑ *2* ❑ *3* ❑ *4 or more*

◢ 6-18 yrs old

❑ *0* ❑ *1* ❑ *2* ❑ *3* ❑ *4 or more*

◢ 19-34 yrs old

❑ *0* ❑ *1* ❑ *2* ❑ *3* ❑ *4 or more*

◢ 35-54 yrs old

❑ *0* ❑ *1* ❑ *2* ❑ *3* ❑ *4 or more*

◢ 55-64 yrs old

❑ *0* ❑ *1* ❑ *2* ❑ *3* ❑ *4 or more*

◢ 65 yrs old and over

❑ *0* ❑ *1* ❑ *2* ❑ *3* ❑ *4 or more*

How many times per week would you estimate you currently run the following high energy use appliances between the hours of 12pm to 6pm on weekdays?

◢ dishwasher

❑ *0* ❑ *1-2* ❑ *3-4* ❑ *5-6* ❑ *7 or more*

◢ clothes washer

❑ *0* ❑ *1-2* ❑ *3-4* ❑ *5-6* ❑ *7 or more*

◢ clothes dryer

❑ *0* ❑ *1-2* ❑ *3-4* ❑ *5-6* ❑ *7 or more*

How effectively do you feel your household will be able to manage and shift energy usage to take full advantage of the program incentives? **On a scale of 1 to 10, please circle the number that best represents your answer.**

1 = not effectively; 10 = highly effectively

1 2 3 4 5 6 7 8 9 10

continued, page 3

Please rank the following by checking the box that you think best corresponds to the amount of energy that appliance consumes relative to the others:

◀ ***uses LEAST energy*** • • • • • • • • • • • • ***uses MOST energy*** ▶

										central air conditioning system
										plasma TV
										clothes washer
										clothes dryer
										dishwasher
										toaster oven
										electric oven
										refrigerator
										electric water heater
										microwave
										well pump
										pool pump
										60 watt incandescent light bulb
										15 watt compact fluorescent (CFL) light bulb

Have you incorporated any significant energy efficiency measures in your household in the last 10 years? Check all that apply:

- ❑ Added/replaced insulation
- ❑ Added air sealing
- ❑ Had a home energy audit
- ❑ Installed energy efficient windows or storm windows
- ❑ Purchased ENERGY STAR heating or cooling systems
- ❑ Purchased ENERGY STAR appliance(s)
- ❑ Other _____

This information will be used to compare your answer to other demographic groups and will not be used for any other purpose.

ATTACHMENT C

DRAFT Post-Pilot Survey

Unitil Logo

Thank you for participating in our Unitil's Energy Savings Management Pilot Program. Please complete the attached questionnaire which will help us to better understand your experience with the program and how we could improve it. The information collected will be used only to compare your answers to other program participants and will not be used for any other purpose.

Name _____
Date _____
Address _____
_____

1) On a scale of 1-10, how would you rate your overall experience with the program?

   1 = Extremely Dissatisfied
   10 = Extremely Satisfied

2) If this program were offered on a full time basis, would you be interested in participating?

   - ☐ Yes
   - ☐ No
   - ☐ Don't Know

3) Did your monthly electric bills increase, decrease, or stay the same during the pilot program?

   - ☐ decreased significantly
   - ☐ decreased slightly
   - ☐ stayed the same
   - ☐ increased slightly
   - ☐ increased significantly

4) How clear and easy to understand were your monthly electric bills?

   - ☐ Extremely confusing
   - ☐ Somewhat confusing
   - ☐ Same as before
   - ☐ Somewhat clear and easy to comprehend
   - ☐ Extremely clear and easy to comprehend

5) What specifically, if anything did you find confusing about your monthly bills that could be changed to make them easier to understand?

   _____
   _____

6) After participating in the pilot, how aware would you say your household is of energy usage and the impacts of energy use on the environment? On a scale of 1 to 5, please circle the number that best represents your answer.

   1 = not at all aware; 5= extremely aware

7) After participating in the pilot, wow would you rate your household in terms of Energy Conservation (e.g turning off lights when leaving a room, unplugging phone chargers when not in use, etc.)? On a scale of 1 to 5, please circle the number that best represents your answer.

1 = needs improvement; 5 = excellent

8) After participating in the pilot, how would you rate your household in terms of Energy Efficiency (e.g. replacing incandescent lights with CFL's, purchasing high efficiency appliances, etc.)? On a scale of 1 to 5 please circle the number that best represents your answer.

1 = needs improvement; 5 = excellent

9) How would you rate your experience with the installation contractor who initially visited your home, installed the equipment and explained the program to you? On a scale of 1 to 5 please circle the number that best represents your answer.

1 = poor; 5 = excellent

10) Did you or your family access the web portal at myunitil.com to view your daily energy usage and energy saving tips?

- ☐ Yes
- ☐ No
- ☐ Don't know

11) If so, did you find it useful?

- ☐ Yes
- ☐ No
- ☐ Did not access

12) Do you have any recommendations for making the web portal more useful or easier to navigate?

_____

_____

13) The program was designed so that you would be made aware of Critical Peak Periods (CPP's) one day in advance. Based on your experience, how clearly did Unitil communicate that a CPP would be declared the following day?

- ☐ Very clearly
- ☐ Somewhat clearly
- ☐ Neither clearly nor unclearly
- ☐ Somewhat poorly
- ☐ very poorly

14) Please circle the number of Critical Peak Periods (CPP's) you believe were declared during the course of the pilot?

List numbers: 0-8

TECHNOLOGY

Simple TOU	**Enhanced Technology**	**Smart Thermostat**
How easy to understand were the time-of-use rates? On a scale of 1-5, please circle the number that best represents your answer: 1 = very complicated; 5 = very simple 1 2 3 4 5	How easy to understand were the time-of-use rates? On a scale of 1-5, please circle the number that best represents your answer: 1 = very complicated; 5 = very simple 1 2 3 4 5	Did you experience a noticeable change in the comfort of your home during these critical peak periods? ☐ Yes ☐ No ☐ Don't Know
How effectively did the educational materials explain the time-of-use rates? On a scale of 1-5, please circle the number that best represents your answer: 1 = not at all effectively; 5 = very effectively 1 2 3 4 5	How effectively did the educational materials explain the time-of-use rates? On a scale of 1-5, please circle the number that best represents your answer: 1 = not at all effectively; 5 = very effectively 1 2 3 4 5	Did you override the temperature set point of your central air conditioning system during any critical peak periods? ☐ Yes ☐ No ☐ Don't Know
	How effectively were the time-of-use rates shown and/or explained in the energy management system web portal? On a scale of 1-5, please circle the number that best represents your answer: 1 = not at all effectively; 5 = very effectively 1 2 3 4 5	
On a scale of 1-5, with 1 being "strongly disagree" and 5 being "strongly agree", please rate your response to the following	On a scale of 1-5, with 1 being "strongly disagree" and 5 being "strongly agree", please rate your response to the following statements:	On a scale of 1-5, with 1 being "strongly disagree" and 5 being "strongly agree", please rate your response to the following statements:

statements: • I made active efforts to shift energy usage from high price (on-peak) periods to low price (off-peak) periods (1-5) • The educational materials provided by Unitil provided useful tips on how to shift usage to off-peak hours. (1-5) • The educational materials provided by Unitil provided useful tips on how to incorporate energy efficiency and reduce overall energy consumption in my home. (1-5) • I will continue to incorporate energy conservation and efficiency in my household. (1-5)	• The home energy management system was easy to use and understand. (1-5) • The home energy management system increased my understanding of how energy is used in my home. (1-5) • The home energy management system encouraged me to conserve energy in my home. (1-5) • The home energy management system clearly and effectively communicated that Critical Peak Periods were occurring. (1-5) • I made active efforts to shift energy usage from high price (on-peak) periods to low price (off-peak) periods (1-5) • I used the enhanced programming features of my home energy management system to minimize the use of central air conditioning or other high energy use appliances during high price (on-peak and critical peak) periods. (1-5) • I will continue to incorporate energy conservation and efficiency in my household. (1-5) • I would be more likely to continue incorporating energy efficiency and awareness if I were allowed to keep the Tendril system. (1-5)	• The thermostat was easy to use and understand. (1-5) • The educational materials provided by Unitil made me more aware of my energy use habits. (1-5) • I incorporated some of the energy efficiency tips included in the educational materials I received. (1-5) • I will continue to incorporate energy conservation and efficiency in my household. (1-5)

	On a scale of 1-5, with 1 being “strongly disliked” and 5 being “strongly liked”, please rate your perception of the following components of your home energy management system: • In-home display (1-5) • Programmable thermostat (1-5) • Volt controllable outlet (1-5) • Tendril Vantage web portal (1-5) • Unitil Web portal (myunitil.com) (1-5)	
What kinds of specific actions did you take to shift energy use to off-peak periods? Check all that apply: ☐ washed clothes off peak ☐ dried clothes off peak ☐ hung dry clothes instead of machine drying ☐ used timer on my water heater ☐ used my dishwasher off-peak ☐ avoided drying cycle of my dishwasher and let air dry ☐ washed my car off-peak ☐ Other _____	What kinds of specific actions did you take to shift energy use to off-peak periods? Check all that apply: ☐ Set rules in the web portal to minimize usage during high price periods ☐ washed clothes off peak ☐ dried clothes off peak ☐ hung dry clothes instead of machine drying ☐ used timer on my water heater ☐ used my dishwasher off-peak ☐ avoided drying cycle of my dishwasher and let air dry ☐ washed my car off-peak ☐ other _____	
What kinds of specific actions did you take to minimize energy during peak and critical peak periods? Check all that apply:	What kinds of specific actions did you take to minimize energy during peak and critical peak periods? Check all that apply:	

☐ Increased temperature of thermostat ☐ Conserved water ☐ Minimized the use of home electronics ☐ Turned off lights ☐ minimized use of appliances ☐ Reduced phantom loads by turning off power strips when electronics not in use ☐ Other _____	☐ Increased temperature of thermostat ☐ Conserved water ☐ Minimized the use of home electronics ☐ Turned off lights ☐ minimized use of appliances ☐ Reduced phantom loads by turning off power strips when electronics not in use ☐ Other _____	
Did you incorporate any of the tips for energy efficiency? Check all that apply: ☐ Turned off lights when a room is not being used ☐ Replaced incandescent lights with CFL's or LED's ☐ Turned up temperature set point of thermostat ☐ Shut off AC and used fans instead ☐ Closed shades to keep sun out ☐ Air dried dishes ☐ Ran clothes washer using only cold water ☐ Washed only full loads of dishes ☐ Installed aerators on faucets or showerheads ☐ Installed timer on electric water heater ☐ Increased refrigerator temperature ☐ Other _____	Did you incorporate any of the tips for energy efficiency? Check all that apply: ☐ Turned off lights when a room is not being used ☐ Replaced incandescent lights with CFL's or LED's ☐ Turned up temperature set point of thermostat ☐ Shut off AC and used fans instead ☐ Closed shades to keep sun out ☐ Air dried dishes ☐ Ran clothes washer using only cold water ☐ Washed only full loads of dishes ☐ Installed aerators on faucets or showerheads ☐ Installed timer on electric water heater ☐ Increased refrigerator temperature ☐ Other _____	Did you incorporate any of the tips for energy efficiency? Check all that apply: ☐ Turned off lights when a room is not being used ☐ Replaced incandescent lights with CFL's or LED's ☐ Turned up temperature set point of thermostat ☐ Shut off AC and used fans instead ☐ Closed shades to keep sun out ☐ Air dried dishes ☐ Ran clothes washer using only cold water ☐ Washed only full loads of dishes ☐ Installed aerators on faucets or showerheads ☐ Installed timer on electric water heater ☐ Increased refrigerator temperature ☐ Other _____
During the program, what temperature did	During the program, what temperature did you	During the program, what temperature did you

you typically set your thermostat to during the following periods: • 12pm-6pm weekdays (on-peak) ___ • 12pm-6pm weekdays (critical-peak) ___ • All other times (off-peak) _____	typically set your thermostat to during the following periods: • 12pm-6pm weekdays (on-peak) ___ • 12pm-6pm weekdays (critical-peak) ___ • All other times (off-peak) _____	typically set your thermostat to during the following periods: • 12pm-6pm weekdays (on-peak) ___ • 12pm-6pm weekdays (critical-peak) ___ • All other times (off-peak) _____
Did you have any problems with any of the technologies? If so, please describe briefly: (blank lines for write-in)	Did you have any problems with any of the technologies? If so, please describe briefly: (blank lines for write-in)	Did you have any problems with any of the technologies? If so, please describe briefly: (blank lines for write-in)
What recommendations would you have for improving the program in the future? (blank lines for write-in)	What recommendations would you have for improving the program in the future? (blank lines for write-in)	What recommendations would you have for improving the program in the future? (blank lines for write-in)