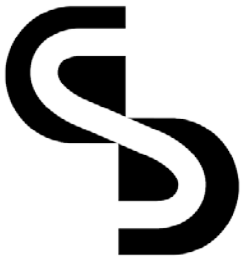

GDS Associates, Inc.
Engineers and Consultants

MARBLEHEAD MUNICIPAL LIGHT DEPARTMENT

MARBLEHEAD, MASSACHUSETTS

DE-0E0000308

ENERGYSENSE CPP PILOT

FINAL EVALUATION REPORT

JUNE, 2013

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I. INTRODUCTION

This report is a final evaluation of Marblehead Municipal Light Department's (MMLD's) two-year Critical Peak Pricing (CPP) pilot program. It details the design, development, implementation and evaluation of the smart grid pilot program. MMLD was assisted by GDS Associates throughout the design and implementation of the pilot program. This evaluation report has been prepared jointly by MMLD, GDS Associates, and the Department of Energy (DOE) sponsored Technical Assistance Group (TAG), assigned to oversee and support this study. The TAG group provided invaluable contributions to the design, implementation and evaluation of the program's results. The design of the pilot study was closely coordinated between MMLD, GDS and the TAG and documented in MMLD's final Consumer Behavior Study Plan (CBSP), dated November 16, 2010.

A. PROJECT BACKGROUND

MMLD is a municipal electric utility in the State of Massachusetts that serves approximately 10,000 customers in the seacoast Town of Marblehead, Massachusetts. MMLD's service territory is primarily residential with a small commercial base, and its nearly 19,000 residents can be broadly described as affluent and highly educated. The Town of Marblehead has a rich history dating back to its pivotal role in the Revolutionary War and its location 18 miles north of Boston makes it an ideal community for many commuters.

In 2009, MMLD received a Smart Grid Investment Grant (SGIG) Award from the Department of Energy for the town wide installation of a mesh based Advanced Metering Infrastructure (AMI) project that included installing new "smart" meters at every residence and business in addition to a wireless backhaul network that permits near real-time monitoring of conditions and usage throughout the system. The project scope included a pilot program to test the adoption and effectiveness of critical peak pricing (CPP) over two consecutive summers; the consumer behavior study was primarily focused on evaluating demand and energy consumption impacts for a summer-based critical peak pricing program to guide future planning of smart grid projects.

MMLD worked closely with the TAG group to design and implement a study that utilized true randomized assignment to measure the Year One impacts between treatment and control groups. In the first year, the treatment group received bill protection that assured they would not pay more under the pilot CPP rate. In the second year of the study, a within-subjects approach was employed by placing all participants on the rate and using a selection of sufficiently hot, non-event days as a baseline for determining the event day impacts. In the second year of the study, those year one control customers who were exposed to the CPP rate for the first time received bill protection. However, year one treatment customers who were exposed to the CPP rate in 2011 were not bill protected.

B. CPP PILOT PROJECT OVERVIEW

MMLD's pilot program, branded "EnergySense", was a two-year program focused on evaluating Critical Peak Pricing (CPP) in Marblehead. MMLD's Critical Peak rate included a 35% rate discount ($0.05 per kWh) during all non-CPP summer hours, and a steep 750% increase in the electricity price during critical peak periods. Critical peak periods were declared by MMLD based specifically on forecasted peak demands, and pilot participants were notified the day prior that the critical peak pricing would be in effect the following day. The rates were designed to be revenue neutral based on an anticipated twelve (12) CPP events per summer period. In actuality, MMLD declared three (3) CPP events in the summer of 2011 and five (5) CPP events in the summer of 2012, so all participants ended up saving money compared to the standard flat rate.

In the first year of the two-year pilot (2011), an opt-in enrollment model was used to recruit customers into the program. Over 500 customers (~9% of total eligible population) responded to promotional mailings and chose to participate in the program. These customers were asked a series of questions regarding the presence and use of central air conditioning and electric water heating in their home, and whether the residence is typically occupied during the day. These customer characteristics were used to stratify the volunteers before a true randomization separated participants into control and treatment groups. .

During the summer of 2011 (Year One), the treatment group was placed on the CPP rate from June 1 through August 31 and was bill protected against paying higher charges on this rate. The control group remained on the standard flat rate and was informed that they would receive the special rate in the summer of 2012. Both groups received basic educational material on energy efficiency and on their new web portal that provides near real-time feedback on household energy use. The treatment group additionally received tips and tools for reducing their peak demand during the high-priced critical peak periods. Neither group received any enabling technologies during the summer of 2011.

On the first of September, 2011, the treatment group customers were returned to their standard flat rate. There was no pilot activity until the spring of 2012 when year two information packets were disseminated. During the summer of 2012, all participants were placed on the CPP rate and those with central air conditioning systems and/or electric water heating were offered free enabling (load control) technologies.

During both summers, a wealth of interval electric usage data was collected and analyzed. Participants were also surveyed before and after the pilot period to obtain demographic data and qualitative reactions to the program.

Objectives and Expected Benefits

The study was designed primarily to evaluate enrollment rates, energy impacts, and attrition. The "EnergySense" Pilot focused on an energy issue similar to that of the "Stop peaking" program that MMLD has run for many years in which signs are hung throughout the town to promote energy conservation during peak periods. MMLD has also previously conducted a water heater load control program using radio based one-way communication. MMLD's current investment in an advanced metering infrastructure (AMI) enables a new age of dynamic pricing and load control technologies. This pilot sought to evaluate and understand the potential impacts and benefits of a large scale deployment, in addition to customer adoption and interaction with the technologies and concepts. Studying the impacts to customer's bills under this type of rate structure was another important objective of the pilot, though the limited number of declared CPP events limited the ability to assess these impacts.

The principle benefit expected to be realized from the pilot program was a reduction in system peak demand. MMLD also anticipated that many of the participating customers would realize bill savings through the discounted Non-CPP rate, and that the pilot would be a gateway to engaging more customers on household energy consumption via a web portal that provides granular feedback.

C. QUESTIONS OF INTEREST

The Consumer Behavior Study Plan included four primary hypotheses for the study. The first was evaluated after the first year of the pilot while the remainder depended on results from both the first and second years of the pilot. The four hypotheses are as follows:

1. Participants placed on a CPP rate will reduce their peak demand during critical peak events compared to what participants would have done if they had stayed on a flat rate

2. Participants who realize bill savings compared to their current flat rate in the first year will elect to participate in the second year of the pilot at a higher percentage rate than participants whose bills would have increased in the first year [in the absence of bill protection]
    - *Note: Since all participants saved on their bill in the first summer, it was not feasible to evaluate this hypothesis in the second year. MMLD evaluated whether customers with greater bill savings compared to their peers were more likely to participate in the second year of the pilot.*
3. A high percentage (>75%) of Year 1 Treatment customers who elect to participate in the second year of the study will accept the offer for free load control technology to be placed in their home.
4. First year Treatment group customers who elect to participate in the second year of the study will accept enabling technology at a higher rate than first year control group customers placed on the CPP rate in year 2.

II. PROJECT DESCRIPTION

A. DESIGN ELEMENTS

Target Population

The theoretical target population was entirely residential customers who would participate in a voluntary program if a permanent dynamic pricing tariff were to be offered. The operational target population, that is the group of customers who were recruited to participate, consisted of MMLD's entire residential population with monthly electricity consumption exceeding 200 kWh.[1] Accounts were also screened for those having a Marblehead billing address, and those who did not were deemed ineligible. Because the CPP program is a simple rate tariff, the program was designed to be applicable to all of MMLD's residential customers. Internet access and ownership of a personal computer were not pre-requisites for participation. No specific customer segments or sub-populations were recruited for the pilot. Due to sample size requirements, MMLD's entire qualifying residential population was recruited to participate in the study.

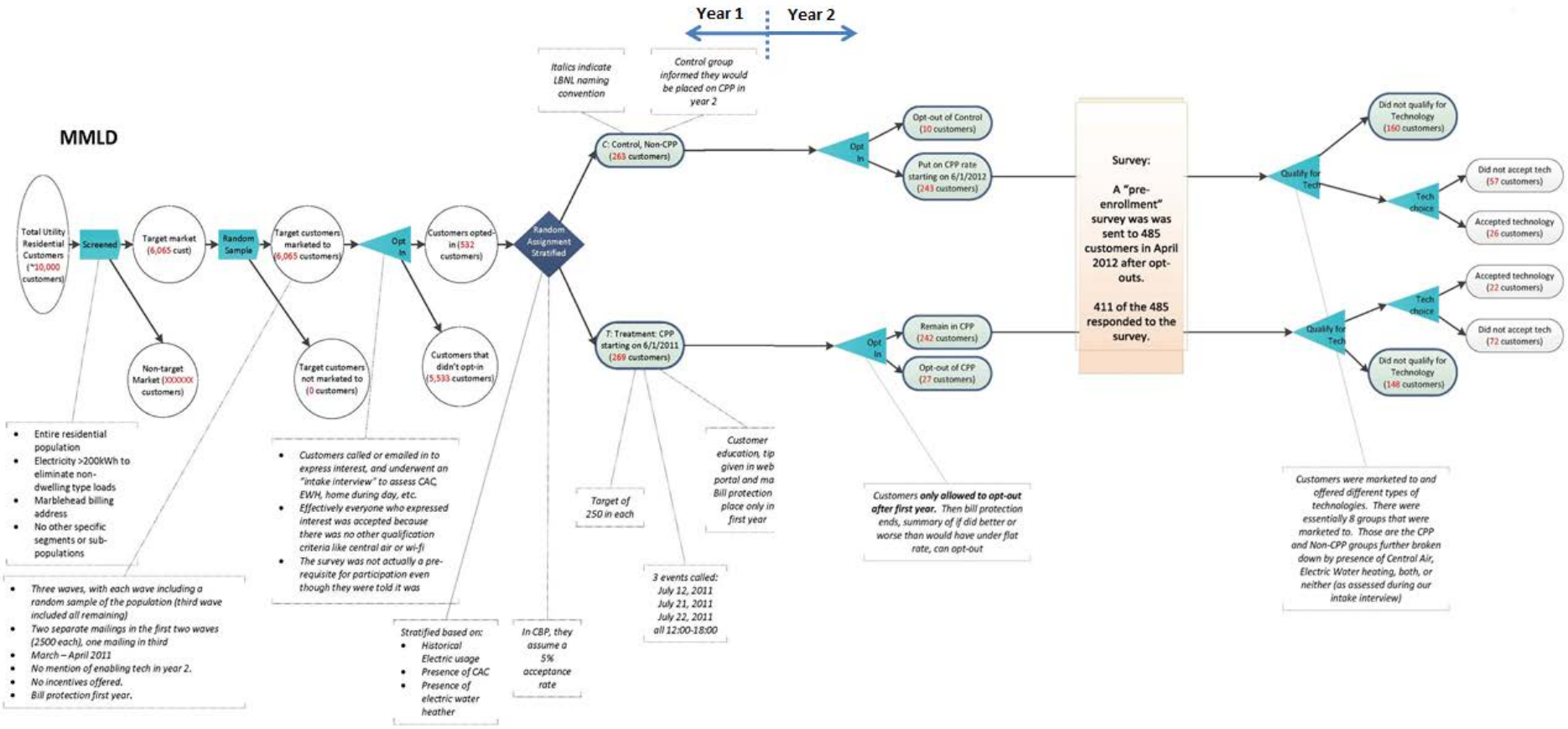
Customers who were participants of MMLD's legacy radio-based water heater load control system were neither specifically targeted nor excluded from the randomly selected group to which marketing was focused. Customers of MMLD's existing legacy control program who wished to participate in this study were not asked to leave the legacy program, however no control events had been initiated through this program in the last several years. MMLD did not initiate any events through the legacy program during either year of the study.

Randomization and Assignment Method

The basic design of the study is a randomized control trial using a recruit and delay method for year one and then a within-subjects design for year 2. This shift was included so that the pilot could test not only the effect of the CPP but also technology adoption, and there was a desire to allow all participants to receive the opportunity to experience the CPP rate. The structure of the recruitment process and randomization is visually depicted in Figure 1 below.

[1] A minimum annual kWh level was established to eliminate non-dwelling type loads.

FIGURE 1 – RECRUITMENT FLOW CHART



MMLD utilized an opt-in recruitment model to develop the study sample. Marketing material was distributed to randomly selected customers in multiple waves from March through April 2011. Customers were provided with basic information on the study and told they would be randomly selected to receive the "reduced electric rate" either during summer 2011 (Year One Treatment Group) or during summer 2012 (Year One Control Group). Interested customers called into MMLD and spoke with a representative who administered a brief intake survey to collect contact and household information that was later used to help stratify the sample. As is discussed in later sections of this report, the samples were stratified based on 2010 monthly electric usage and the presence of central air conditioning and electric water heating. This helped ensure that random variation in selection did not lead to differences between treatment and control groups along these important dimensions.

The definition of sample sizes for the study was a product of multiple iterations between MMLD and the TAG. Considering MMLD's limited residential population, it was ultimately decided to calculate a sample based on a realistic participation rate of 5% - a good result for most programs with aggressive recruitment. Given a total residential population of 10,000 customers, and an assumed response rate of 5%, a sample size of 500 was targeted for the study. After screening customers for eligibility based on a minimum monthly electric usage of 200 kWh, and a Marblehead billing address, the eligible pool of customers fell to 6,065 accounts[2]; however a total of 532 customers ultimately enrolled in the program, representing a participation rate of nearly 9%.

Customers who volunteered to participate in the study were randomly assigned to either the year one treatment or control group using a recruit and delay strategy. MMLD recruited interested customers from March through April, informing them that they had been accepted into the study but without stating whether they would receive the CPP rate or not in the first year. The enrollment process involved a brief phone survey to obtain contact information and to assess whether customers had central air conditioning or electric water heaters. This information, in conjunction with historical billing data, was used to stratify the sample. Following the stratification analysis, customers were randomly assigned to treatment and control groups ensuring equal distribution of strata to each group. MMLD elected to stratify the sample to reduce the potential that random assignment could lead to significant differences between the two groups compared with a simple random assignment

Two of the principle characteristics used to stratify the sample were the presence of central air conditioning and electric water heaters. The two tables below illustrate the final composition of the two groups relative to these two characteristics. These tables reflect the two groups as they were composed at the end of the summer of 2011 (year one) and take into account changes in group composition due to dropouts and customers removed for other reasons such as meter incompatibility during the first year.

TABLE 1: CONTROL GROUP APPLIANCES

Control Group	No Electric WH	Electric WH
Central AC	49 (19.3%)	17 (6.7%)
No AC or Room AC only	163 (64.2%)	25 (9.8%)

[2] Note the roughly 40% reduction in eligible population is more that was originally expected when the screening methodology was developed. It is possible if not likely that this screen criteria eliminated some dwellings and smaller apartment types units and it a potential reason why the participant population was biased towards higher income, higher educated and older residences.

TABLE 2: CPP GROUP APPLIANCES

CPP Group	No Electric WH	Electric WH
Central AC	54 (20.5%)	19 (7.2%)
No AC or Room AC only	155 (58.7%)	36 (13.6%)

Once the treatment and control groups had been established, MMLD sent enrollment packages to each of the enrolled customers. The enrollment packages were tailored to the treatment and control groups respectively, and included a welcome letter, information on the program (for their group), and a brief written survey. Copies of the enrollment materials are included as Appendix D to this report.

Treatments

MMLD's pilot program consisted of a Critical Peak Pricing (CPP) rate, access to printed and web based information including real time feedback of electric consumption, and access to enabling load control technologies during the summer of 2012 (year two). This section individually describes the various treatments.

1) RATE DESIGN

MMLD's smart grid pilot program focused on a critical peak pricing tariff. This pricing strategy works as an overlay on a customer's existing flat rate. The CPP rate tariff is included for reference in Appendix B to this evaluation report and summarized in the table below.

TABLE 3: STANDARD AND PILOT RATE STRUCTURES

Rate Component	Standard Rate	CPP Rate
Basic Monthly Charge	$4.25 per month	$4.25 per month
Non-CPP kilowatt-hours	$0.1425 per kWh	$0.09 per kWh
CPP kilowatt-hours	$0.1425 per kWh	$1.05 per kWh

The three (3) summer months of June through August are the peak months for the ISO-NE system. Review of historical MW system load data for MMLD from 2005 through 2009 indicated that MMLD's system peaks also occur during these three months, therefore these three months were selected as the critical peak months for the pilot. Based on the hourly load data for those three summer months, a critical peak pricing period consisting of non-holiday weekdays from 12pm through 6pm was established. All other hours on weekdays and all hours during weekends and holidays were considered Non-CPP hours during the three summer months, June through August. Notifications to customers of critical peak days were issued based on MMLD's projected load forecast; all events were six (6) hours in duration.

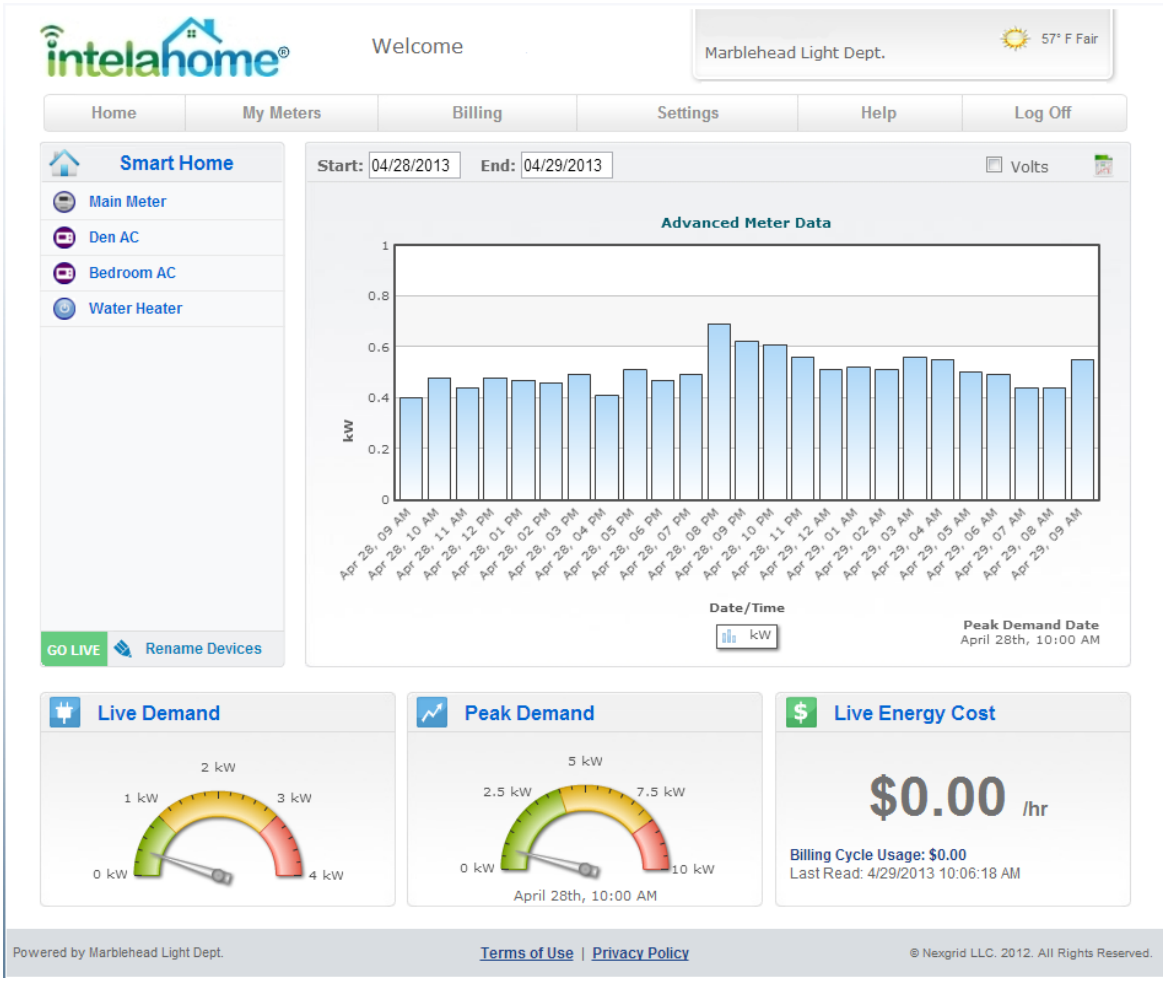
Several types of costs that could be associated with the critical peak period described above were considered in the development of the CPP rate, including the current and projected forward capacity market ("FCM") cost, the capacity cost of new entry ("CONE"), and MMLD's current and projected monthly transmission cost. After examining these various costs, the current (2011) FCM cost of $4.50 per kW-mo. (for 12 months per year) and the current transmission cost of $5.42 per kW-mo. (for 3 months per year) were selected as the costs to be recovered by the Critical Peak Price ("CPP") adder. The combined FCM and transmission costs were divided by the estimated kWh in the critical peak period to compute the CPP adder. A standard rate of $0.0990 per kWh reflecting MMLD's supply and

transmission costs for the residential rate class was used to determine the revenue under the current retail rate structure, and the Non-CPP discount was calculated to achieve revenue neutrality for an average customer based on an assumed twelve (12) CPP events.[3] The same rate tariff was utilized in summers 2011 and 2012.

2) *ONLINE WEB PORTAL*

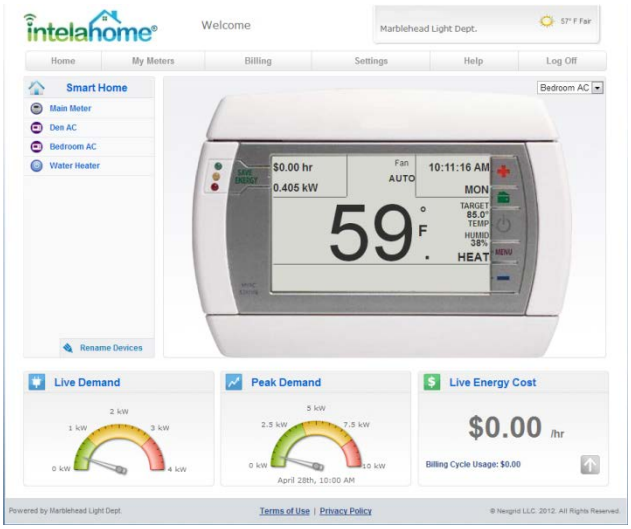
Beginning in May of 2011 and continuing throughout the duration of the pilot and beyond, all pilot participants were provided with access to an online web portal which allowed them to monitor their consumption in real-time, view historical usage statistics, and provide an estimation of their monthly bill. The web portal was hosted by Nexgrid who is the AMI implementation vendor selected by MMLD. A screenshot of the web portal is shown below.

FIGURE 2: NEXGRID INTELAHOME WEB PORTAL

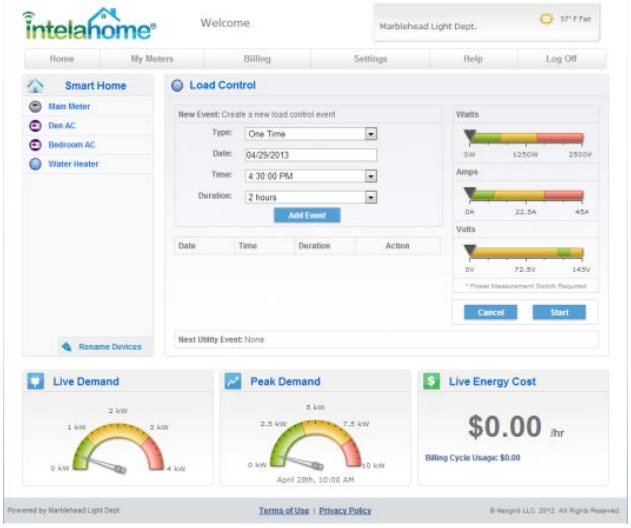


[3] A breakout of the CPP rate derivation and assumptions, including ratio to standard flat rate is available upon request

THERMOSTAT CONTROL SCREEN



HOT WATER SWITCH CONTROL SCREEEN



In addition to providing information on real time and historical energy usage, the online web portal was also the location from which customers were able to interact with and control their enabling technologies. The navigation bar on the right side of the screenshot above shows modules for two separate controlled programmable thermostats and a single water heater switch. These technologies, which were deployed in summer of 2012, are discussed in more detail below.

3) *ENABLING TECHNOLOGIES*

During the spring of 2012, all pilot participants who had previously reported the presence of either central air conditioning (CAC) or electric water heating were offered a Wi-Fi enabled programmable controllable thermostat (PCT) or water heater load switch, respectively. Participants with both CAC and electric water heating were offered both technologies. The rationale behind selecting Wi-Fi versus Zigbee enabled devices was primarily a product of guidance from the smart meter vendor, Nexgrid, who had familiarity working with these specific devices.

FIGURE 3: RADIO THERMOSTAT MODEL CT80

The enabling technologies were offered for free and it was the customer's responsibility to have the equipment installed by a licensed professional. MMLD offered a credit to the customer upon successful completion that was intended to offset the cost of hiring an electrician or HVAC technician to complete the installation. MMLD's experience with this installation approach is detailed later in this report.

The PCT selected for this study was the CT80 model produced by Radio Thermostat of America (Figure 3). The CT80 is a dynamic large display touch screen thermostat with 7-day programming capability. The thermostat has the ability to display real time electric cost and was reportedly compatible with

"nearly every HVAC system". Actual in-field experiences revealed some issues with system compatibility that inhibited MMLD's ability to fully deploy and evaluate this product for the pilot.

In-line water heater load control switches were also offered to customers in the second summer of the pilot. The purpose of these remotely controllable switches was to shut down power to the electric water heater during critical peak periods when the cost of power is very high.

FIGURE 4: ENTEK WATER HEATER SWITCH

The product utilized for this pilot was the EnTek MC140RAC Remote Appliance Controller (Figure 4). Per the manufacturer, the MC140 Series is an updated multi communications device utilizing USNAP standards. The MC140 can operate with multiple (up to 3) communications boards in different media allowing bridging functions and redundant broadcast modes. It contains up to 2 HVAC control relays and /or a 30 Amp relay for high current applications such as electric water heaters, pool pumps or lighting. The MC series logs valuable data for load analysis and can perform sub-metering functions on connected loads. For this application, the MC140 controller was utilized as an inline Wi-Fi enabled load control switch for electric water heaters.

No additional technologies were deployed during the course of the two summer pilot. In home displays were considered during the design phase, but they were ultimately determined to be cost prohibitive based on the anticipated incremental impact they would provide. In lieu of providing in home displays, MMLD elected to promote the use of the online web portal that will remain functional beyond the conclusion of the pilot effort.

4) INFORMATION DESCRIPTION

Customers were provided with enrollment packages prior to the start of the pilot that included two key documents. The first was a one-page "Pilot Details" flyer that provided basic information on the pilot design including duration, rate details, their meter exchange, and access to the online web portal. The pilot details flyer was tailored to whether the customer was in the treatment or control group. A second document was titled "Ways you Can Save" and provided simple and actionable tips for general energy conservation and then specifically for load curtailment during critical peak periods. Both the treatment and control groups received the general energy conservation piece, however only the treatment group on the CPP rate received the tips for conserving specifically during CPP periods. Copies of the enrollment packages for the treatment and control groups are provided for reference in Appendix D.

Before the second year of the pilot an additional informational packet was sent out. For those already on the CPP rate it thanked them for their continued participation in the pilot, reiterated the suggestions on event days, the explanation of the rate structure, and the notifications that would be released by MMLD prior to the event days. Importantly, the year one treatment group customers were informed that they would no longer receive bill protection in the summer of 2012 and gave them the option to opt out of continued participation. For the year one control group the information was the same. However, for this group it was the first time they had received information on their new rate structure and suggested measures on event days.

Additionally, this mailing informed customers about the two new technology options available; the Wi-Fi-enabled thermostats and hot water heater switches. All the 2012 pilot customers were encouraged to contact MMLD directly (via email or phone) to request these technologies. They were informed that the

technology would be supplied to them and should be installed by a professional electrician. Though MMLD did not offer to perform the installation it did offer a $200 reimbursement for the installation cost once the installation had been verified. Copies of the promotional material are included in Appendix D.

On August 1, 2012, additional information was sent out following reports of confusion and underutilization of the enabling technologies, specifically the programmable thermostats. Two additional information packets in the form of PDF's were sent via email to participants who had requested and received the technology. One document explained the basic functionality of the thermostat including instructions on programming it and utilizing other energy saving features of the device. The second explained the use of the online-portal relative to the thermostat with specific attention paid to suggesting energy saving measures on event days. Copies are provided for reference in Appendix D.

B. IMPLEMENTATION

Project Schedule

Table 4 below illustrates the key schedule dates as well as unscheduled events such as the Critical Peak Periods.

TABLE 4: PROJECT SCHEDULE

Date	Milestone
March 8, 2011	First wave of mailings sent out
March 22-24, 2011	Second wave of mailings sent out
March 31, 2011	Third wave of mailings sent out
April 29, 2011	Pre-pilot demographic survey #1 sent out
May 9, 2011	Enrollment packages sent to enrolled participants
June 6, 2011	Field installation of AMI meters began
June 1, 2011	Pilot Begins
June 18, 2011	Field installation of CPP group AMI meters complete
June 28, 2011	Field installation of Control group AMI meters complete
July 12, 2011	CPP Event #1
July 21, 2011	CPP Event #2
July 22, 2011	CPP Event #3
August 31, 2011	First Summer of Pilot Ends
October 2, 2011	Post-pilot survey #1 sent out with letter describing return to flat rate and pilot design for Year Two
April 12, 2012	Pre-Year Two Summer Mailings including second demographic survey
May 24, 2012	Year One Interim Evaluation Report Issued

June 1, 2012	Second Year Pilot Begins
June 21, 2012	CPP Event #1
June 22, 2012	CPP Event #2
July 17, 2012	CPP Event #3
August 1, 2012	Additional information sent out customers that requested technology
August 3, 2012	CPP Event #4
August 17, 2012	CPP Event #5
August, 1 2012	End of Pilot Program
October 5, 2012	Post-pilot survey #2 sent out

Recruitment and Customer Retention

MMLD launched marketing materials in early March 2011 and continued recruitment through the end of April. Direct mail marketing pieces were developed and mailed to a random selection of customers. Two separate direct mail pieces were developed; one was a 4-panel detailed brochure that provided more detailed program information and, while it included mention of the opportunity for bill savings, also included "green" and "community benefit" messaging. The second marketing piece was a simpler postcard that stressed only the cost savings opportunities of the program. The two marketing pieces are included for reference in Appendix E.

The first mailing went out to a randomly selected group of 2,500 qualified customers. A second mailing went out several weeks later with a second wave to the first group, and the first wave to a new random group of 2,500 customers. A third mailing was also sent with a second wave to the second group and a first wave to a third group of all remaining customers. This was sufficient to recruit more than the total quota of customers.

Prior to the beginning of the year 2 pilot a total of 37 customer opted out of the program. This option was presented in a mailing in April 2012 (along with information regarding enabling technologies). A small number also dropped out prior to the year 2 mailing. Each customer who did opt out was asked to explain their motivation for leaving the program with 31 not giving a specific reason, 5 because of health reasons, and 9 customers opted out because they moved. No customer specifically cited the structure or management of the pilot for their departure from the program. However, it should be mentioned that the majority of the opt outs were from the year 1 CPP group as opposed to the control group.

Incentive Approach

The principle incentive for customers to participate in the pilot was the opportunity to save money on their monthly electric bills. The marketing materials also focused on some of the community benefits of this type of program with respect to power stability and reducing the need for new power plants. Closely related to the opportunity for bill savings was the promise of bill protection in the first year which provided customers with an opportunity to pursue bill savings through the CPP rate with no risk of paying a higher bill. In the second year, bill protection was transferred to the first year control customers which guaranteed that no household would face increased energy costs during their first summer on the CPP rate. The free enabling technology offered by the program also incentivized participation in the second year of the pilot. There were no fixed incentives to encourage participation in the pilot.

Customer Surveys

A pre-enrollment oral survey was administered to customers interested in participating in the pilot and was used to collect basic information on the presence and type of air conditioning and electric water heating systems. This information was used to stratify the sample prior to the random assignment to treatment and control groups.

A total of four surveys were conducted via mailings to the pilot participants over the course of the pilot which collected reactions to the program as well as demographic data. A pre-summer demographic survey [provided to MMLD by DOE] was sent out during both years. The original pre-pilot survey administered in spring 2011 failed to link the survey data with customer account numbers which led to a decision to conduct a second survey of participants in spring of 2012 prior to the second summer period. Participant specific demographic data was required as part of DOE's guidance documentation. A post-summer survey was sent out both years which gauged both the response of the customers to the pilot and their level of participation in load-reduction and technology utilization. Copies of the survey instruments are included in Appendix A.

Response to the first pre-pilot survey was excellent – 469 responses out of 529 distributed surveys for a response rate of almost 89%. However, as mentioned, the first year surveys were administered without unique identifiers meaning that data collected was available at the sample level but not at the individual customer level, and was not conducive to cross-sectional analysis. In the second year the demographic survey was repeated with unique identifiers to allow for such analysis. The pre-pilot surveys collected information on occupancy, appliances, income levels, and education levels of the pilot participants. This second demographic survey had a response rate of 85%. Results are summarized in Section V(c).

Post pilot surveys were administered in early September following the end of the pilot period in both years. These surveys included questions regarding notification methods, utilization of the web portal, actions during CPP events, technology utilization and other pertinent data. Response rates for the post pilot survey were slightly lower than for the pre-summer surveys. In year one the response rate was 60% for the treatment group (161/269) and 46% for the control group (119/260) and an overall 48% response rate in year two. These were issued with unique identifiers that enable cross sectional analysis. Results of these surveys are summarized in Section V(c).

Technology Installation

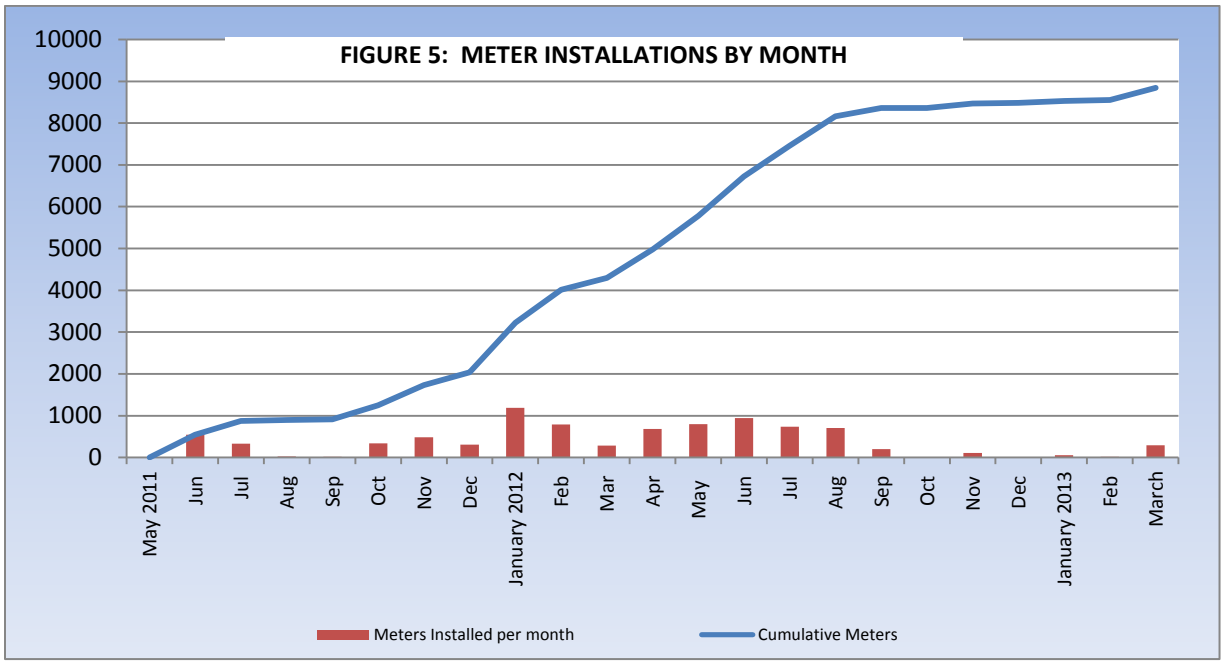
1) AMI METERS

Prior to year one of the pilot all participants needed to have the AMI meters installed by a MMLD technician. Since the DOE funding was for a city-wide AMI system, the initial conceptual deployment plan was to first establish a complete backhaul network for the town, then to begin installing AMI meters throughout geographic regions starting with pilot participants. Installing meters in this fashion, with the backhaul already in place, would have strengthened the mesh network and facilitated the installations.

However, a delay in the delivery of the backhaul equipment and rush to initiate the pilot in summer 2011 led to the first shipment of meters arriving before the backhaul equipment in mid-May. This delay meant prioritizing the installation of meters at pilot participant residences before the backhaul system and other key infrastructure was in place. The result was an inefficient installation process which was exacerbated by the random recruitment process which guaranteed that pilot participants were spread throughout the town. A somewhat makeshift backhaul system was set up to facilitate communications from these pilot participant meters while the town-wide system was yet to be installed. Also, the piecemeal installation of pilot participant meters meant that there was no strong mesh network

comprised of numerous adjacent meters, which would have strengthened the network. The timing of the CPP pilot relative to the installation of AMI meters and backhaul presented a major challenge to the project.

Despite these challenges, all pilot participants had meters installed by mid-June, before the calling of the first Critical Peak Event. MMLD conducted tests to confirm that meter reads obtained through the AMI system were consistent with field register readings and found very few issues. After the initial difficulties the town-wide installation of the AMI has proceeded much more smoothly with over 90% of customers having had their meters installed by the end of the second year of the pilot. This is despite management changes, storms, and other priorities. A graph depicting meter installations throughout the pilot is presented below:



2) ENABLING TECHNOLOGIES

Two enabling technologies were offered free-of-charge to customers during the April 2012 pre summer 2012 mailing. Those with central air conditioning (CAC) were offered Wi-Fi enabled programmable thermostats while those with electric hot water heating were offered Wi-Fi enabled hot water switches. The mailing included information on the benefits and capabilities of both devices. The offer stipulated that the device(s) would be sent via mail to the participant's home to be installed by the electrician of the customer's choice. Once the installation was complete MMLD would issue a refund to the customer to cover the cost of the installation. From the mailing a total of 49 thermostats and 9 hot water switches were requested. The following table breaks down the requests by the customers by their participation in either year 1 control or CPP group and by the heating and hot water systems utilized in their house. Several prefacing comments to this table:

- The "total participants" shown for each group (those with central air, or electric water heating, or both, as self reported) indicates the total customer sub population that received the technology offer.

- The "technology adoption" metric shows those customers who requested the technology but does not mean the technology was ultimately installed. AS discussed later in this report a number of issues were encountered during the installation that led to a significantly lower number of appliances actually being installed.
- A small number of customers in the "No-CAC, No-Electric WH" group requested the technology. The rationale behind this is that these customers likely self-reported the systems incorrectly in the original screen and learned of the technology offering through their peers.

TABLE 5: YEAR TWO TECHNOLOGY ACCEPTANCE RATES

	Year 1 CPP			Year 1 non-CPP		
	Total Participants	Technology Adoption	% Tech Adoption	Total Participants	Technology Adoption	% Tech Adoption
No CAC or ELEC WH	155	1 WH Switch	0.6%	163	1 WH Switch	0.6%
CAC / NO ELECT WH	54	16 tstats (13 customers)	24.1%	49	19 tstats (17 customers)	34.7%
NO CAC / ELEC WH	36	1 tstat 2 WH Switches	8.3%	25	1 tstat 2 WH Switches	12.0%
CAC/ELEC WH	19	7 tstats (6 customers) 4 WH Switches	52.6%	17	10 tstats (7 customers) 3 WH Switches	58.8%
TOTAL	264	20 tstat customers, 7 WH customers	10.2%	254	25 tstat customers, 6 WH customers	12.2%

The original hypothesis predicted that technology adoption rates would be higher among the Year 1 CPP customers than the Year 1 Non-CPP customers due to their familiarity with the CPP rate and load reduction efforts in the first year. However, the technology adoption rate was found to be higher among the control group as compared to the CPP group, though these differences were not statistically significant.

Despite the relatively smooth process of recruitment, several issues and learning experiences arose during the implementation of the enabling technology. Final technology implementation rates were about half of the requested rates, with 20 thermostats being installed and only 3 hot water switches successfully installed. The majority of issues with installation can be categorized into one of two groups; equipment deficiencies and contractor training.

The principal issue with contractor training had to do with the premise of mailing the technology to the customers, having them work with their preferred contractor to install the equipment, and then receiving a credit from MMLD to offset the contractor cost. This approach was conceptually simple; it was designed to alleviate MMLD of the responsibility of entering the home and installing the equipment while also supporting local contractors. Both technology vendors reported their equipment to be universally compatible and simple to install. MMLD's actual experience was very different from the initial concept. The equipment was not always compatible and the installation instructions were not always intuitive to contractors who had not been exposed to that specific brand. This ultimately spurred more questions back to MMLD, more contractor time on site, and more cost. It also resulted in several frustrated customers and equipment that was never ultimately installed.

The Wi-Fi-enabled programmable thermostats had very few technical issues once installed, however installation issues prevented about 25 units from being installed before the pilot ended. The largest issue for the installation was the thermostat required a C-wire to operate and did not run on batteries. This resulted in many customers having trouble with installation as their current thermostat did not require a C-wire. This problem was compounded by the fact that the familiarity of individual electricians with the thermostats varied, and issues only arose once they had already come to the customer's home. The result was that a couple dozen thermostats went unused in people's houses as well as requests for reimbursement for electrician visits when no thermostat was installed due to technical issues.

The Wi-Fi enabled hot water switches had similar and more difficult installation problems. Several of the first orders of the switches had to be sent back to the manufacturer as they lacked necessary components (missing an amp meter for example) or were impossible to install (directions mentioned wires by color, all wires on the device were black). Once the correct units were received other issues arose such as an inflexible and rare connector, a lack of easy ways to secure the box, and quick-fixes resulting in less than safe wiring. All these problems led local electricians to begin refusing to attempt the installations and a resultant very low installation success rate. It is worth mentioning that once installed, the switches worked as expected.

III. DATA DESCRIPTION

Participant Energy Use Data

15-minute interval data was collected for all participating customers in the study beginning with the installation of their AMI meters at the onset of the pilot and continuing through the end of the pilot, including the months between summers when participants were returned to the standard fixed rate. The data was stored by the AMI vendor, Nexgrid, and provided electronically to the MMLD team for evaluation. A sample of the data that was received can be seen in Appendix G.

The interval load data was reviewed by the MMLD team prior to its use in impact evaluation modeling. First, the 15-minute data was summarized to hourly data. During year one several (less than 50) 15-minute readings posted consumption in excess of 100 kW, indicative of metering errors instead of true residential consumption. These readings were removed from the data and not replaced. Then, the data was scanned for large data gaps. Many of the customers had very small or no gaps in the data and the few that had larger data gaps (of several hours during a day) did not have gaps on event days. Since no gaps were significant in either year of the study, no customers for which data was obtained were excluded from the impact evaluations in either year.

During year one a total of 40 control and 13 treatment customers were excluded from the analysis because no interval data was collected for these customers over the summer. The reasons for the missing accounts are described in the table below. The 23 control meters that went in too late were due to paperwork errors.

TABLE 6: REASONS FOR MISSING DATA- YEAR ONE

Reason	No. Control	No. Treatment
Specialty Meter – Could Not Install	8	2
Homeowner Moved/Sold Home	1	3
Dropped Out of Program	3	0
Meter Installed Too Late	23	0
Other*	5	8
Total	40	13
* Includes wrong account numbers, meter not working, no access to meter, rusted meter base		

The MMLD team noted that a disproportionate number of missing meters came from the control group (in excess of 15%). To investigate the extent to which these missing meters were biasing the evaluation, billing history data for these accounts was examined (since interval meters were not installed for the summer, we were unable to investigate loads at hourly or daily intervals). The most pertinent month for the year one evaluation is July 2011 (the three event days and eight of the ten hottest non-event days occurred in July). The 40 excluded customers had an average July 2011 consumption of 1,011 kWh. The 210 Control customers used in the study had a July 2011 average consumption of 1,052 kWh. Based on the bill history for the most critical month, it did not appear that much bias was introduced into the study. Moreover, there were no systemic reasons why these customers were missed other than MMLD made sure to set CPP meters prior to Control meters. Additionally, the 23 meters installed too late did not come from the same neighborhood or have other demographic element in common that would lead to bias

System-Wide Energy Use Data

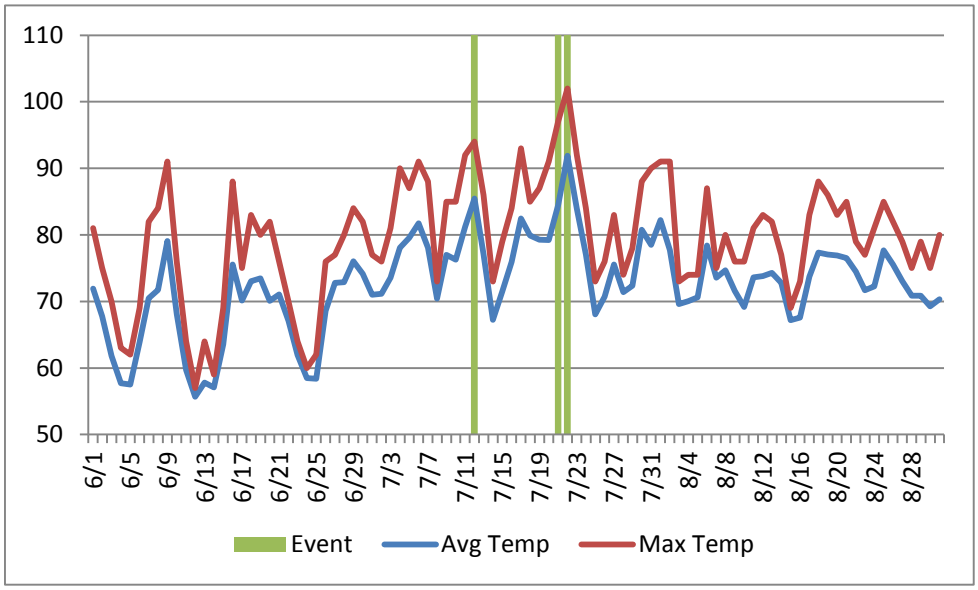
MMLD has hourly Tie Line metered data for its entire system that reports peak loads by day and hour. This data was utilized as the basis for billing through the Independent System Operator serving New England (ISO-NE). This data was used to evaluate the magnitude and timing of MMLD's peak loads during the course of the summer, and how the timing of these peak loads coincided with critical peak events issued through the pilot program.

Weather Data

Hourly temperature data for Boston, Massachusetts was obtained from the National Oceanic and Atmospheric Administration (NOAA) and was used as part of the impact analyses. Cooling Degree Hours ("CDH") were calculated from this hourly data based on the differential in actual temperature and a standard cooling set point of 65° F. Boston, MA was selected as the source for weather data recognizing there could be some difference in temperatures between Boston and Marblehead. However, our experience has been that weather data from Boston tends to be easier to obtain, more complete, and therefore more reliable than data for smaller stations.

In year one, three CPP event days were called by MMLD on the three hottest days of the summer. The figure below illustrates the weather data for the 2011 pilot period as well as the three days in July that were declared as critical peak days.

FIGURE 6: 2011 MAXIMUM AND DAILY AVERAGE WEATHER DATA FOR BOSTON MA

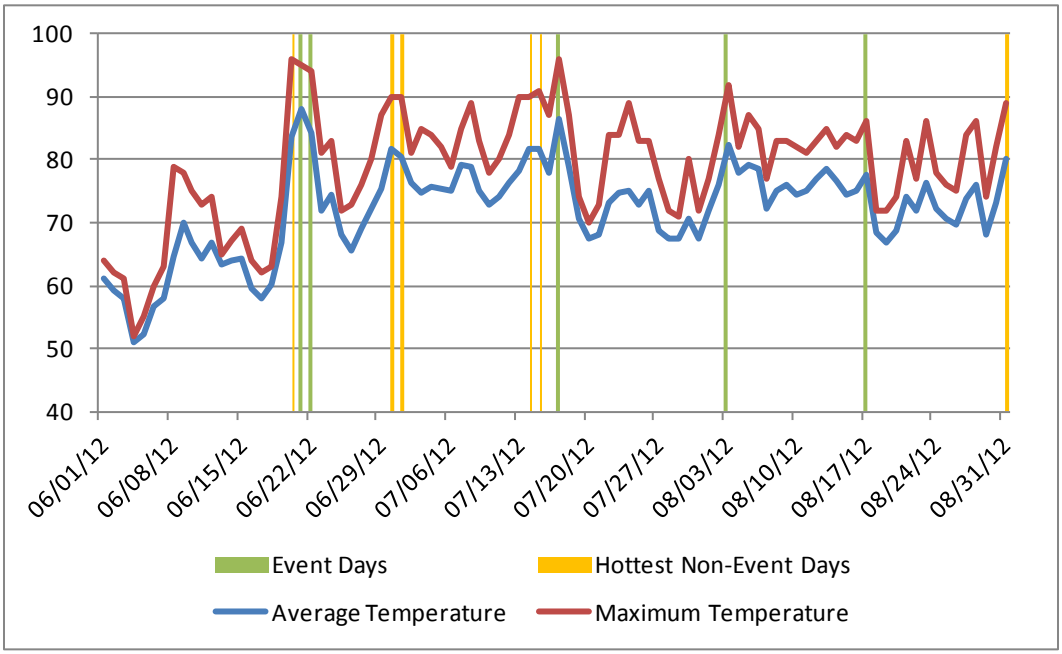


In 2011, the event days were declared by the then General Manager of MMLD based on an expectation that MMLD's system would experience peak conditions. There was no well defined "trigger" for calling events, and there existed an apprehension about calling a high number of events simply for purposes of the study that would not have been declared under non-pilot conditions.

In 2012, MMLD did implement a "trigger" for CPP events of a projected average daily temperature at or in excess of 78 °F. Any non-holiday weekday that met these conditions was deemed a qualifying day, and every other qualifying day was declared as a CPP event. The reasoning for only calling every other qualifying day as a CPP event was to provide a dataset of similarly hot, non-event days for the purpose of the evaluation. The five event days thusly did not correspond to the five hottest days of the summer but rather the three hottest, the fifth hottest, and the eleventh hottest (by average temperature).The

temperature data for the 2012 pilot period is presented below with event days, and the hottest non-event days, highlighted.

FIGURE 7: 2012 MAXIMUM AND DAILY AVERAGE WEATHER DATA FOR BOSTON MA



Participant Data

Participant data was collected via an initial screening survey, and pre-and post-pilot surveys administered at the beginning and end of each summer period. Overall, demographic survey results showed Marblehead to be an affluent, bedroom community with high average education levels and an aging population. The tables below show the key results of these surveys. Participants that did not answer a question were removed from the calculations. The second column shows 2010 census data for the town of Marblehead to help illustrate similarities or differences between the pilot group and the town as a whole. When applicable, the third column compares these results to the Massachusetts Residential Appliance Saturation Survey[4] (MRASS) results - prepared in April 2009. These comparisons show how the participants are similar and also different to the average Massachusetts residential utility customer. These similarities and differences are presented in Table 7.

[4] Five Massachusetts electric energy efficiency program administrators – Cape Light Compact, National Grid, NSTAR Electric, Unitil, and Western Massachusetts Electric Company retained Opinion Dynamics Corporation to conduct a state-wide residential appliance saturation survey. The study effort consisted of a mail/Internet survey of close to 3,000 Massachusetts residential customers and an in-home verification of customer-provided data in 118 of the survey respondents' residences.

TABLE 7: PARTICIPANTS' CHARACTERISTICS

Characteristic	% MMLD Pilot Respondents	2010 MMLD Census Data	MRASS Results
Own the Residence	96.4%	78.4%	81%
Single-Family Home	92.8%	75.4%	64.7%
Apartment/condo in a >4 unit building	0.7%	-	14%
Duplex or two-family	3.9%	-	-
Townhouse or row house	2.6%	-	-
Residence Has Central AC	31.3%	-	29%
Residence has at least 1 Room AC	58.1%	-	64%
Have Programmable Thermostat	63.3%	-	62%
Set programmable thermostat to automatically change temperatures during day (Of those that have them)	67.7%	-	-
Residence has Electric Clothes Dryer	77.3%		82%
At least one person with a chronic illness or disability that requires regular or occasional in home medical treatment	4.2%	6.3%[5]	-
Someone home Monday to Friday sometime between 1 PM and 5 PM at least one day a week	92.5%	-	-
At least one person in household working full time for pay	65.0%	-	-
At least one person in household with a job where they work at home at least one weekday a week	45.6%	-	-
Remembered receiving information from electric utility asking to participate in a utility pilot program	97.7%	-	-
Thought that the information was useful in helping decide whether or not to participate in the pilot	99.5%	-	-
Primary Language is English	98.9%	-	94.4%

Online census data for Marblehead was used to characterize the entire population of the town and to help determine whether any significant differences existed between the study group (those who accepted the offer to participate) and the town at large. In several cases, as summarized above, the survey categories matched between the pre-pilot survey and census questions. In other cases, the data did not align exactly and could not be reported in table form. Below are some observations of some key similarities and differences between the two groups based on the pre-pilot survey and census data.

- The prevalence of pilot participants living in single family homes was higher than in the general population of Marblehead according to survey and census data. The 200 kWh/month requirement may have excluded some multifamily homes from participation which would contribute to this difference. This trend towards single family homes leads to a higher

[5] Non-institutionalized civilians with a disability; census does not specify whether in-home care or treatment is received

prevalence of better educated and higher income individuals who are more likely to own single family homes.

- 65% of pre-pilot survey respondents said that at least one person in the house is working full time for pay. At first, it seemed like 35% of households not having anyone working is a very high percentage, but taking into account the 26.1% of the total population of Marblehead that collects social security, 15.3% that have retirement income (likely overlap with the social security group), and those that work part time, and the percentage seems reasonable.
- The pre-pilot survey asked how many people older than 65 years live in the residence. 20.7% responded with one, and 25.6% responded with two, a total of 46.3% of households that have at least one person over the age of 65. Census data shows that only 27.2% of Marblehead households have at least one person older than 65. This difference appears to show a higher interest in the program from households with at least one person older than 65. This difference is also consistent with the finding that 65% of pilot participants had only one person working full time for pay.
- 45.6% of pre-pilot survey respondents said that they have at least one person in the household with a job where they work from home at least one workday per week. This number initially seemed high. However, taking into account that 10.1% of the Marblehead population always work at home, 81.7% of all Marblehead's employed work in the fields of management, business, science, arts, sales, and office occupations, and the generally high income and large homes of Marblehead residents (allowing the space for home offices and the purchase of high-end equipment), it seems to be a reasonable percentage.
- 92.5% of pre-pilot survey respondents said that at least one person is home Monday through Friday at some point between 1:00PM to 5:00PM at least one day a week. Considering that 45.6% will meet this criterion through work, the fact that most children in school likely return home in this timeframe or will be on summer vacation (34.6% of homes have at least one person under the age of 18), and likely almost all of the retired population meeting this criterion, this high percentage is no surprise.

There were minor differences between the household income of the survey group and the entire Marblehead population which may have been due to the previously mentioned eligibility screen of minimum monthly electric consumption. The tables below summarize household income from both the study participant group and the census data for the town.

TABLE 8: HOUSEHOLD INCOME

Average Household Income	% of respondents	% of Households (Census)
$10,000 - $20,000	1.3%	4.0%
$20,000 - $30,000	3.6%	4.3%
$30,00 - $40,000	5.5%	5.6%
$40,000 - $75,000	18.5%	8.6%
$75,000 - $90,000	7.3%	12.7%
$90,000 - $100,000	7.3%	9.2%
$100,000 - $150,000	23.4%	19.9%
>$150,000	33.1%	31.5%

There was also a difference in education level which is quantitativley consistent with the higher prevalence of single family homes; 52.5% of participants hold graduate school or professional degrees, while only 30.3% of the Marblehead population over the age of 25 hold them. The reason for this disparity is not clear. It could simply be that the average participant is well over the age of 25, therefore more likely to hold a higher degree. It could be that the member of the family who answered the survey is more likely to hold higher degrees than other family members. It could also be that the program appeals to those holding higher degrees more than others; a finding that has been noted in many studies across the country.

TABLE 9: EDUCATION - STUDY PARTICIPANTS

Education Level	% All Respondents
None or grade 1-8	0.0%
High School incomplete (grade 9 -11)	0.0%
High School graduate	4.0%
Technical/trade or vocational school AFTER high school	2.1%
Some college (no 4yr degree)	9.9%
College graduate	31.0%
Post-graduate or Professional Schooling	52.5%

TABLE 10: EDUCATION – MMLD CENSUS DATA

Education Level	% Residents over 25
Less than 9th grade	[illegible]
9th to 12th grade, no diploma	[illegible]
High school graduate (includes equivalency)	[illegible]
Some college, no degree	[illegible]
Associate's degree	[illegible]
Bachelor's degree	[illegible]
Graduate or professional degree	[illegible]

This comparison shows that the program group is a close representation of the entire population of Marblehead, with the exceptions that there seemed to be a higher interest in the program from homeowners, residents of single family homes, those with graduate or professional degrees, and people over the age of 65, as discussed above.

IV. ANALYTICAL METHODOLOGIES

A. YEAR ONE (SUMMER 2011)

The MMLD team employed several methodologies to estimate the impacts of the CPP rate in both years of the study. In year one, three methods were tested: 1) adjusted comparison of means, 2) panel regression, and 3) individual regressions. All three methodologies are subject to sampling error. The regression approaches are subject to model specification error. In year one, the three hottest days of the summer of 2011 were all event days, so the possibility of specification error in the regression approaches may be an issue concerning the relationship between temperature and electricity consumption on hot days. The control and treatment groups in year one were developed using randomized assignment within usage and AC stratum to minimize the sampling bias. Therefore, it was decided that the adjusted comparison of means represents the best methodology for measuring impacts in year one given the randomized control design of the pilot program.[6]

In the simple comparison of means approach, the loads on event days between CPP and control customers are compared with the difference representing the impacts associated with the CPP events. However, during non-event days in the first year of the pilot, a difference in usage was noted between the two groups that was not apparent during the sample design phase of the program (based on 2010 billing history, the original control and CPP groups had equivalent summer usage). This is an important issue since small biases in the reference load can lead to large biases in the estimated impacts. During on-peak hours on the hottest non-event days, control loads were averaging 7% to 8% higher than the CPP loads for the summer of 2011.

The MMLD team constructed 90% confidence intervals on the difference between hourly control and hourly CPP group loads for each of the ten hottest non-event days of 2011. The confidence intervals, which all contain zero, indicate that we cannot conclude that the loads are statistically different. The charts below show the control and CPP average loads, the difference between the two, and the confidence interval for the difference for each of the ten hottest non-event days. Although this indicates no statistically measurable difference in the loads, other hypothetical issues could be leading to a difference. For instance, the CPP customers may have been more aware of their consumption since they have received educational materials and are actively on a CPP rate. Such awareness may have led to lower consumption even on non-event days. Furthermore, as described in the Data Description Section of this report (Section III), a disproportionate number of control customers relative to CPP customers were excluded from the study due to several reasons. That exclusion may have biased the data used in the impact evaluation. Therefore, we elected to make an adjustment to the comparison of means approach based on the hottest non-event days. The adjustment makes the impacts estimated by the method more conservative. The difference between this adjusted baseline and the CPP loads represents the impacts of the rate during 2011 event days. The formula below demonstrates how the baseline was calculated and how the impact is measured:

[6] As described in more detail in the year one *Interim Evaluation Report*, the three methods provided similar estimates for the customer load response to CPP event prices. In this report, only results from the comparison of means approach will be presented. Refer to the *Interim Evaluation Report* for impacts estimated from the panel and individual regression approaches for year one.

$Baseline_{event,h} = Control_{event,h} \times (CPP_{hot\ non\text{-}event,h}/Control_{hot\ non\text{-}event,h})$

$Impact_{event,h} = CPP_{event,h} - Baseline_{event,h}$

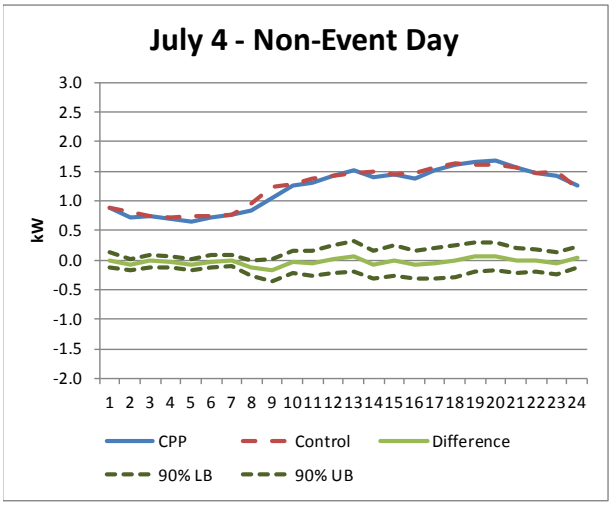
Where: h=hour

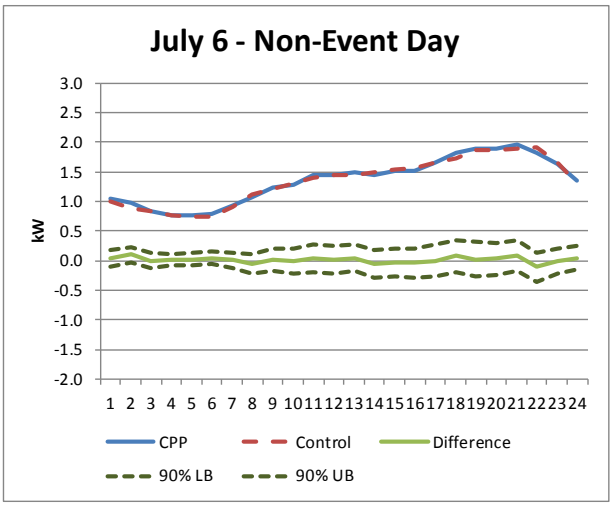
event,h = the average load in hour h of the event days

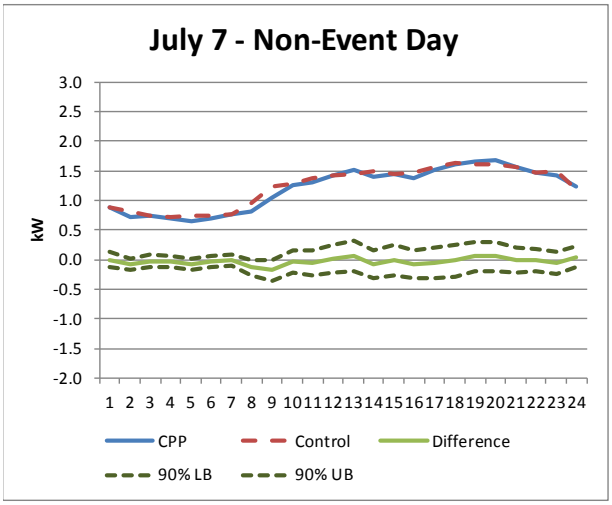
hot non-event,h = the average load in hour h of the 10 hottest non-event days.

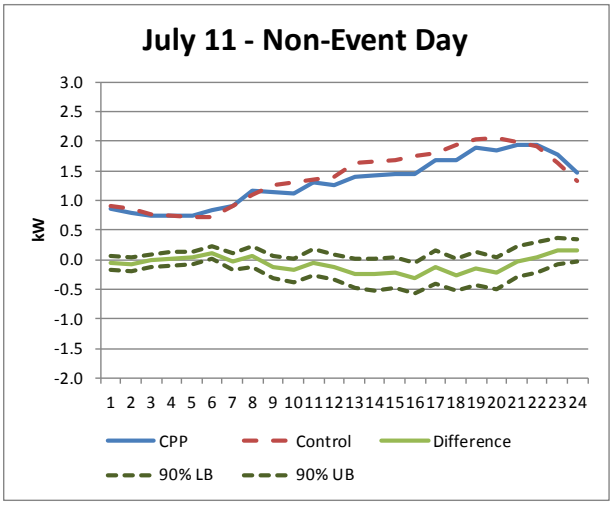
The cause of the difference between the Control group and CPP group on non-event days was further investigated using billing analysis, as described in the results section of this report.

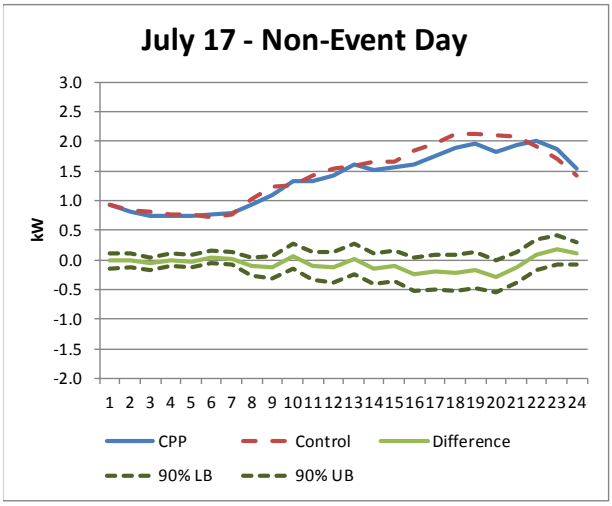
FIGURE 8: NON-EVENT DAY CONTROL AND CPP LOADS- YEAR ONE (2011)

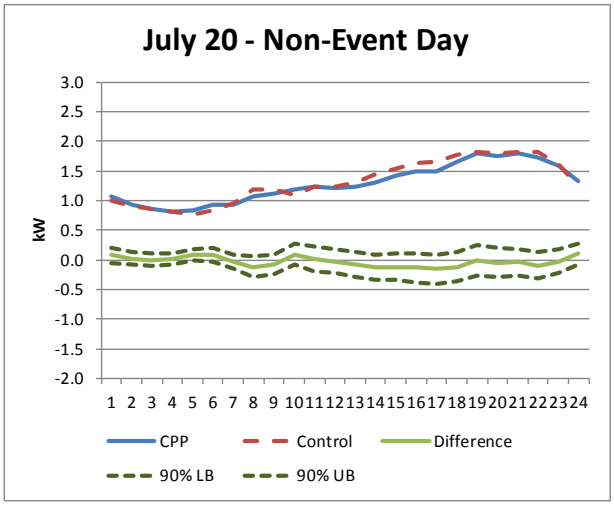


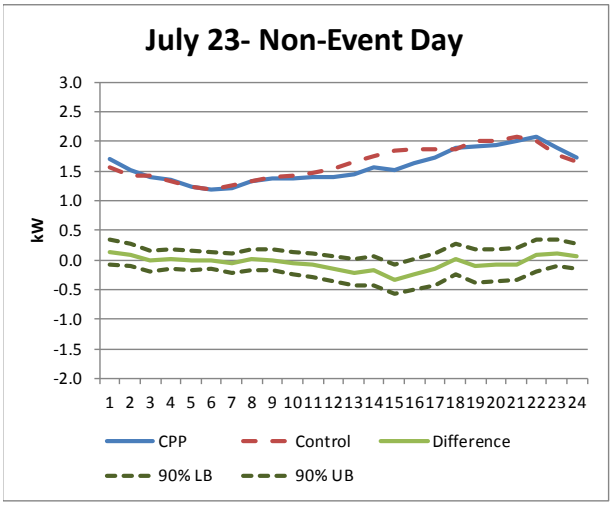


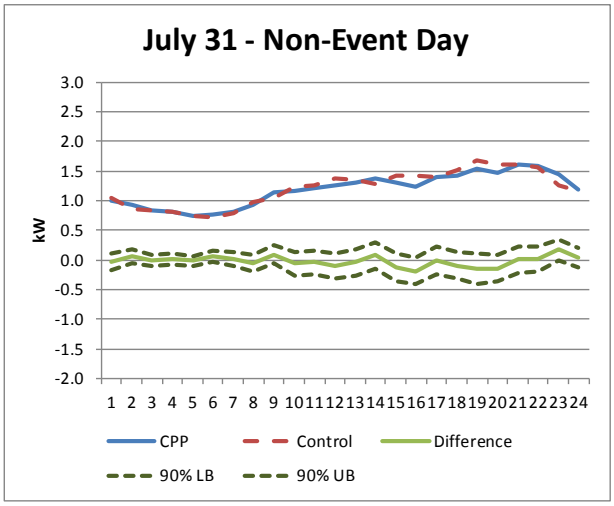


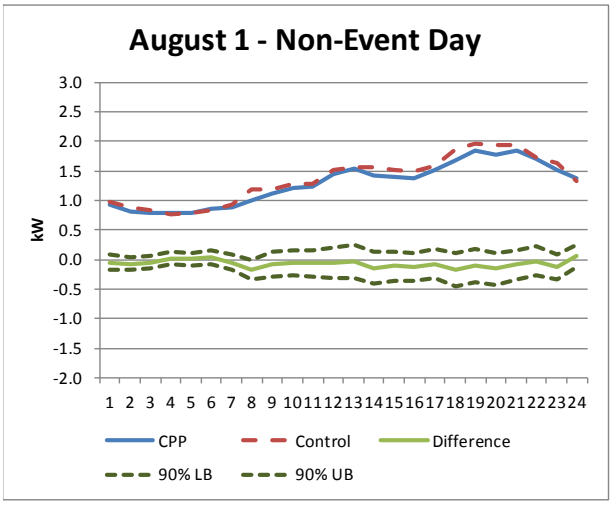


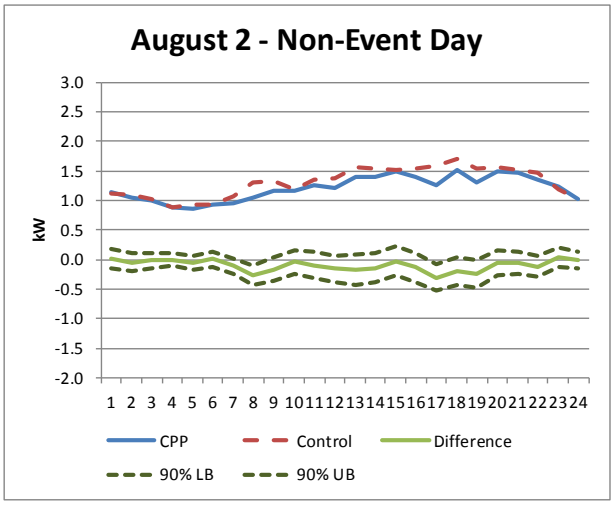

July 17 - Non-Event Day
kW
CPP
Control
Difference
90% LB
90% UB

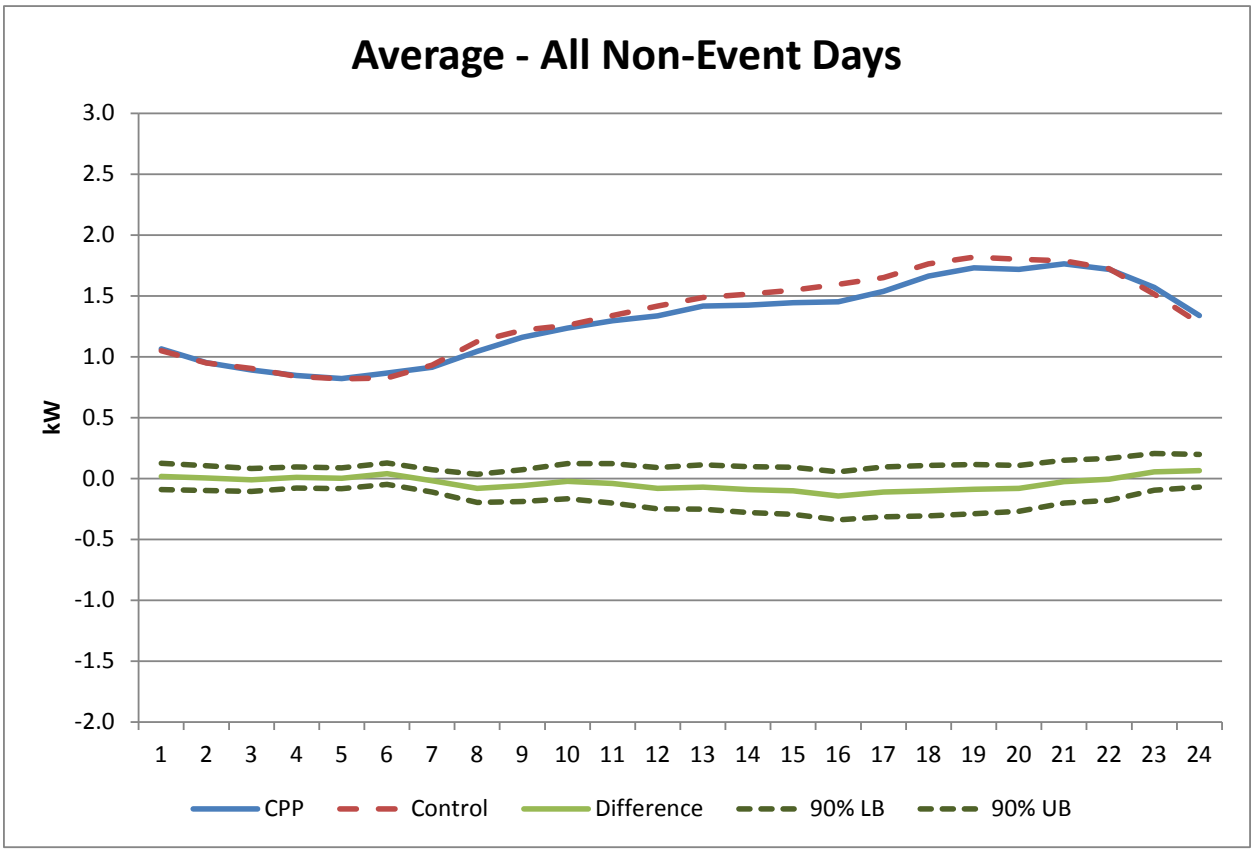

July 20 - Non-Event Day
kW
CPP
Control
Difference
90% LB
90% UB


July 23- Non-Event Day
kW
CPP
Control
Difference
90% LB
90% UB


July 31 - Non-Event Day
kW
CPP
Control
Difference
90% LB
90% UB


August 1 - Non-Event Day
kW
CPP
Control
Difference
90% LB
90% UB


August 2 - Non-Event Day
kW
CPP
Control
Difference
90% LB
90% UB



B. YEAR TWO (SUMMER 2012)

In year two, the lack of a control group precluded the adjusted comparison of means approach. Therefore, the MMLD team used the individual regression approach to evaluate impacts in year two. Anticipating the potential for specification error on the hottest days, MMLD purposely called an event only on approximately every second day that would be considered a possible event day. Data from the year one pilot indicated that peak demand was more strongly correlated to the average temperature of the 24-hour period as opposed to the maximum daily temperature. The year two CPP event threshold was set at an average daily predicted temperature of 78°F or higher. Temperature projections were collected from the National Weather Service Boston Regional Office website[7]. Several qualifying and borderline days were not called as event days in an attempt to provide a baseline of usage patterns during hotter days in which to estimate the individual regression equations. However, it was a relatively mild summer in 2012, so very few hot days were actually available for the analysis. In the year two regression models, we also included event days and non-event days from 2011 in order to estimate the model coefficients.

Individual regression modeling involves creating a regression model to describe hourly loads for each customer in the pilot. The approach relies on pre- and post-treatment data to estimate load impacts. The results of the individual regression approach are more robust if the pilot includes alternating or repeated patterns for treatment (e.g., multiple hot days that are CPP events and similar hot days that are not CPP events). This allows for observation of load behavior both with and without treatment under similar conditions. Unfortunately, many of the hottest days in both years fell on weekends, and

[7] See www.weather.gov/BOX.

weekend days were not eligible to be CPP events. Therefore, weekends had to be excluded from the analysis given how different load patterns are on weekdays versus weekends. As shown below, 15 days were included in the regression model databases, with 7 non-event days and 8 event days.

TABLE 11: HOTTEST EVENT & NON-EVENT DAYS

Date	Average Temperature	Maximum Temperature	CPP Event Day	Included in Analysis
Thursday, June 21, 2012	88.0	95	Y	Y
Tuesday, July 17, 2012	86.4	96	Y	Y
Friday, June 22, 2012	84.1	94	Y	Y
Wednesday, June 20, 2012	83.7	96		Y
Friday, August 03, 2012	82.4	92	Y	Y
Saturday, July 14, 2012	81.8	90		
Saturday, June 30, 2012	81.7	90		
Sunday, July 15, 2012	81.7	91		
Sunday, July 01, 2012	80.5	90		
Friday, August 31, 2012	80.0	89		Y
Friday, August 17, 2012	77.5	86	Y	Y
Friday, July 22, 2011	91.9	102	Y	Y
Tuesday, July 12, 2011	85.5	94	Y	Y
Thursday, July 21, 2011	84.5	97	Y	Y
Saturday, July 23, 2011	83.9	92		
Sunday, July 17, 2011	82.5	93		
Monday, August 01, 2011	82.2	91		Y
Monday, July 11, 2011	81.2	92		Y
Wednesday, July 20, 2011	79.2	91		Y
Sunday, July 31, 2011	78.5	90		
Monday, July 04, 2011	78.0	90		Y
Tuesday, August 02, 2011	77.7	91		Y
Saturday, July 16, 2011	76.0	91		

The model that was specified for each individual CPP participant was kept fairly simple. With so few days to use for estimation, the evaluation team felt that a model with few variables would work best. The model consists primarily of a temperature-based variable that is the average temperature from midnight to 5:00 PM. Since customers and homes cannot respond instantly to hourly temperatures, models with average temperatures tend to work better. Models that included squared temperature terms were considered; however, given the few number of very hot days, there were not enough high temperature data points to appropriately estimate the curvature in load that may result at higher temperatures. The formula below shows the model that was specified for each CPP customer.

$$kW_h = \beta_0 + \sum_{h=1}^{24} \beta_{1h} \times HR_h + \sum_{h=1}^{24} \beta_{2h} \times HR_h \times MeanTemp17 + \sum_{h=13}^{18} \beta_{3h} \times Event_h + \varepsilon_h$$

Where:

β_0-β_3	Estimated coefficients
h	Hour
kW_h	kW demand in hour h
MeanTemp17	Average temperature from midnight through hour ending 5:00 PM
HR	Indicator variable for hour of the day
Event	Indicator variable for event day if on the CPP rate
ε	Error term

The model above specifies the hourly demand for an individual customer. To estimate the hourly impacts of an event, the model estimate is calculated with and without the event-day variables for each event day hour. The difference represents the model-estimated average impact of the critical peak events.

Goodness of Fit

The goodness of fit for the individual models varies to some degree because of the difficulty of predicting individual load behavior based solely on weather and calendar variables (for instance, an individual consumer may take a week-long vacation that cannot possibly be captured in the models). However, the pilot is focused on measuring the behavior of the group of customers as a whole, or the behavior of an average CPP participant. Therefore, the R^2 and goodness of fit statistics for the average customer are provided below, as well as a distribution of individual R^2.

FIGURE 9: DISTRIBUTION OF R^2 VALUES FOR ALL INDIVIDUAL REGRESSION MODELS

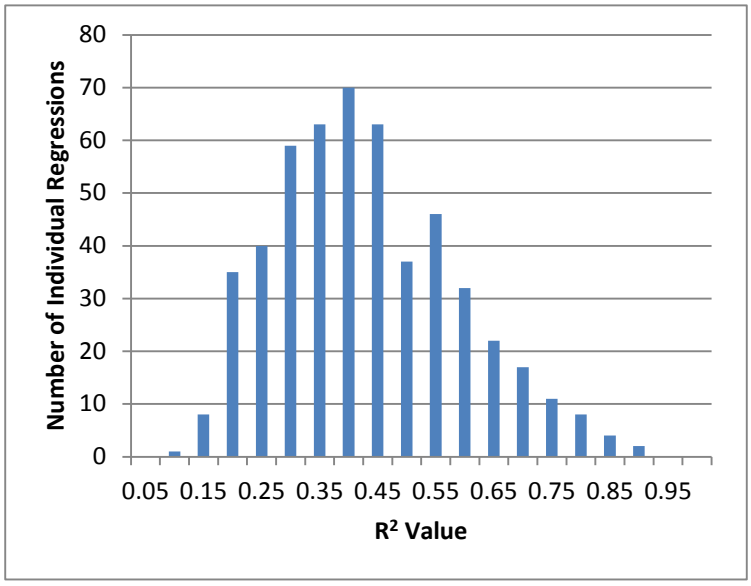


TABLE 12: GOODNESS OF FIT STATISTICS FOR THE AVERAGE CPP CUSTOMER

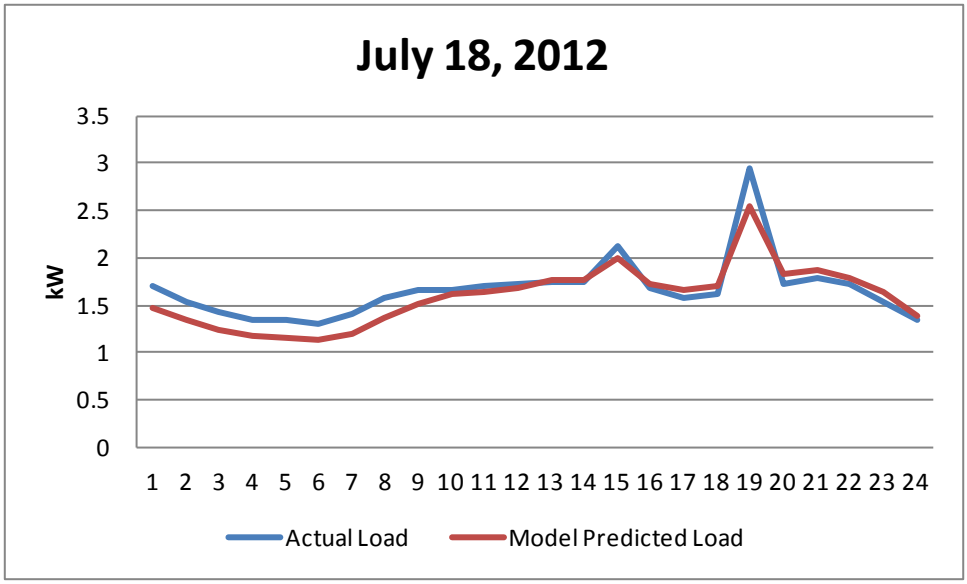
Group	Mean	MAD[1]	MAPE[2]	R^2
CPP	1.46	0.07	4.3%	0.9508

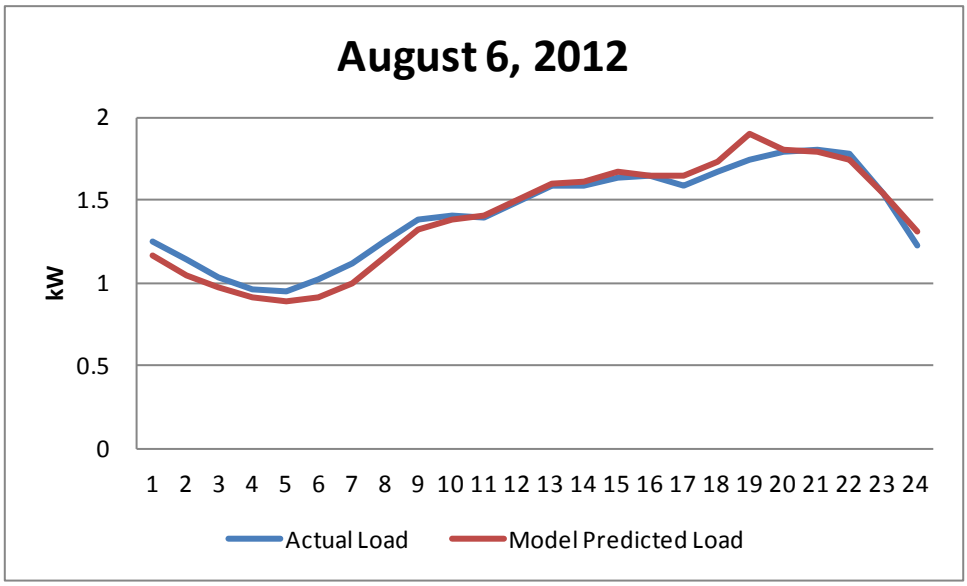
1 - Mean Absolute Deviation across all hours in sample.

2 - Mean Absolute % Error across all hours in sample.

An out-of-sample test was also conducted to validate the model specification. Out-of-sample testing involves predicting several hotter days that were left out of the data upon which model coefficients were estimated. Comparison of the model-predicted values on the out-of-sample days to actual loads provides further validation of the model's ability to predict loads it has not "seen" during estimation. The out-of-sample tests for July 18, 2012, and August 6, 2012, are shown graphically in the figure below. These two dates are some of the hotter weekdays in the summer of 2012 that were not included in the individual regression model estimations. The models perform well during event hours, averaging 1.1% error on July 18 and 1.8% error on August 6. As shown in the graphical prediction for these two days, the models have a more difficult time predicting morning hours.

FIGURE 10: OUT-OF-SAMPLE TEST RESULTS: MODELED PREDICTED LOAD VS. ACTUAL LOAD





Matched Control Group

In year one, a randomly selected control group was used to estimate load impacts. With consultation from MMLD's Technical Advisory Group (TAG), it was concluded that a matched control group approach might have been an effective alternative in the year two evaluation. However, in order to develop a control group in year two, MMLD would have had to do a propensity scoring procedure to develop an appropriately composed control group from its non-CPP customers that would mitigate sampling bias. Given the small customer base for MMLD, however, the ability to create a representative control group is questionable. Furthermore, budget and time constraints limited the evaluation team's ability to conduct a propensity matching analysis.

V. RESULTS

A. IMPACT EVALUATION

As described in Section IV, various methodologies were employed to estimate the impacts of the CPP pilot program in the two years of the study. For the year one evaluation, comparison of means and regression approaches were tested. In year two, regression approaches were used to estimate impacts. The impacts presented here for year one are estimated using the comparison of means approach. For year two, the impacts presented are based on an individual regression modeling approach.

In year one, the average kW reduction from CPP customers during the three event days from noon to 6:00 PM was 0.74 kW, a reduction of 36.7%. Daily energy use declined by nearly 5 kWh in year one, a reduction of 12.1%. A 90% confidence interval on the average kW reduction ranges from 0.55 kW to 0.95 kW. Given a reduction of 0.74 kW in year one, and with a rate changing from $0.09 per kWh to $1.05 per kWh during event hours, the arc price elasticity of demand is estimated to be -0.035 in year one.

In year two, the average kW reduction from CPP customers during the five event days from noon to 6:00 PM was 0.37 kW, a reduction of 21.3%. Daily energy declined by 3.9%, or 1.5 kWh. A 90% confidence interval on the average kW reduction ranges from 0.20 kW to 0.53 kW. Given a reduction of 0.37 kW in year two, the arc price elasticity of demand is estimated to be -0.020.

The lower impact in year two relative to year one would be expected, since the weather in 2012 was more mild than 2011. On the three event days in 2011, the average daily temperature averaged 87.3°F and the maximum temperature averaged 97.7°F. For the five event days in 2012, the average daily temperature averaged 83.7°F and the maximum temperature averaged 92.6°F. Therefore, with lower overall temperatures on event days, it is not surprising that average load impacts are lower in year two, since less air conditioning load was likely available to respond to CPP events. However, other factors have also likely impacted the evaluation results between years one and two. Changing methodologies can lead to differences in estimated impacts as well as changes in the population and other exogenous factors, such as economic improvement or changes in customer behavior (e.g., vacation schedules).

The tables and figures below summarize the overall average impacts in each year of the pilot. Impacts on each event day in 2011 and 2012 are provided in Appendix F.

TABLE 13: YEAR ONE IMPACTS – AVERAGE OF ALL EVENT DAYS IN 2011

					90% CI on Impact kW	
Hour Ending	Event kW	Baseline kW	Impact kW	% Impact	Lower	Upper
1	1.30	1.28	0.02	1.4%	(0.09)	0.12
2	1.18	1.16	0.02	1.9%	(0.47)	0.51
3	1.09	1.11	(0.02)	-2.1%	(0.10)	0.05
4	1.07	1.08	(0.01)	-0.8%	(0.17)	0.15
5	1.06	1.06	0.00	0.2%	(0.04)	0.05
6	1.11	1.10	0.00	0.3%	(0.00)	0.01
7	1.19	1.17	0.02	1.6%	(0.10)	0.14
8	1.34	1.35	(0.01)	-1.1%	(0.03)	0.00
9	1.57	1.52	0.05	3.6%	(0.09)	0.20
10	1.70	1.63	0.07	4.4%	(0.55)	0.69
11	1.68	1.79	(0.11)	-5.9%	(0.26)	0.05
12	1.68	1.82	(0.14)	-7.6%	(0.01)	(0.27)
13	1.19	1.90	(0.71)	-37.4%	(0.52)	(0.91)
14	1.20	1.92	(0.72)	-37.4%	(0.52)	(0.91)
15	1.24	2.04	(0.80)	-39.3%	(0.58)	(1.02)
16	1.27	2.00	(0.73)	-36.4%	(0.53)	(0.93)
17	1.36	2.09	(0.72)	-34.7%	(0.52)	(0.93)
18	1.40	2.16	(0.76)	-35.3%	(0.55)	(0.97)
19	1.93	2.29	(0.36)	-15.7%	(0.14)	(0.58)
20	2.09	2.26	(0.17)	-7.5%	(0.36)	0.02
21	2.25	2.28	(0.02)	-1.0%	(0.14)	0.09
22	2.29	2.20	0.09	4.3%	(0.66)	0.85
23	2.06	2.02	0.04	2.0%	(0.17)	0.25
24	1.79	1.78	0.01	0.6%	(0.01)	0.03
Energy	**36.04**	**40.99**	**(4.96)**	**-12.1%**	**(1.98)**	**(7.94)**
HE 13-18 (Event Hours)	**1.28**	**2.02**	**(0.74)**	**-36.7%**	**(0.54)**	**(0.95)**

TABLE 14: YEAR TWO IMPACTS – AVERAGE OF ALL EVENT DAYS IN 2012

					90% CI on Impact kW	
Hour Ending	Event kW	Baseline kW	Impact kW	% Impact	Lower	Upper
1	1.32	1.22	0.10	8.3%	0.00	0.21
2	1.21	1.12	0.09	8.1%	(0.03)	0.22
3	1.08	1.03	0.06	5.7%	(0.02)	0.15
4	1.03	0.97	0.05	5.4%	(0.02)	0.13
5	0.98	0.95	0.04	3.9%	(0.04)	0.11
6	1.04	1.00	0.04	4.1%	(0.04)	0.12
7	1.15	1.11	0.04	3.9%	(0.04)	0.13
8	1.41	1.34	0.06	4.7%	(0.09)	0.22
9	1.63	1.53	0.10	6.2%	(0.05)	0.25
10	1.60	1.53	0.07	4.5%	(0.07)	0.22
11	1.69	1.62	0.07	4.3%	(0.09)	0.24
12	1.65	1.63	0.02	1.1%	(0.13)	0.19
13	1.38	1.66	(0.29)	-17.3%	(0.11)	(0.45)
14	1.31	1.66	(0.35)	-21.0%	(0.18)	(0.50)
15	1.31	1.72	(0.41)	-23.7%	(0.24)	(0.56)
16	1.35	1.75	(0.40)	-23.0%	(0.23)	(0.55)
17	1.46	1.81	(0.35)	-19.1%	(0.15)	(0.51)
18	1.49	1.94	(0.45)	-23.3%	(0.27)	(0.61)
19	1.94	1.97	(0.02)	-1.3%	(0.18)	0.16
20	2.10	2.07	0.03	1.6%	(0.12)	0.23
21	2.10	2.10	0.00	0.1%	(0.14)	0.19
22	2.12	2.10	0.02	0.7%	(0.13)	0.20
23	1.90	1.90	0.00	0.2%	(0.13)	0.16
24	1.65	1.63	0.02	1.4%	(0.10)	0.16
Energy	**35.92**	**37.37**	**(1.46)**	**-3.9%**	**(5.91)**	**0.11**
HE 13-18 (Event Hours)	**1.38**	**1.76**	**(0.37)**	**-21.3%**	**(0.20)**	**(0.53)**

FIGURE 11: YEAR ONE IMPACTS – AVERAGE OF ALL EVENT DAYS IN 2011

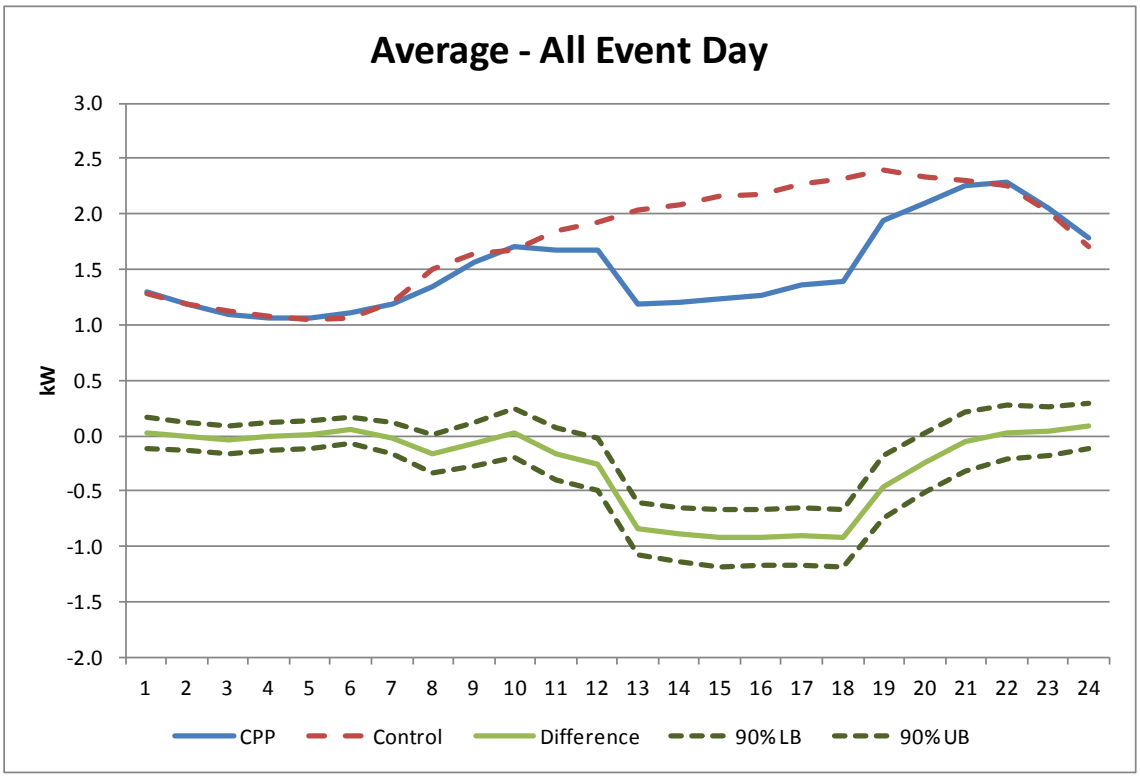
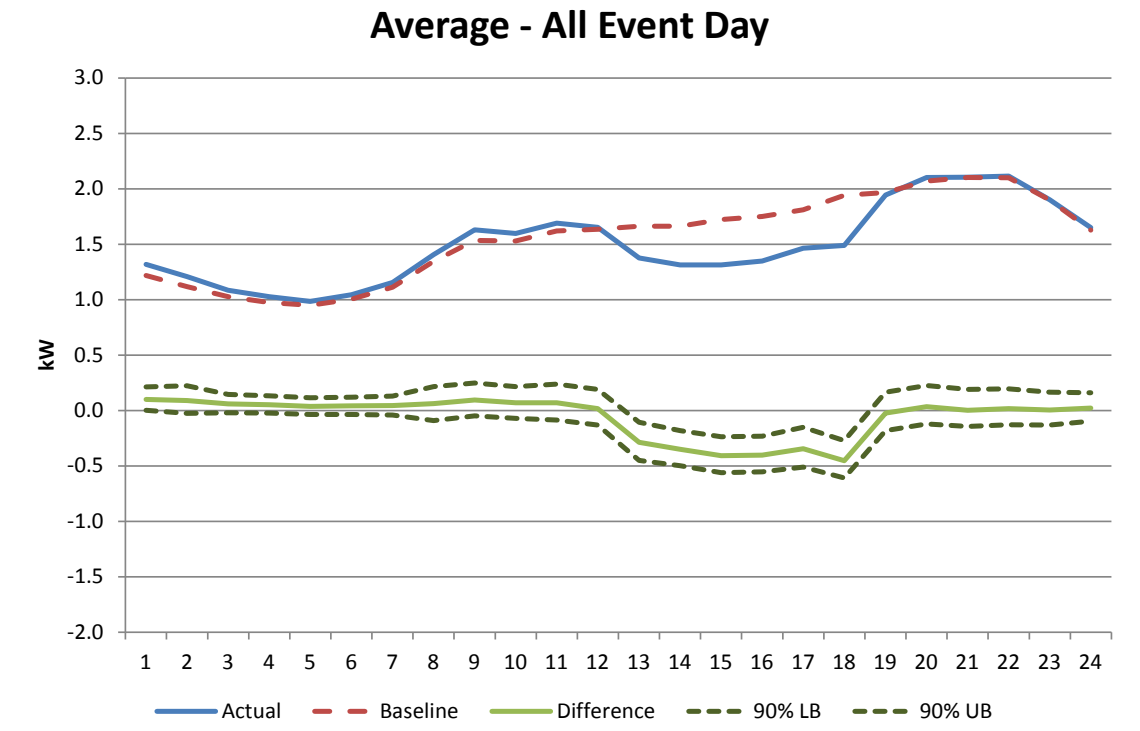


FIGURE 12: YEAR TWO IMPACTS – AVERAGE OF ALL EVENT DAYS IN 2012



In year one (2011), the MMLD system peaked on July 22 at hour ending 16. This coincided with a critical peak event. During that hour, each CPP customer reduced their load on average by 1.06 kW. The resultant total pilot reduction in system peak demand was 267 kW, a total reduction of 0.8% of the 31,452 kW peak demand. The average reduction for the CPP group as a whole during all event hours in 2011 was 187 kW.

TABLE 15: IMPACT MERICS – YEAR ONE (2011)

Impact Metric	Value[1]	Units	Description
Average Seasonal Impact on Electricity Consumption	-0.3%	% Change[2]	Average impact on consumption across 3 months (Jun-Aug)
	(3,747)	kWh/Season	
Relative Error	34.6%	% kWh/Season	
Average Hourly Impact on Electricity Consumption Over All Events	-36.7%	% Change[2]	Over critical events in CPP Program (Three event days, HE 13-18)
	(186.72)	kW	
Relative Error	3.8%	% kW	
Impact on System Coincident Peak Demand	-0.8%	% Change[3]	Program impacts when single hour Coincident Peak demand occurs (7/22/11 HE 16)
	(267.12)	kW	
Relative Error	14.5%	% kW	
Impact on Future Reliability Requirements			Impact on planning reserve margin.

1 - Value is for a total of 252 customers participating in the pilot program on the CPP rate in 2011.
2 - Represents the % change for just the pilot customers.
3 - Represents the % of MMLD's estimated 2011 Peak Demand of 31,452 kW (31,185 kW measured demand plus 267 kW reduction from CPP pilot program).

In year two (2012), the MMLD system peak was measured on July 17 at hour ending 21. This measured peak did not coincide with a critical peak hour. An event was called on July 17, but the critical peak events occur between hours ending 13 and 18. However, when the effects of the CPP pilot program are added back to the system loads during event days and hours, the system would have peaked on June 21 at hour ending 18. At that hour, the pilot customers reduced load by an average of 0.50 kW, for a pilot total reduction of 258 kW. That represents a pilot reduction in coincident peak demand of 0.9% of the total system peak demand of 27,393 kW. The average total reduction in demand across all 2012 event hours is estimated to be 194 kW. Although the number of participants in 2012 nearly doubled relative to 2011, the average load reduction declined by nearly half. The results are similar kW load impacts for the entire pilot program in each year of the study, as seen by comparing Tables 15 & 16. The more mild weather conditions in 2012 resulted in a total system peak that was 4 MW lower than the 2011 peak.

TABLE 16: IMPACT MERICS – YEAR TWO (2012)

Impact Metric	Value[1]	Units	Description
Average Seasonal Impact on Electricity Consumption	-0.3%	% Change[2]	Average impact on consumption across 3 months (Jun-Aug)
	(3,775)	kWh/Season	
Relative Error	48.7%	% kWh/Season	
Average Hourly Impact on Electricity Consumption Over All Events	-21.3%	% Change[2]	Over critical events in CPP Program (Three event days, HE 13-18)
	(194.04)	kW	
Relative Error	5.7%	% kW	
Impact on System Coincident Peak Demand	-0.9%	% Change[3]	Program impacts when single hour Coincident Peak demand occurs (6/21/12 HE 18)
	(257.68)	kW	
Relative Error	21.8%	% kW	
Impact on Future Reliability Requirements			Impact on planning reserve margin.

1 - Value is for a total of 518 customers participating in the pilot program on the CPP rate in 2012.
2 - Represents the % change for just the pilot customers.
3 - Represents the % of MMLD's estimated 2012 Peak Demand of 27,393 kW (27,135 kW measured demand plus 257 kW reduction from CPP pilot program).

Enabling Technology

In year two of the program, customers were offered enabling technology. The options included a Wi-Fi enabled programmable, controllable thermostat and a Wi-Fi enabled water heater switch. However, as detailed earlier in this report, there were substantial issues with the installation of these technologies. These challenges precluded a thorough analysis of the impact of technology on the event day impacts. In total, only 20 thermostats and 3 water heater controls were installed on the MMLD system in 2012. Furthermore, many of the controls were installed after some or even all of the event days in 2012 had been called. The timing of these installations is summarized in the table below.

TABLE 17: TIMING OF ENABLING TECHNOLOGY INSTALLATIONS

Number	Thermostat	WH Switch	Thermostat Install Date	Thermostat % of Events	WH Switch Install Date	WH Switch % of Events
1	1	0	06/12/12	100%		
2	1	1	06/18/12	100%	07/17/12	40%
3	1	0	06/02/12	100%		
4	1	0	07/11/12	60%		
5	1	0	06/26/12	60%		
6	1	0	06/28/12	60%		
7	1	0	07/02/12	60%		
8	1	0	06/07/12	100%		
9	1	0	06/28/12	60%		
10	1	0	07/17/12	40%		
11	1	0	07/14/12	60%		
12	1	0	07/20/12	40%		
13	1	0	07/20/12	40%		
14	1	0	07/23/12	40%		
15	1	0	08/11/12	20%		
16	1	0	07/31/12	40%		
17	1	0	08/24/12	0%		
18	1	0	09/05/12	0%		
19	1	0	07/23/12	40%		
20	1	0	07/23/12	40%		
21	0	1			07/17/12	40%
22	0	1			07/20/12	40%
Total	**20**	**3**		**53%**		**40%**

With so few data points available for enabling technology, it was not possible to include impacts from these technologies in the individual regression models. In order to attempt to determine if the thermostats provided any additional load reduction benefits, the MMLD evaluation team conducted a paired t-test comparing the load reduction during event hours for each customer before they received a thermostat and after they received a thermostat.[8] The paired t-test was unable to prove a statistically significant reduction in loads due to the thermostat controls. This does not necessarily indicate that

[8] With only three water heater controls installed, no additional analysis was conducted on them.

such controls do not produce greater load impacts, but with so few data points, it was difficult to prove a difference in this study.

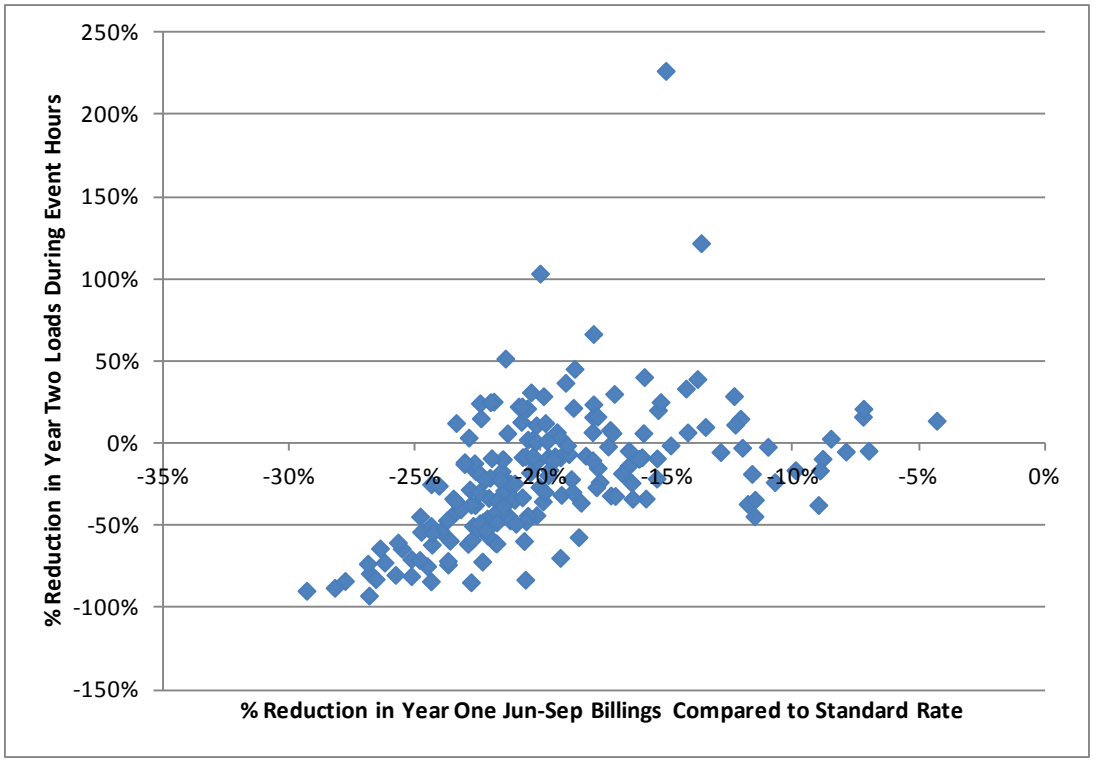
Impact Persistence

One issue of interest to MMLD was whether customers on the CPP rate in year one would exhibit any kind of fatigue in year two compared to customers that were in the control group and experiencing the CPP rate for the first time in year two. To assess this possibility the difference in kW load reductions between year one CPP and year one control customers for their year two load reductions were compared. The CPP group had a 2012 load reduction that averaged 0.31 kW and the control group average a 0.47 kW reduction, indicating a 0.16 kW greater load reduction for the group experiencing the CPP rate for the first time. A 90% confidence interval on the 0.16 kW difference in impacts provides a range of 0.01 kW to 0.32 kW. Therefore, a statistically significant difference between the two groups does exist. It is likely that the customers experiencing a second year of the CPP rate did not experience significant fatigue in responding to critical peak events, even though there is a statistical difference in the response rates for the two groups.

Comparison of Year 1 Bill Savings vs. Year 2 Performance

A final question of interest is whether or not those CPP customers that had the greatest bill reductions in year one would perform better in terms of load reductions in year 2. In year one, all CPP participants had summer 2011 bills that were lower than they would have been under the standard residential rate. A simple scatter plot of the % reduction in 2012 loads versus the % reduction in 2011 bills indicates that there is some relationship between the two variables, an indicator that customers that performed better than their peers in 2011 continued to perform better in2012.

FIGURE 13: % REDUCTION IN 2012 LOADS DURING EVENTS VS. % REDUCTION IN 2011 BILLING – YEAR ONE CPP CUSTOMERS ONLY



Approximately 47% of year-one CPP customers had bill savings greater than 20%, and 53% had savings of less than 20%. The load reductions in year two for these two groups were compared using a t-test. The group with larger bill savings averaged 0.75 kW reductions in 2012 while the group with lower bill savings averaged 0.12 kW during peak event hours. A t-test on the 0.63 kW difference between these two groups at 90% confidence demonstrates that there is a statistically significant difference between the two groups. A 90% confidence interval on the difference between the load reductions for each group ranges from 0.43 kW to 0.83 kW. [9] The hypothesis test further confirms that those customers that performed better in terms of bill savings in 2011 had a more significant load reduction on average in 2012. It makes sense that customers who adopted a more aggressive or better strategy for reducing loads in year one (and thereby achieving greater retail rate savings relative to the standard rate) would continue to reduce load at a better rate by employing the same strategies in year two.

Conclusions

The two year pilot study demonstrates that customers did indeed respond to critical peak prices in the summer of 2011 and 2012. In terms of eliciting load reductions through price signals, the pilot was a success. Load impacts may be quite significant under very hot weather conditions, such as a couple of the days in 2011. Even on milder summer days, evidence from the pilot suggests customers will reduce some proportion of their load, perhaps as little as 0.2 kW. With the difficulties associated with enabling technology, this pilot was unable to measure the impact such technology may have on improving load reductions.. Finally, there is evidence that customers on the CPP rate in both years exhibited year-to-year fatigue, performing in 2012 at a lower level as customers that were originally in the control group in 2011.

B. PROCESS EVALUATION

AMI Installations

The meter installations met several snags leading up to the pilot launch in summer 2011. Having reviewed the difficulties in installing the pilot participant's meters before the town-wide backhaul and meter infrastructure installation, the key finding from MMLD's perspective is that these problems arose because the schedule of the pilot dictated the meter installations. It would have been preferable if the CPP Pilot had been delayed for a year until the backhaul and meter network were more established. This would have allowed for a more cost and time-effective meter installation as well as given participants more time to become familiar with the online portal.

Enabling Technology Installations

Several lessons can be learned from the rollout of the enabling technologies. One is that an extended and thorough pre-test period for the equipment is imperative to smooth implementation of the technology. Pre-testing prior to summer 2012 was limited to several locations in part because the technology was delayed in arriving and in part because there was not a sense of urgency in getting the technology in the door and pretested due to an over-simplified belief that the products would work as advertised. A more robust pre-testing period would have built experience dealing with installations in a variety of settings – these experiences then could have been shared with installing contractors in a targeted manner as opposed to simply providing them the installation manuals. This pre-test period

[9] GDS performed the t-test excluding the outlier customer (>200% in year 2 loads). The t-test results were nearly identical, indicating that one outlier did not impact the results significantly. The 90% CI excluding that customer ranges from 0.42 kW to 0.82 kW, compared to an interval of 0.43 kW to 0.83 kW with the customer.

could also have helped identify some of the issues noted with the water heater switches – namely the lack of amp meters on some devices, poor installation instructions, and compatibility issues with different types of wiring. The leadership transition that occurred at MMLD between 2011 and 2012 was also a factor in regards to when the equipment was ordered and the extent that pretesting occurred.

Another lesson learned from the technology installations had to do with the manner in which contractors were engaged to conduct the installations. MMLD sought to limit their liability and spur local contractor work by providing the equipment to customers for free and having them use their preferred contractors for the installations. This approach was simple in concept because it was foreseen to free up MMLD's already taxed staff, put the onus on customers and their contractors, and then provide rebates to customers to offset the contractor cost. In reality, this approach led to several key issues as follows:

- Because this approach allowed the use of any qualified contractor, none received specialized training on the equipment being installed. The original belief was that the equipment was intuitive and no training was needed. However in a number of circumstances the contractors could not follow the directions and had to call MMLD for clarification. This increased the burden on MMLD as well as the contractor's time on site – and the subsequent cost of installation.
- At some residences, contractors would visit the home and determine the equipment was incompatible with their systems. Despite not completing the installation, the contractor typically charged the customer for the truck roll and the customer was left with uninstalled equipment and a bill from the contractor. Rebates were provided only for completed installations so the customer was left holding the bill. These occurrences were more common with the water heater switches than the thermostats. Some contractors were vocal with their complaints about the technology, however these issues were never reported to have directly led to customers leaving the program.

In hindsight, MMLD would have been better served to bid out the installation services to a single contractor or small group of contractors and provide training and support to that group. This approach would have resulted in higher cost to MMLD but it would likely have resulted in more efficient installations and better customer experience. Overall a more centralized and streamlined process with ample pre-testing would help to solve many of the problems faced by the enabling technology implementation.

Billing

Managing the integration between AMI and the billing system and working through issues related to the CPP rate was one of the most challenging aspects of initiating the pilot in 2011. The principle issue had to do with managing the integration between two outside vendors – the AMI vendor who provided monthly billing kWh for each billing component, and the billing system vendor who received and managed the billing data, and produced the monthly statements. MMLD was in the position of managing the handoff of this data, and quality checking any data manipulation that led to the final billing statements. This process would have been challenging had it been limited to just a new source of data (AMI vendor), however the simultaneous implementation of the pilot program and new billing components for certain subgroups of customers made the process more difficult. Ultimately, the billing integration was successful and any minor errors discovered along the way were corrected.

Interim billing – that is the bill customers received that included the start of the pilot – was another challenge from a billing perspective. MMLD did not adapt customer's billing cycle to align with the calendar months of the pilot. Rather, the interim bills were received on the normal billing cycle but included three components; kWh (prior to June 1), Non-CPP kWh, and CPP-kWh. Because all of the AMI

meters were not in place on May 31st, all meters had to be manually read on this date and fed into the billing system. This caused some issues with double charging, not charging at all, basic monthly charges and/or hydro credits. Each interim bill had to be individually reviewed for these issues with errors corrected before the bills could be issued. This issue added time and cost to the effort but is expected to be a one-time occurrence. Now that the AMI system is in place and functioning, interim billing for the next calendar year should be much simpler and will not require the manual reads.

Complexities with rounding and presentation of billing components (CPP kWh and Non-CPP kWh) were encountered when the first CPP events were declared in July 2011. Essentially, each component was rounded to the nearest whole number for billing purposes, but additional charges such as the Purchased Power Adjustment (PPA) were based on absolute register readings. Until a precise methodology for rounding and reporting was developed, there were some situations where the total register reading did not equal the sum of the parts. Quality checking and correcting each of the bills to avoid over or undercharging customers was very time consuming in August and resulted in many customers' August bills being held back and instead delivered as part of a two-month bill received in September, as issuing a late bill would have exacerbated the billing situation. Since MMLD offers online bill presentation and direct debit payment option to its customers, a bill issued two weeks late would have created a past due amount on the succeeding bill and automatically debited the customer account for both months. Additionally, a new due date would have been established as a result of the late issued bill, creating a double debiting of the customer account for the month of August. To avoid the double debit of customer accounts MMLD chose not to issue the August bill late and to instead allow the kWh usage to carry over into one September bill.

It is worth noting that the billing issues discussed above were addressed in 2011 and the process for billing customers on a CPP rate in 2012 went very smoothly with no additional findings to report.

Information Technology

MMLD's AMI vendor, NexGrid, handled most of the IT related aspects of the project which centered on the customer web portal. MMLD's role was primarily to quality check the data presented and assist in the resolution of any issues. Most issues noted were non-critical, and included improperly displayed rates during CPP periods, time stamps and detailed interval use data, inactive or incorrect links, and estimated bills. There were also some minor software debugging issues. Overall, the software has undergone much iteration to address these minor issues and has functioned very well with minimal required intervention from MMLD.

Critical Peak Event Dispatch

During the enrollment phase of the pilot, customers were asked to identify their preferred methods of communication (email, phone or both), and were prompted for the email addresses or phone numbers they would like to receive important messages on. Customers were allowed to select multiple emails and/or phone numbers. These contact lists were utilized for the distribution of critical peak event notifications on the day prior to an event. Overall, the process was very smooth from MMLD's perspective. During the first year of the pilot, 94% of customers who responded to the post pilot survey indicated they recalled being notified of pending critical event days. 86% of customers responded they were satisfied with the type and content of communication regarding critical peak events. During the second year of the study the number of people to be contacted doubled as the control group was brought on to the CPP rate. Respondents to the post-summer 2012 survey reported similarly high rates of being notified of peak periods and satisfaction with these notifications. While 96% of responders remembered being notified of the CPP event days and 94% were satisfied with the level of notification, 3% did not recall being notified and 1% thought the level of notification was excessive. These numbers indicate a very successful peak event dispatch routine. However; a much smaller proportion of

respondents in both years correctly remembered the number of CPP days that were called during the summer. For year one 41% of the respondents correctly reported three (3) event days being called while in 2012 only 22% of respondents correctly reported that five (5) event days had been called. However, given the long timeframe between the first CPP day and the time of the survey this is understandable, and the percentage of people who responded with a value ±1 from the true value is much higher (78% for 2011 and 62% for 2012).

C. ADDITIONAL RESULTS

Bill Impacts

MMLD conducted an analysis of all participants' bill impacts at the conclusion of both of the three month pilot periods. It was determined that every customer on the CPP rate saved money over the summer compared to what they would have paid on their prior fixed rate, thus no bill credits were issued. Although there were noticeable reductions in energy usage during the higher-priced CPP periods within the treatment group, these bill impact findings are attributable in large part to the fact that the rate was designed to be revenue-neutral assuming twelve (12) CPP events. During summer 2011, MMLD only issued three (3) events.

The second year of the pilot had a similar impact on participant's monthly bills. From the bill protection analysis it was determined that every new CPP customer saved money compared to a normal rate. On average they saved a little under 20% over the course of the summer due to the rate change. Once again, there were noticeable reductions in the energy use during the CPP periods. However, for the second year the number of CPP events (5) was far below the predicted revenue-neutral number of 12 CPP events. This was a driving factor behind the savings received by customers.

Post-Pilot Survey Results

Post-pilot survey instruments were administered after the completion of the first and second year of the program. MMLD developed two separate survey instruments for the first year; one for the Year 1 Treatment group and one for the Control group. In the second year all participants received the same survey which was an updated version of the year one treatment group survey. The Treatment survey was designed to assess customer satisfaction with the CPP rate treatment, usage of the web portal, identify which customers had central air and/or electric water heaters, and gauge the level of interest in having enabling technologies provided in Year 2. The Control group survey was a stripped down version of the Year 1 Treatment survey. The Year 2 post-pilot survey maintained the questions regarding the web portal, satisfaction with the CPP rate, and energy saving techniques but also investigated the use of the new enabling technologies. Both years' surveys were administered via mail alongside a letter form MMLD which thanked customers for their participation in the program.

Response Rate and Reaction to the Program

Overall response rates to the post-pilot surveys were good in both years. The year one post-pilot survey had an overall response rate just over 50% with a control group response rate of 45% and treatment group response rate of 60%. The year two post-pilot survey had an overall response rate of 48%. The decline in the overall response rate from year one to year two was due to a decrease in response from those who entered their second year with the CPP rate. This could indicate that engagement in the program decreased as the novelty of the pricing scheme decreased.

Despite the negative trend in the response rate to the post pilot survey, the overall experience reported by survey respondents did not change significantly from year one to year two. In year one 86% of the treatment group customers reported a positive experience while in year two the combined groups responded with 85% having an overall positive experience. The number of people who reported a *very*

positive experience jumped from 57% to 68% as the total number of people on the CPP rate doubled and bill protection dropped for the year one CPP group.

CPP Events and Electric Bills

Overall the vast majority of respondents on the CPP rate in both years remembered being notified of CPP events and took actions to reduce their electricity use. In year two 84% of respondents reported enacting some sort of recommended measures to help save money during Critical Peak Events. About 41% of respondents reported using multiple methods to reduce energy use while 15% of respondents reported using three or more. The most commonly used load reduction actions were setting back a thermostat (43%) and turning off unneeded appliances (51%). Other actions included avoiding hot water use or going outside or away from the house during portions of the CPP.

As discussed earlier with regard to communicating the CPP events the majority of people remember being contacted and were satisfied with the level of communication. It is worth mentioning again how only a minority of people accurately recalled the number of CPP events for either summer, though a majority of respondents were within one day of the correct number. Over a dozen people responded with a question markin the 2012 survey response indicating that many forgot the number of event days by the time the survey was conducted in October. Of those who thought that there was inadequate notification for the CPP events the suggested improvements were to use multiple forms of communication (for example email and a phone call, which was actually offered), to issue multiple reminders, or the most common suggestion which was to allow for multiple points of contact per household (ie both spouses).

In year two 49% of respondents to the survey believed that their electric bill dropped from 2011 to 2012. This is compared to only 3.4% who believed it was higher while the remaining 47% either thought there was no change, did not know the change, or did not respond to the question. These numbers are mirrored well by the percentage of respondents who believed they saved energy relative to prior summers with 39% agreeing they decreased their energy use and only 9.4% saying they consumed more. However, when asked about the causes behind the perceived changes in expenditures for and consumption of electricity, respondents were almost equally as likely to credit a decrease in summer temperatures (28%) or other factors such as increased vacation time or decreased occupancy (33%) as active energy reduction (38%) due to the pilot. Since nearly 84% of people reported enacting at least one energy conservation measure, it seems that there is some doubt in the minds of the public that these actions had any appreciable effects on their consumption. In any case, it seemed that the program benefited from the lack of a particularly hot summer which kept the number of CPP events, and therefore pilot participant's bills, lower and most likely had a positive impact on the high approval ratings for the program.

Online Portal and Technology Usage

Respondents to the surveys showed a much less enthusiastic attitude toward the technology offered by the pilot than to the pilot in general. In the first year the only technology offered was the smart meter and the ability to view their consumption in real-time via the web portal. During the first year only 39% of the treatment group respondents reported using the web portal while only 17% of the control group accessed the web portal even once. In the second year, with the entire pilot on the CPP rate, the number of respondents who reported accessing the portal was 32%. Of those who reported using the online portal, more than 40% reported only using it once, and this holds true across both years. Respondent-supplied reasons for this lack of utilization were most commonly lack of time/motivation (16 instances), forgetting about the existence of the portal (11), or not being aware of the portal from the beginning (7). Those who used the portal were most likely to regard it as "somewhat helpful" (60%)

while fewer found the portal "very helpful" (30%) or "not helpful at all" (9%). When questioned on methods to improve the web portal to increase its usefulness common comments included:

- Change layout/ More user friendly (11 Instances)
- Make the portal easier to access (8 instances)
- Make the portal available on mobile devices/tablets (4 instances)
- Add additional information and/or match information to bills (6 instances)

Despite the low utilization of and high criticism for the online portal there still existed a large amount of enthusiasm for the option (at least in theory) with more than three quarters of respondents to the question claiming they plan to continue (or start) the use of the online portal after the end of the pilot. This includes over 70% of those who have already used the portal and a surprising 54% of those who never used it during the pilot (note, this percentage is limited to those who responded to both questions). Part of the discrepency between this apparent enthusiasm for the online portal and actual utilization could simply be response bias where participants responded with the answer they believed MMLD wanted.

In addition to the basic metering technology, pilot customers were offered the use of two enabling technologies; a Wi-Fi-enabled thermostat and a Wi-Fi-enabled hot water switch. As discussed earlier, managerial changes as well as administrative and technical difficulties limited the roll-out of these technologies to just a handful of pilot customers. That being said, those that did have the technology generally found it helpful

It is worth noting that several participants attached hand-written letters to their survey responses at the end of the second year of the pilot. While their sentiments ranged from apologetic to apathetic the most commonly repeated feeling was appreciation for the programs goals and encouragement for MMLD to continue such efforts in the future.

VI. CONCLUSIONS

The two year pilot study demonstrated considerable opportunity for sustained peak load reduction through the implementation of critical peak pricing among a residential population. The pilot also gave MMLD the practical experience and confidence to implement this type of program in future years. From a process standpoint, following are the key conclusions from the two year pilot:

- The rush to initiate the pilot in summer of 2011 caused significant stress and meant that the pilot dictated the initial deployment of the AMI system, rather than the AMI system being installed first per the design and then proceeding with the pilot. In hindsight, it would have been more preferable to wait until 2012 to initiate the pilot. This would have also allowed MMLD to collect nearly a year's worth of pre-treatment interval data on the study participants.

- Deployment of the enabling technologies suffered from a lack of pre-testing and challenges of using a market based installation approach. Any future use of enabling technologies should include a more thorough pre-testing period and should involve a heavier focus on training a smaller subset of qualified technicians.

- The CPP rate was designed to be revenue neutral based on an anticipated twelve (12) event days per summer. Only three (3) event days were declared in 2011 and five (5) in 2012, meaning that even customers who made little effort to shift or reduce load during peak periods would have realized bill savings during the pilot. Any future deployment of dynamic rates should include reconsideration of the number of target event days – possibly six or eight.

With respect to the questions of interest, several of the study hypotheses centered around bill savings and the adoption of enabling technologies. The limited number of event days resulted in all participants saving money on the rate which hampered the ability to assess those hypotheses however it was noted that as would be expected, the participants who achieved the highest levels of load reduction were also those who achieved the greatest bill savings. Similarly, unanticipated issues with the deployment of enabling technology limited our ability to draw definitive conclusions on the impact of those technologies. However several key conclusions can still be drawn relative to the original questions or interest:

- Participants on the CPP rate achieved significant reductions in peak demand compared with peers who were not on the CPP rate, and even compared with CPP participants on non-event days.

- In year one, the average kW reduction from CPP customers during the three event days from noon to 6:00 PM was 0.74 kW, a reduction of 36.7%. In year two, the average kW reduction from CPP customers during the five event days from noon to 6:00 PM was 0.37 kW, a reduction of 21.3%. The lower impact in year 2 appears to be a partial function of weather conditions (year two was a more mild summer).

- A question of interest was how the year one CPP group would fare in the second year compared with the year one control group who was placed on the CPP rate for the first time in 2012. In 2012, the [year 1] CPP group had a 2012 load reduction that averaged 0.31 kW and the [year one] control group average a 0.47 kW reduction, indicating a 0.16 kW greater load reduction for the group experiencing the CPP rate for the first time. A 90% confidence interval on the 0.16 kW difference in impacts provided a range of 0.01 kW to 0.32 kW.

- No significant correlation was found between bill savings in year one and customers who elected to opt out in 2012. However, questions remain as to the full impact of utlity bill changes on program participation (such as bill increases) as every CPP customer saved money in the first year of the pilot.

- Regarding the adoption of enabling technology in year two, both of the original hypotheses proved incorrect. First, it was hypothesized that the year one CPP group – being acclimated to the nature of the rate and actions needed to reduce load during peak periods – would be more inclined to accept the technology in year two. In reality, the year one control group accepted year two technology at a higher rate than the year one CPP group. Second, it was hypothesized that a very high percentage (>75%) of year one treatment group members would accept the technology. In reality, the adoption rate was closer to 20%.

APPENDICES

Appendix A – Survey Instruments

Appendix B – Rate Tariffs

Appendix C – Technology

Appendix D – Educational Material

Appendix E – Marketing Material

Appendix F – Supplemental Analysis Methodology and Results

Appendix G – Supplemental Data Description

APPENDIX A

SURVEY IMPLEMENTS

ORDER:

DEMOGRAPHIC SURVEY

POST 2011 PILOT CPP GROUP SURVEY

POST 2011 PILOT CONTROL GROUP SURVEY

POST PILOT 2012 SURVEY

This is a quick and easy survey requested by the Department of Energy as part of a Smart Grid Investment Grant received by Marblehead Municipal Light Department. Your answers are protected and will be anonymous

Use a blue or black pen

START HERE

Q1. Do you own or rent your home?

Mark [X] ONE box

- [ ] Own
- [ ] Rent

Q2. What type of residence do you live in? Do you live in a…

Mark [X] ONE box

- [ ] Single-family
- [ ] Duplex or two-family
- [ ] Apartment/condo in a 2-4 unit building
- [ ] Apartment/condo in a >4 unit building
- [ ] Townhouse or row house (adjacent walls to another house)
- [ ] Mobile home, house trailer

Q3. Does your home have central air conditioning?

Mark [X] ONE box

- [ ] Yes
- [ ] No

Q4. Do you have any room air conditioners?

Mark [X] ONE box

- [ ] Yes
- [ ] No (GO TO Q6)

Q5. How many room air conditioners do you have?

[ ][ ]

Q6. Do you have a programmable thermostat?

Mark [X] ONE box

- [ ] Yes
- [ ] No (GO TO Q8)

Q7. Is the programmable thermostat currently set to automatically change temperatures during the day when no one is home?

Mark [X] ONE box

- [ ] Yes
- [ ] No

Q8. Do you have an electric clothes dryer?

Mark [X] ONE box

- [ ] Yes
- [ ] No

Q9. Including yourself, how many adults, 18 or older, currently live in your household?

[ ][ ]

Q10. And how many of these adults are over 65?

[ ][ ]

Q11. How many children under the age of 18 live in your household at least part of the week?

[ ][ ]

Q12. Do you or does anyone in your household have a chronic illness or disability that requires regular or occasional in-home medical treatment?

Mark [X] ONE box

- [ ] Yes
- [ ] No

Q13. Is there someone home Monday to Friday sometime between 1 PM and 5 PM at least one day a week?

Mark [X] ONE box

- [ ] Yes
- [ ] No

TURN OVER AND CONTINUE →

Q14. Is there anyone in your household working full time for pay?

Mark [X] ONE box

- [ ] Yes
- [ ] No (GO TO Q16)

Q15. Do you or anyone in your household have a job where you work at home at least one weekday a week rather than go into an office or some other location?

Mark [X] ONE box

- [ ] Yes
- [ ] No

Q16. What is the primary language spoken in your home?

Mark [X] ONE box

- [ ] English
- [ ] Spanish
- [ ] Chinese
- [ ] Korean
- [ ] Vietnamese
- [ ] Russian
- [ ] Other

Q17. Last year -- that is, in 2011 -- what was your total household income from all sources, before taxes?

Mark [X] ONE box

- [ ] Less than $10,000
- [ ] $10,000 to less than $20,000
- [ ] $20,000 to less than $30,000
- [ ] $30,000 to less than $40,000
- [ ] $40,000 to less than $75,000
- [ ] $75,000 to less than $90,000
- [ ] $90,000 to less than $100,000
- [ ] $100,000 to less than $150,000
- [ ] $150,000 or more

Q18. What is the LAST grade or class that you COMPLETED in school?

Mark [X] ONE box

- [ ] None, or grade 1-8
- [ ] High School incomplete (grade 9-11)
- [ ] High School graduate (grade 12 or GED certificate)
- [ ] Technical, trade or vocational school AFTER high school
- [ ] Some college, no four-year degree (includes associate degree)
- [ ] College graduate (B.S., B.A., or other four-year degree)
- [ ] Post-graduate or professional schooling after college (e.g., towards a Master's degree or Ph.D; law or medical school)

This is a quick and easy survey requested by the Department of Energy as part of a Smart Grid Investment Grant received by Marblehead Municipal Light Department. Your answers are protected and will be anonymous

Use a blue or black pen

START HERE

MA1. How would you rate your overall experience with the first year of the Marble *EnergySense* Pilot Program?

Mark [X] ONE box

- ☐ Very Positive
- ☐ Somewhat Positive
- ☐ Neutral
- ☐ Somewhat Negative
- ☐ Very Negative

MA2. Do you remember personally receiving any information from Marblehead Light that told you how you could save money on your current electric bill by changing what activity you do in your home or when you do the activity?

Mark [X] ONE box

- ☐ Yes
- ☐ No (GO TO MA 5)
- ☐ Don't Know (GO TO MA5)

MA3. Did you think the information was useful?

Mark [X] ONE box

- ☐ Yes
- ☐ No
- ☐ Don't Know

MA4. Did you do anything that was suggested by this utility information to help you save money?

Mark [X] ONE box

- ☐ Yes
- ☐ No
- ☐ Don't Know

MA5. What actions did you take to help save money during Critical Peak Events? Please list all you can remember. If none, write "none". _____

_____

_____

_____

_____

MA6. Do you recall being notified of Critical Peak Events the day before they occurred?

Mark [X] ONE box

- ☐ Yes
- ☐ No
- ☐ Don't Know

MA7. Were you satisfied with the type and content of communication you received that notified you about Critical Peak Days?

Mark [X] ONE box

- ☐ Yes, the type and frequency of communication kept me informed
- ☐ No, I was not made aware of CPP days as they were occurring
- ☐ No, the level of communication was excessive.
- ☐ Other_____

_____

MA8. How many Critical Peak Days do you recall being declared? ☐☐

MA9. How do you feel your electrical <u>bill</u> for this summer compared with past years?

- ☐ A lot lower than past summers
- ☐ Slightly lower than past summers
- ☐ About the same as past summers
- ☐ Slightly higher than past summers
- ☐ A lot higher than past summers (GO TO MA11)
- ☐ Don't Know (GO TO MA11)

MA10. How do you feel your electrical <u>usage</u> for this summer compared with past years?

- ☐ A lot lower than past summers
- ☐ Slightly lower than past summers
- ☐ About the same as past summers
- ☐ Slightly higher than past summers
- ☐ A lot higher than past summers (GO TO MA11)
- ☐ Don't Know (GO TO MA11)

TURN OVER AND CONTINUE →

MA11. Please list any reasons as to why you feel your electrical usage for this summer was more or less than past summers? (e.g. Summer 2011 was warmer/cooler, actively reduced usage in response to *EnergySense* Pilot, increase/decrease in size of household, etc.)

_____
_____
_____
_____

As part of the pilot program you were given access to a web portal which allows you to monitor your energy usage. The web portal is accessed through the Marblehead Light Department website (www.marbleheadelectric.com) and clicking on the "view my meter" link. The following questions pertain to this web portal:

MA12. Did you ever access the web portal during the course of the pilot? If you mark "No" please explain why you never accessed it, and then skip to the next section

Mark [X] ONE box
- ☐ Yes
- ☐ No_____
  _____

MA13. How frequently did you access the web portal?

Mark [X] ONE box
- ☐ Only accessed it once
- ☐ At least once per month
- ☐ More than twice per month
- ☐ Don't Know

MA14. Do you feel that the web portal's interface was well laid out and easy to navigate?

Mark [X] ONE box
- ☐ Yes
- ☐ No
- ☐ Somewhat

MA15. Did you feel that the information provided on the web portal was helpful?

Mark [X] ONE box
- ☐ Very Helpful
- ☐ Somewhat Helpful
- ☐ Not at all Helpful

MA16. Please list any suggestions as to how the web portal could be more useful or engaging to you and your household?_____
_____
_____
_____

The *EnergySense* Pilot will continue next summer and for some customers with central air and/or electric water heaters it may include technologies to help conserve energy during critical peak periods. The following questions pertain to these technologies. Your responses below are solely for Marblehead Municipal Light to understand compatibility with and interest in these technologies and they DO NOT represent any formal commitment to provide these technologies.

MA17. Does your home have either an electric water heater, central air conditioning, or both?

Mark [X] ONE box
- ☐ Central Air only
- ☐ Electric Water Heater only
- ☐ Both, Electric Water Heater and Central Air
- ☐ Neither

If you marked "Neither" for MA17, you may skip the remaining questions

MA18. Did your household previously participate in Marblehead Light's Water Heater Control Program?

Mark [X] ONE box
- ☐ Yes
- ☐ No
- ☐ Don't Know

MA19. How interested would you be in receiving equipment next summer that would help you conserve energy during Critical Peak Event Days?

Mark [X] ONE box
- ☐ Very Interested
- ☐ Somewhat Interested
- ☐ Not at all Interested

MA20. Would you be more or less interested in receiving the technology if it were automatically controlled by Marblehead Light on Critical Peak Event Days?

Mark [X] ONE box
- ☐ More Interested
- ☐ Neutral
- ☐ Less Interested

MA21. Would you be more or less interested in receiving the technology if it were configured to respond automatically to the price of energy, and YOU had the ability to determine how you want the equipment to respond?

Mark [X] ONE box
- ☐ More Interested
- ☐ Neutral
- ☐ Less Interested

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Use a blue or black pen

START HERE

MA1. How do you feel your electrical bill for this summer compared with past years?

- ☐ A lot lower than past summers
- ☐ Slightly lower than past summers
- ☐ About the same as past summers
- ☐ Slightly higher than past summers
- ☐ A lot higher than past summers (GO TO MA11)
- ☐ Don't Know (GO TO MA11)

MA2. How do you feel your electrical usage for this summer compared with past years?

- ☐ A lot lower than past summers
- ☐ Slightly lower than past summers
- ☐ About the same as past summers
- ☐ Slightly higher than past summers
- ☐ A lot higher than past summers (GO TO MA11)
- ☐ Don't Know (GO TO MA11)

MA3. Please list any reasons as to why you feel your electrical usage for this summer was more or less than past summers? (e.g. Summer 2011 was warmer/cooler, change in size of household, extended vacations, etc.)_____

_____

_____

_____

As part of the pilot program you were given access to a web portal which allows you to monitor your energy usage. The web portal is accessed through the Marblehead Light Department website (www.marbleheadelectric.com) and clicking on the "view my meter" link. The following questions pertain to this web portal:

MA4. Did you ever access the web portal during the course of the pilot? If you mark "No" please explain why you never accessed it, and then turn survey over to next section.

Mark [X] ONE box

- ☐ Yes
- ☐ No_____

_____

MA5. How frequently did you access the web portal?

Mark [X] ONE box

- ☐ Only accessed it once
- ☐ At least once per month
- ☐ More than twice per month
- ☐ Don't Know

MA6. Do you feel that the web portal's interface was well laid out and easy to navigate?

Mark [X] ONE box

- ☐ Yes
- ☐ No
- ☐ Somewhat

MA7. Did you feel that the information provided on the web portal was helpful?

Mark [X] ONE box

- ☐ Very Helpful
- ☐ Somewhat Helpful
- ☐ Not at all Helpful

MA8. Please list any suggestions as to how the web portal could be more useful or engaging to you and your household?

_____

_____

_____

_____

_____

TURN OVER AND CONTINUE →

The *EnergySense* Pilot will continue next summer and for some customers with central air and/or electric water heaters it may include technologies to help conserve energy during critical peak periods. The following questions pertain to these technologies. Your responses below are solely for Marblehead Municipal Light to understand compatibility with and interest in these technologies and they DO NOT represent any formal commitment to provide these technologies.

MA9. Does your home have either an electric water heater, central air conditioning, or both?

Mark [X] ONE box

- ☐ Central Air only
- ☐ Electric Water Heater only
- ☐ Both, Electric Water Heater and Central Air
- ☐ Neither

If you marked "Neither" for MA9, you may skip the remaining questions

MA10. Did your household previously participate in Marblehead Light's Water Heater Control Program?

Mark [X] ONE box

- ☐ Yes
- ☐ No
- ☐ Don't Know

MA11. How interested would you be in receiving equipment next summer that would help you conserve energy during Critical Peak Event Days?

Mark [X] ONE box

- ☐ Very Interested
- ☐ Somewhat Interested
- ☐ Not at all Interested

MA12. Would you be more or less interested in receiving the technology if it were automatically controlled by Marblehead Light on Critical Peak Event Days?

Mark [X] ONE box

- ☐ More Interested
- ☐ Neutral
- ☐ Less Interested

MA13. Would you be more or less interested in receiving the technology if it were configured to respond automatically to the price of energy, and YOU had the ability to determine how you want the equipment to respond?

Mark [X] ONE box

- ☐ More Interested
- ☐ Neutral
- ☐ Less Interested

This is a quick and easy survey requested by the Department of Energy as part of a Smart Grid Investment Grant received by Marblehead Municipal Light Department. Your answers are protected and will be anonymous

Use a blue or black pen

START HERE

MA1. How would you rate your overall experience with the Marblehead *EnergySense* Pilot Program?

Mark [X] ONE box

- ☐ Very Positive
- ☐ Somewhat Positive
- ☐ Neutral
- ☐ Somewhat Negative
- ☐ Very Negative

MA2. Based on your experience with the *EnergySense* Pilot Program, would you take part in future energy saving programs created by MMLD?

- ☐ Yes
- ☐ No
- ☐ Maybe

MA3. Would you recommend others to take part in a program similar to the *EnergySense* Pilot?

- ☐ Yes
- ☐ No
- ☐ Maybe

If no, why not?_____

_____

MA4. What actions did you take to help save money during Critical Peak Events this summer? Please list all you can remember. If none, write "none".

_____

_____

_____

_____

MA5. Do you recall being notified of Critical Peak Events the day before they occurred?

Mark [X] ONE box

- ☐ Yes
- ☐ No
- ☐ Don't Know

MA6. Were you satisfied with the type and content of communication you received that notified you about Critical Peak Days?

Mark [X] ONE box

- ☐ Yes, the type and frequency of communication kept me informed
- ☐ No, I was not made aware of CPP days as they were occurring
- ☐ No, the level of communication was excessive.
- ☐ Other_____

_____

MA7. How many Critical Peak Days do you recall being declared this past summer?

☐☐

MA8. How do you feel your electric <u>bill</u> for this summer compared with Summer 2011?

- ☐ A lot lower than past summers
- ☐ Slightly lower than past summers
- ☐ About the same as past summers
- ☐ Slightly higher than past summers
- ☐ A lot higher than past summers
- ☐ Don't Know

MA9. How do you feel your electrical <u>usage</u> for this summer compared with Summer 2011?

- ☐ A lot lower than past summers
- ☐ Slightly lower than past summers
- ☐ About the same as past summers
- ☐ Slightly higher than past summers
- ☐ A lot higher than past summers
- ☐ Don't Know

TURN OVER AND CONTINUE ⟶

MA10. Please list any reasons as to why you feel your electrical usage for this summer was more or less than past summers? (e.g. Summer 2012 was warmer/cooler, actively reduced usage in response to *EnergySense* Pilot, increase/decrease in size of household, etc.)

_____

_____

_____

_____

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MA11. Did you ever access the web portal during the course of the pilot? If you mark "No" please explain why you never accessed it, and then skip to the next section.

Mark [X] ONE box

- ☐ Yes
- ☐ No_____

_____

MA12. How frequently did you access the web portal this past summer?

Mark [X] ONE box

- ☐ Only accessed it once
- ☐ At least once per month
- ☐ More than twice per month
- ☐ Don't Know

MA13. Do you feel that the web portal's interface was well laid out and easy to navigate?

Mark [X] ONE box

- ☐ Yes
- ☐ No
- ☐ Somewhat

MA14. Did you feel that the information provided on the web portal was helpful?

Mark [X] ONE box

- ☐ Very Helpful
- ☐ Somewhat Helpful
- ☐ Not at all Helpful

MA15. Please list any suggestions as to how the web portal could be more useful or engaging to you and your household?_____

_____

_____

MA16. Will you continue to use the web portal even though the pilot program has come to an end?

- ☐ Yes
- ☐ No

As part of the *EnergySense* Pilot some customers were given thermostats and/or water heater controls to reduce electricity consumption. The following questions pertain to these technologies. If you did not receive either of these technologies, please check "none" on question 17 and skip the remaining questions

MA17. Which load reduction technology did you have installed for the pilot?

- ☐ **Programmable thermostat (go to MA18)**
- ☐ **Hot water switch (go to MA21)**
- ☐ **Both (complete all questions)**
- ☐ **None (Skip to the end)**

MA18. Did you or your installer manually program your thermostat?

- ☐ Yes
- ☐ No
- ☐ Don't Know

MA19. Did you ever control your thermostat remotely during any event period using the online portal?

- ☐ Yes
- ☐ No

MA20. Was the thermostat easy to operate?

- ☐ Yes
- ☐ No

MA21. Did you ever control your hot water switch remotely during any event period using the online portal?

- ☐ Yes
- ☐ No

MA22. What impact did the technology (thermostat or water heater switch) have on your ability to respond to critical peak events:

- ☐ No or negligible impact
- ☐ Modest impact
- ☐ Significant impact
- ☐ Other. Please explain_____

THANK YOU FOR COMPLETING THIS SURVEY AND FOR YOUR PARTICIPATION IN MARBLEHEAD'S *ENERGYSENSE* PILOT PROGRAM!

APPENDIX B

RATE TARIFFS

MARBLEHEAD MUNICIPAL LIGHT DEPARTMENT

Issued:	April 22, 2011		MDPU - 76
Effective:	June 01, 2011	Cancels	New

Rate CPP

Available for lighting, space heating, water heating and all other domestic uses in a single private dwelling or individual apartment. The Critical Peak Period will only occur between the hours of 12pm and 6pm on twelve non-holiday weekdays during the months of June, July, and August.

Monthly Charge	Winter Sep – May	Summer Jun - Aug
Basic Monthly Charge	$ 4.25 per Month	$ 4.25 per Month
Non CPP kilowatt-hours	$ 0.1425 per kilowatt-hour	$ 0.09 per kilowatt-hour
CPP kilowatt-hours	N/A	$ 1.05 per kilowatt-hour

Terms and Conditions

The Department's terms and conditions in effect from time to time where not inconsistent with any specific provision of this tariff are part of this tariff.

All kilowatt-hour usage under this tariff is subject to the Purchase Power Adjustment Clause, MDPU - 74

All Terms and Conditions of this tariff are subject to applicable law

Marblehead Municipal Light Department
80 Commercial Street
P.O. Box 369
Marblehead, Massachusetts 01945

By:_____
Robert V. Jolly, General Manager

APPENDIX C

TECHNOLOGY DESCRIPTION

APPENDIX D

EDUCATION MATERIALS

ORDER:

YEAR 1 ENROLLMENT INFO (CPP & CONTROL)

YEAR 2 ENROLLMENT INFO AND TECHNOLOGY OFFER (CPP & CONTROL)

MID SUMMER 2012 MAILING

PROGRAMMABLE THERMOSTAT USERS GUIDE

BUSINESS (781) 631-5600 PLANT (781) 631-0240

MARBLEHEAD MUNICIPAL LIGHT DEPARTMENT

80 COMMERCIAL STREET • P.O. BOX 369

MARBLEHEAD, MASSACHUSETTS 01945

ROBERT V. JOLLY, JR.

GENERAL MANAGER

May 3, 2011

Dear Customer,

Thank you again for volunteering to participate in the Marblehead Municipal Light Department's (MMLD) ***EnergySense*** Pilot program. My name is Robert V. Jolly Jr. and on behalf of the MMLD, I would like to officially welcome you to the program. As a participant in our pilot program, you have been randomly selected to receive the reduced electric rate during the summer of 2012. You will be among the first households in town to receive a new "smart" electric meter and access to a dynamic web portal that will allow you to chart your energy consumption online.

This packet includes important information regarding the details of the ***EnergySense*** Pilot program and steps you need to take to confirm your enrollment. We encourage you to review the enclosed materials closely and let us know if you have any questions or concerns. Below is a list of materials included in this enrollment packet:

- ✓ **Pilot Details** – A program overview that includes pilot design, duration and rate details
- ✓ **Pre-Pilot Survey** – This brief, two page survey is important to understand the characteristics of customers participating in this program so we can evaluate and report results back to the U.S. Department of Energy.
- ✓ **Ways you Can Save** – Tips and tactics for limiting energy consumption during critical peak periods so you can take full advantage of the discounted rates during all other hours.

To confirm your enrollment in this program, please take a moment to complete the brief survey included in this packet. Completion of the survey is critically important for us to evaluate the success of the pilot so we ask that you please return the completed survey to us in the pre-paid envelope we have included with this packet. Once you complete and return the survey, we will proceed with scheduling the installation of a smart meter at your home.

Again, welcome to the program and thank you for volunteering to participate in this exciting and cutting edge smart grid initiative. Please do not hesitate to contact us with any questions you may have.

Sincerely,

Robert V. Jolly, Jr.
General Manager

EnergySense Pilot Program Details

Marblehead Municipal Light Department in conjunction with GDS Associates, Inc. and the Department of Energy's Technical Advisory Group has developed the ***EnergySense*** Pilot Program. The goals of the program are to gauge the level of community interest in a Critical Peak pricing program, evaluate demand and energy consumption impacts of a Critical Peak Price program for future planning purposes and to assess the impact of giving consumers access to web based tools that allow them to monitor their personal consumption. The results of this pilot initiative will help inform decisions regarding the smart grid and incentive based pricing programs going forward.

Pilot Design:
The pilot will span for 15 months starting June 1st 2011 and ending August 31st, 2012. Customers who have volunteered to participate are randomly assigned to one of two groups; those who will receive the reduced electric rate during the summer of 2011 and those who will receive the reduced rate in summer of 2012. All participants will be among the first in town to receive a new smart meter.

Rate Details:
Your group has been randomly selected to receive the reduced electric rate during the summer of 2012. For this upcoming summer, you will remain on your current fixed electric rate of approximately 14¢ per kilowatt-hour.

Meter Change:
All participants in the ***EnergySense*** Pilot Program will receive a new smart meter at their home that is capable of transmitting energy use data in near real to you (through the web portal) and to MMLD. The meter change out will cause a momentary disruption in power but the new meter will otherwise function no differently from your current meter. The change will be made during May prior to the start of the pilot in June.

Web Portal:
Participants in both rate groups will have access to a dynamic web portal that will enable them to chart their personal energy consumption online. To gain access to your personal web portal, please visit us at www.marbleheadelectric.com and click on the "View Meter" tab at the top of the page then follow the on-screen instructions.

For questions regarding the details of the EnergySense Pilot Program, Please call

Customer Service at ***(781) 631-5600***

Energy Saving Tips for Your Household

Refrigerators (15%) and other appliances (11%) can account for 26% of the energy consumed in your home (other appliances include dishwashers, clothes washers, dryers, etc.).

- Air dry dishes instead of dishwasher drying cycle
- Wash only full loads of dishes
- Run clothes washer using cold water to conserve hot water
- Dry heavier loads separately from lighter materials, routinely empty lint filter, check exhaust connection for lint
- Don't keep your refrigerator or freezer too cold
- Recommended temperatures are 37° to 40°F for the fresh food compartment of the refrigerator and 5°F for the freezer section
- Unplug second refrigerators or freezers if they are not necessary

Water heating can account for 15% of the energy consumed in your home.

- Install aerators on faucets and low-flow showerheads to reduce hot water usage
- Reduce set point temperature on your water heater to 120° F
- Install a timer to turn off your water heater when less water heat is used, or when cost is highest, such as during the day.
- Take short showers instead of baths

Home electronics can account for 11% of the energy consumed in your home.

- Turn off your computer and monitor when not in use
- Plug home electronics, such as TVs and DVD players, into power strips and turn the power strips off when the equipment is not in use to eliminate "phantom" loads

Air Conditioning can account for 10% of the energy consumed in your home.

- Turn up your cooling set-point to save on energy — try 78° F
- Shut off your air conditioner and try using a fan or opening the windows at night
- Close shades in the summer — your house will block out more radiant heat from the sun in the summer months if the curtains are closed

Lighting can account for 6% of the energy consumed in your home.

- Turn off lights when a room is not being used
- Replace incandescent light bulbs with ENERGY STAR CFLs (up to 75% savings)
- Replace outdoor lighting with ENERGY STAR CFLs, LEDs, or solar powered fixtures

For a complete list of ideas, visit www.EnergyStar.gov and select the link "Save Energy at Home"

BUSINESS (781) 631-5600 PLANT (781) 631-0240

MARBLEHEAD MUNICIPAL LIGHT DEPARTMENT

80 COMMERCIAL STREET • P.O. BOX 369

MARBLEHEAD, MASSACHUSETTS 01945

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GENERAL MANAGER

May 3, 2011

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- ✓ **Pilot Details** – A program overview that includes pilot design, duration and rate details
- ✓ **Pre-Pilot Survey** – This brief, two page survey is important to understand the characteristics of customers participating in this program so we can evaluate and report results back to the U.S. Department of Energy.
- ✓ **Ways you Can Save** – Tips and tactics for limiting energy consumption during critical peak periods so you can take full advantage of the discounted rates during all other hours.

To confirm your enrollment in this program, please take a moment to complete the brief survey included in this packet. Completion of the survey is critically important for us to evaluate the success of the pilot so we ask that you please return the completed survey to us in the pre-paid envelope we have included with this packet. Once you complete and return the survey, we will proceed with scheduling the installation of a smart meter at your home.

Again, welcome to the program and thank you for volunteering to participate in this exciting and cutting edge smart grid initiative. Please do not hesitate to contact us with any questions you may have.

Sincerely,

Robert V. Jolly, Jr.
General Manager

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Rate Details:
Your group has been randomly selected to receive the reduced electric rate during the summer of 2011. This upcoming summer, your electric rate will drop from 14¢ down to 9¢ per kilowatt-hour for all non-critical peak pricing hours (roughly 97% of the time!). There will be up to 12 critical peak pricing periods during the summer, occurring only on non-holiday weekdays from 12:00pm to 6:00 pm. All other hours on weekdays and all hours during weekends and holidays are considered Non-CPP hours. Customers will be notified by 5pm the day before a Critical Peak Event so that they may take steps to reduce personal consumption and save money during these periods. During critical peak periods, the cost of electricity will increase sharply to $1.05 per kilowatt hour.

Meter Change:
All participants in the ***EnergySense*** Pilot Program will receive a new smart meter at their home that is capable of transmitting energy use data in near real to you (through the web portal) and to MMLD. The meter change out will cause a momentary disruption in power but the new meter will otherwise function no differently from your current meter. The change will be made during May prior to the start of the pilot in June.

Web Portal:
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For questions regarding the details of the EnergySense Pilot Program, Please call

Customer Service at ***(781) 631-5600***

Energy Saving Tips for Your Household

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- Air dry dishes instead of dishwasher drying cycle
- Wash only full loads of dishes
- Run clothes washer using cold water to conserve hot water
- Dry heavier loads separately from lighter materials, routinely empty lint filter, check exhaust connection for lint
- Don't keep your refrigerator or freezer too cold
- Recommended temperatures are 37° to 40°F for the fresh food compartment of the refrigerator and 5°F for the freezer section
- Unplug second refrigerators or freezers if they are not necessary

Water heating can account for 15% of the energy consumed in your home.

- Install aerators on faucets and low-flow showerheads to reduce hot water usage
- Reduce set point temperature on your water heater to 120° F
- Install a timer to turn off your water heater when less water heat is used, or when cost is highest, such as during the day.
- Take short showers instead of baths

Home electronics can account for 11% of the energy consumed in your home.

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- Plug home electronics, such as TVs and DVD players, into power strips and turn the power strips off when the equipment is not in use to eliminate "phantom" loads

Air Conditioning can account for 10% of the energy consumed in your home.

- Turn up your cooling set-point to save on energy — try 78° F
- Shut off your air conditioner and try using a fan or opening the windows at night
- Close shades in the summer — your house will block out more radiant heat from the sun in the summer months if the curtains are closed

Lighting can account for 6% of the energy consumed in your home.

- Turn off lights when a room is not being used
- Replace incandescent light bulbs with ENERGY STAR CFLs (up to 75% savings)
- Replace outdoor lighting with ENERGY STAR CFLs, LEDs, or solar powered fixtures

For a complete list of ideas, visit www.EnergyStar.gov and select the link "Save Energy at Home"

Tips for Avoiding High Cost (Critical Peak) Periods

Shift you chores - Perform household chores requiring power-hungry appliances—like washers, dryers, dishwashers, pool pumps, and vacuums—before 12 p.m. or after 6 p.m.

Prepare easy meals - Prepare afternoon snacks that don't require opening the fridge or using the stove or oven. Dinner is as easy as a quick microwave meal or a summer evening barbeque in the back yard.

Pre-cool - Cool your home by a few extra degrees in the morning before it gets hot outside, so your air conditioner won't have to work so hard – and your home begins the event at a lower temperature.

Keep hot air out - Draw your shades to keep the sun's rays out and seal air leaks around windows with low-cost weather stripping to keep pre-cooled air inside.

Enjoy an afternoon out - System events might be just the excuse you needed to get out of the house. Set the thermostat to 80 (or higher if you want!) and head to the mall, the library or beach, or even take in a summer movie with the kids.

Programmable thermostat - Set the air conditioning to turn on after 6 p.m. if you use a programmable thermostat.

Unplug - Unplug non-essential devices such as computers, printers, and entertainment electronics while you are home or before you leave. Power strips make it easy to turn off multiple devices with the flip of a switch

Use timers - Install plug-in or hard-wired timers on outdoor lights, pumps, dehumidifiers and other large appliances.

Use online tools - Use your MMLD web portal tools to check your meter usage data online at www.marbleheadelectric.com and click "view meter".

April 13, 2012

Dear Customer,

Thank you again for volunteering to participate in the Marblehead Municipal Light Department's (MMLD) ***EnergySense*** Pilot program. Thanks to your efforts and those of others participating in the pilot, last year's program was a huge success! We achieved significant reductions in electric demand during peak summer periods and ***all*** customers who received the reduced electric rate saved money over the course of the summer!

The second year of the pilot program begins on June 1, 2012 and will last through August 31, 2012. This summer, you will be placed on the reduced electric rate and will receive "bill-protection" – meaning that you are guaranteed to not pay more on the rate but you are able to keep any savings. Details on the new electric rate are included in the "details" sheet of this information packet. If for any reason you wish to opt out of the program, please contact us at (781) 631-0240 or by email at energysense@marbleheadelectric.com. If you do not contact us to opt out of this summer's program, you will automatically be enrolled on the incentive rate from June through August.

ENABLING TECHNOLOGIES

To help you save money on the incentive rate, we are offering a new ***FREE*** state-of-the-art programmable digital thermostat to customers with central air conditioning and who are participating in the pilot. The thermostat is controllable via the internet, connects to your home network through the electric meter, and features energy saving settings that can help you save during critical peak periods. Best of all, ***YOU*** are in full control of the thermostat at all times – it will never be controlled by the light department.

The thermostat is a $250 value that we are offering for free. If you have central air conditioning and are interested in receiving a thermostat for this upcoming summer, please contact us at (781) 631-0240 or by email at energysense@marbleheadelectric.com. We will schedule a delivery or a time when you can pick the thermostat up from the light department. It will be your responsibility to have the thermostat installed, and we will issue a reimbursement payment of $100 when we confirm the thermostat has been successfully installed.

In addition, we are offering customers with electric water heaters a free water heater control switch shown to the left ($150 value). This device is used to interrupt power to your electric water heater during critical peak periods. This can significantly reduce your electric load during these periods and help you save on the incentive rate. If you have an electric water heater and are interested in receiving a water heater control switch, please contact us at (781) 631-0240 or by email at energysense@marbleheadelectric.com. These switches need to be professionally installed. It will be your responsibility to have the thermostat installed, and we will issue a reimbursement payment of $200 when we confirm the switch has been successfully installed.

WEB PORTAL

Our analysis of surveys conducted at the end of last summer indicated that the customer web portals were an underutilized asset. Many customers were not aware of the web portal at all. We highly encourage you to visit your web portal and explore some of the available features. There are hour by hour, daily, and monthly summaries of your historical electric usage that can provide tremendous insight into your energy use habits – and help you to manage energy use during high-price critical peak periods!

You can access your web portal by visiting the Marblehead Light Department web page at http://marbleheadelectric.com/ and clicking on "view my meter" on the top right of the screen.

CRITICAL PEAK PERIOD EMAIL NOTIFICATIONS

The light department will issue email and phone notifications prior to Critical Peak periods this summer. Email notifications will be coming from a new email address to the email you provided us when you signed up for the program. The address we will be sending the notifications from is:

criticalpeak@marbleheadelectric.com

It is extremely important that you receive the notifications in order to respond to these high price events. If you have a spam filter, please "approve" or "whitelist" this email address now so that the Critical Peak period notifications do not get caught up in your spam filter. If you would like to change the email address at which you receive notifications, please contact us at (781) 631-0240 or by email at energysense@marbleheadelectric.com.

ENERGYSENSE YEAR 2 PACKET

This packet includes important information regarding the details of the ***EnergySense*** Pilot program and steps you need to take to confirm your enrollment. We encourage you to review the enclosed materials closely and let us know if you have any questions or concerns. Below is a list of materials included in this enrollment packet:

- ✓ **Pilot Details** – A program overview that includes pilot design, duration and rate details for the upcoming summer.
- ✓ **Pre-Pilot Survey** – This brief, two page survey is important to understand the characteristics of customers participating in this program so we can evaluate and report results back to the U.S. Department of Energy.
- ✓ **Ways you Can Save** – Tips and tactics for limiting energy consumption during critical peak periods so you can take full advantage of the discounted rates during all other hours.

Please take a moment to complete the brief survey included in this packet. It is vitally important to the program that we conduct these surveys again this year to identify any changes that may have occurred. We ask that you please return the completed survey to us in the pre-paid envelope we have included with this packet.

Thank you again for volunteering to participate in this exciting and cutting edge smart grid initiative. We look forward to another productive summer period. Please do not hesitate to contact us with any questions you may have.

Kind Regards,

Robert V. Jolly, Jr.
General Manager
Marblehead Municipal Light Department
PO Box 369
80 Commercial Street
Marblehead, MA 01945

EnergySense Pilot Program Details – *SUMMER 2012*

Marblehead Municipal Light Department in conjunction with GDS Associates, Inc. and the Department of Energy's Technical Advisory Group has developed the ***EnergySense*** Pilot Program. The goals of the program are to gauge the level of community interest in a Critical Peak pricing program, evaluate demand and energy consumption impacts of a Critical Peak Price program for future planning purposes and to assess the impact of giving consumers access to web based tools that allow them to monitor their personal consumption. The results of this pilot initiative will help inform decisions regarding the smart grid and incentive based pricing programs going forward.

Summer 2012 Period:
The pilot has technically been active since June of 2011 however you remained on your previous fixed flat rate throughout last summer. Starting on June 1, 2012 you will be placed on the incentive rate for the summer period lasting from June 1st 2012 to August 31st, 2012. August 31st will mark the end of the pilot program. You will still be able to access your personal web portal after the pilot has ended.

Rate Details:
Starting June 1, 2012, your electric rate will drop from 14¢ down to 9¢ per kilowatt-hour for all non-critical peak pricing hours (roughly 97% of the time!). There will be up to 12 critical peak pricing periods during the summer, occurring only on non-holiday weekdays from 12:00pm to 6:00 pm. All other hours on weekdays and all hours during weekends and holidays are considered Non-CPP hours. Customers will be notified by 5pm the day before a Critical Peak Event so that they may take steps to reduce personal consumption and save money during these periods. During critical peak periods, the cost of electricity will increase sharply to $1.05 per kilowatt hour.

Enabling Technologies:
Participating customers with central air conditioning or electric water heaters are eligible to receive a free programmable communicating (wi-fi) thermostat and/or electric water heater control switch to help control electric use during critical peak periods. The light department will provide the equipment free of charge; it is the customer's responsibility to have it installed. The light department will provide installation rebates upon successful verification that the equipment has been installed. If you have central air conditioning or an electric water heater and are interested in receiving the equipment, please contact us at (781) 631-0240 or by email at energysense@marbleheadelectric.com

Web Portal:
All study participants have access to a dynamic web portal that enables you to chart your personal energy consumption online. To gain access to your personal web portal, please visit us at www.marbleheadelectric.com and click on the "View Meter" tab at the top of the page then follow the on-screen instructions.

For questions regarding the details of the EnergySense Pilot Program, Please call

Customer Service at ***(781) 631-0240***

Energy Saving Tips for Your Household

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- Dry heavier loads separately from lighter materials, routinely empty lint filter, check exhaust connection for lint
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Home electronics can account for 11% of the energy consumed in your home.

- Turn off your computer and monitor when not in use
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Air Conditioning can account for 10% of the energy consumed in your home.

- Turn up your cooling set-point to save on energy — try 78° F
- Shut off your air conditioner and try using a fan or opening the windows at night
- Close shades in the summer — your house will block out more radiant heat from the sun in the summer months if the curtains are closed
- Do not run window insert air conditioners in un-occupied rooms

Lighting can account for 6% of the energy consumed in your home.

- Turn off lights when a room is not being used
- Replace incandescent light bulbs with ENERGY STAR CFLs (up to 75% savings)
- Replace outdoor lighting with ENERGY STAR CFLs, LEDs, or solar powered fixtures

Simple Tips for Avoiding High Cost (Critical Peak) Periods

Shift your chores - Perform household chores requiring power-hungry appliances—like washers, dryers, dishwashers, pool pumps, and vacuums—before 12 p.m. or after 6 p.m.

Prepare easy meals - Prepare afternoon snacks that don't require opening the fridge or using the stove or oven. Dinner is as easy as a quick microwave meal or a summer evening barbeque in the back yard.

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Keep hot air out - Draw your shades to keep the sun's rays out and seal air leaks around windows with low-cost weather stripping to keep pre-cooled air inside.

Enjoy an afternoon out - System events might be just the excuse you needed to get out of the house. Set the thermostat to 80 (or higher if you want!) and head to the mall, the library or beach, or even take in a summer movie with the kids.

Programmable thermostat - Set the air conditioning to turn on after 6 p.m. if you use a programmable thermostat.

Unplug - Unplug non-essential devices such as computers, printers, and entertainment electronics while you are home or before you leave. Power strips make it easy to turn off multiple devices with the flip of a switch

Use timers - Install plug-in or hard-wired timers on outdoor lights, pumps, dehumidifiers and other large appliances.

Use online tools - Use your MMLD web portal tools to check your meter usage data online at www.marbleheadelectric.com and click "view meter".

April 13, 2012

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The second year of the pilot program begins on June 1, 2012 and will last through August 31, 2012. You will again receive the reduced electric rate during this period. However, the "bill-protection" provision is no longer applicable – meaning that you are no longer guaranteed to not pay more than the standard rate. While we expect most customers will continue to save on this plan, you do have the option of opting out of the program. If you wish to opt out of the program to avoid the risk of a higher bill this upcoming summer, please contact us at (781) 631-0240 or by email at energysense@marbleheadelectric.com. If you do not contact us to opt out of this summer's program, you will automatically be re-enrolled on the incentive rate from June through August.

ENABLING TECHNOLOGIES

To help you save money on the incentive rate, we are offering a new ***FREE*** state-of-the-art programmable digital thermostat to customers with central air conditioning and who are participating in the pilot. The thermostat is controllable via the internet, connects to your home network through the electric meter, and features energy saving settings that can help you save during critical peak periods. Best of all, ***YOU*** are in full control of the thermostat at all time – it will never be controlled by the light department.

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In addition, we are offering customers with electric water heaters a free water heater control switch shown to the left ($150 value). This device is used to interrupt power to your electric water heater during critical peak periods. This can significantly reduce your electric load during these periods and help you save on the incentive rate. If you have an electric water heater and are interested in receiving a water heater control switch, please contact us at (781) 631-0240 or by email at energysense@marbleheadelectric.com These switches need to be professionally installed by a licensed electrician. It will be your responsibility to have the switch installed, and we will issue a reimbursement payment of $200 when we confirm the switch has been successfully installed.

WEB PORTAL

Our analysis of surveys conducted at the end of last summer indicated that the customer web portals were an underutilized asset. Many customers were not aware of the web portal at all. We highly encourage you to visit your web portal and explore some of the available features. There are hour by hour, daily, and monthly summaries of your historical electric usage that can provide tremendous insight into your energy use habits – and help you to manage energy use during high-price critical peak periods!

You can access your web portal by visiting the Marblehead Light Department web page at http://marbleheadelectric.com/ and clicking on “view my meter” on the top right of the screen.

CRITICAL PEAK PERIOD EMAIL NOTIFICATIONS

The light department will issue email and phone notifications prior to Critical Peak periods this summer. Email notifications will be coming from a new email address to the email you provided us when you signed up for the program. The address we will be sending the notifications from is:

criticalpeak@marbleheadelectric.com

It is extremely important that you receive the notifications in order to respond to these high price events. If you have a spam filter, please “approve” or “whitelist” this email address now so that the Critical Peak period notifications do not get caught up in your spam filter. If you would like to change the email address at which you receive notifications, please contact us at (781) 631-0240 or by email at energysense@marbleheadelectric.com.

ENERGYSENSE YEAR 2 PACKET

This packet includes important information regarding the details of the ***EnergySense*** Pilot program and steps you need to take to confirm your enrollment. We encourage you to review the enclosed materials closely and let us know if you have any questions or concerns. Below is a list of materials included in this enrollment packet:

- ✓ **Pilot Details** – A program overview that includes pilot design, duration and rate details for the upcoming summer.
- ✓ **Pre-Pilot Survey** – This brief, two page survey is important to understand the characteristics of customers participating in this program so we can evaluate and report results back to the U.S. Department of Energy.
- ✓ **Ways you Can Save** – Tips and tactics for limiting energy consumption during critical peak periods so you can take full advantage of the discounted rates during all other hours.

Please take a moment to complete the brief survey included in this packet. It is vitally important to the program that we conduct these surveys again this year to identify any changes that may have occurred. We ask that you please return the completed survey to us in the pre-paid envelope we have included with this packet.

Thank you again for volunteering to participate in this exciting and cutting edge smart grid initiative. We look forward to another productive summer period. Please do not hesitate to contact us with any questions you may have.

Kind Regards,

Robert V. Jolly, Jr.
General Manager
Marblehead Municipal Light Department
PO Box 369
80 Commercial Street
Marblehead, MA 01945

EnergySense Pilot Program Details – *SUMMER 2012*

Marblehead Municipal Light Department in conjunction with GDS Associates, Inc. and the Department of Energy's Technical Advisory Group has developed the ***EnergySense*** Pilot Program. The goals of the program are to gauge the level of community interest in a Critical Peak pricing program, evaluate demand and energy consumption impacts of a Critical Peak Price program for future planning purposes and to assess the impact of giving consumers access to web based tools that allow them to monitor their personal consumption. The results of this pilot initiative will help inform decisions regarding the smart grid and incentive based pricing programs going forward.

Summer 2012 Period:
The pilot has technically been active since June of 2011 however you were returned to your previous flat electric rate as of August 31st 2011. Starting on June 1, 2012 you will be placed back on the incentive rate for the summer period lasting from June 1st 2012 to August 31st, 2012. August 31st will mark the end of the pilot program. You will still be able to access your personal web portal after the pilot has ended.

Rate Details:
Starting June 1, 2012, your electric rate will drop from 14¢ down to 9¢ per kilowatt-hour for all non-critical peak pricing hours (roughly 97% of the time!). There will be up to 12 critical peak pricing periods during the summer, occurring only on non-holiday weekdays from 12:00pm to 6:00 pm. All other hours on weekdays and all hours during weekends and holidays are considered Non-CPP hours. Customers will be notified by 5pm the day before a Critical Peak Event so that they may take steps to reduce personal consumption and save money during these periods. During critical peak periods, the cost of electricity will increase sharply to $1.05 per kilowatt hour.

Enabling Technologies:
Participating customers with central air conditioning or electric water heaters are eligible to receive a free programmable communicating (wi-fi) thermostat and/or electric water heater control switch to help control electric use during critical peak periods. The light department will provide the equipment free of charge; it is the customer's responsibility to have it installed. The light department will provide installation rebates upon successful verification that the equipment has been installed. If you have central air conditioning or an electric water heater and are interested in receiving the equipment, please contact us at (781) 631-0240 or by email at energysense@marbleheadelectric.com

Web Portal:
All study participants have access to a dynamic web portal that enables you to chart your personal energy consumption online. To gain access to your personal web portal, please visit us at www.marbleheadelectric.com and click on the "View Meter" tab at the top of the page then follow the on-screen instructions.

For questions regarding the details of the EnergySense Pilot Program, Please call

Customer Service at ***(781) 631-0240***

Energy Saving Tips for Your Household

Refrigerators (15%) and other appliances (11%) can account for 26% of the energy consumed in your home (other appliances include dishwashers, clothes washers, dryers, etc.).

- Air dry dishes instead of dishwasher drying cycle
- Wash only full loads of dishes
- Run clothes washer using cold water to conserve hot water
- Dry heavier loads separately from lighter materials, routinely empty lint filter, check exhaust connection for lint
- Don't keep your refrigerator or freezer too cold
- Recommended temperatures are 37° to 40°F for the fresh food compartment of the refrigerator and 5°F for the freezer section
- Unplug second refrigerators or freezers if they are not necessary

Water heating can account for 15% of the energy consumed in your home.

- Install aerators on faucets and low-flow showerheads to reduce hot water usage
- Reduce set point temperature on your water heater to 120° F
- Install a timer to turn off your water heater when less hot water is used, or when cost is highest, such as during the day.
- Take short showers instead of baths

Home electronics can account for 11% of the energy consumed in your home.

- Turn off your computer and monitor when not in use
- Plug home electronics, such as TVs and DVD players, into power strips and turn the power strips off when the equipment is not in use to eliminate "phantom" loads

Air Conditioning can account for 10% of the energy consumed in your home.

- Turn up your cooling set-point to save on energy — try 78° F
- Shut off your air conditioner and try using a fan or opening the windows at night
- Close shades in the summer — your house will block out more radiant heat from the sun in the summer months if the curtains are closed
- Do not run window insert air conditioners in un-occupied rooms

Lighting can account for 6% of the energy consumed in your home.

- Turn off lights when a room is not being used
- Replace incandescent light bulbs with ENERGY STAR CFLs (up to 75% savings)
- Replace outdoor lighting with ENERGY STAR CFLs, LEDs, or solar powered fixtures

Simple Tips for Avoiding High Cost (Critical Peak) Periods

Shift your chores - Perform household chores requiring power-hungry appliances—like washers, dryers, dishwashers, pool pumps, and vacuums—before 12 p.m. or after 6 p.m.

Prepare easy meals - Prepare afternoon snacks that don't require opening the fridge or using the stove or oven. Dinner is as easy as a quick microwave meal or a summer evening barbeque in the back yard.

Pre-cool - Cool your home by a few extra degrees in the morning before it gets hot outside, so your air conditioner won't have to work so hard – and your home begins the event at a lower temperature.

Keep hot air out - Draw your shades to keep the sun's rays out and seal air leaks around windows with low-cost weather stripping to keep pre-cooled air inside.

Enjoy an afternoon out - System events might be just the excuse you needed to get out of the house. Set the thermostat to 80 (or higher if you want!) and head to the mall, the library or beach, or even take in a summer movie with the kids.

Programmable thermostat - Set the air conditioning to turn on after 6 p.m. if you use a programmable thermostat.

Unplug - Unplug non-essential devices such as computers, printers, and entertainment electronics while you are home or before you leave. Power strips make it easy to turn off multiple devices with the flip of a switch

Use timers - Install plug-in or hard-wired timers on outdoor lights, pumps, dehumidifiers and other large appliances.

Use online tools - Use your MMLD web portal tools to check your meter usage data online at www.marbleheadelectric.com and click "view meter".

Energy Sense Program, Summer 2012: ***Thermostat Recommendations***

Central air conditioning systems represent one of the single largest sources of energy use in your home. With your new CT-80 thermostat, you are able to control your air conditioning systems from anywhere via your web portal. This reference document provides instructions on how to control your thermostat through your online web portal, and provides recommended strategies for saving energy and money on critical peak event days.

Instructions on how to access online portal:

1. Once your thermostat is installed contact us at (781) 631-0240 or by email at energysense@marbleheadelectric.com to link it to your account and have your rebate processed.
2. To access the online portal start by going to the MMLD website: www.MarbleheadElectric.com
3. Click the "View my meter" tab in the upper right.
4. Click "Register or Login Here" at the bottom of the View my Meter page.
5. If you are a first time user you will have to register by clicking the "Sign Up" tab at the IntelaHome website you are brought to. You will need your MMLD account number to activate your account.
6. Once you have an active account or if you already have accessed the online portal, sign in at the top of the IntelaHome homepage.
7. Once you are viewing your account, explore the different tabs and meters to see current energy usage and ways to control your thermostat remotely. Be patient, sometimes the information takes a few moments to load. ***A graphical explanation of the Smart Grid Portal is on the reverse of this page!***

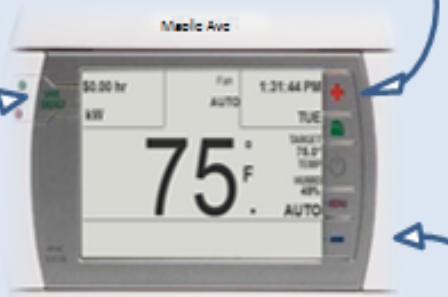
Recommended Actions for Event Days:

When hot weather is forecast be on the lookout for notifications about upcoming Critical Peak days. Reducing use of air conditioning via your thermostat is one of the easiest ways to save energy and money on event days. Some specific strategies for managing energy use on Critical Peak Periods (12pm-6pm) are outlined below:

- ✓ Pre-cool your home in the morning by setting the temperature slightly lower than normal. When the Critical Peak Event starts at noon, increase the temperature by 4-8 degrees or more to save money
- ✓ If you are at home, press the "save energy button" on the upper left of your new programmable thermostat. This automatically sets the temperature 4 °F higher
- ✓ If you are away from your home, access the online portal to control your thermostat. You are able to raise the house temperature for savings on air conditioning usage during the peak periods, especially when house is empty. During other periods, you can lower the temperature, to cool the house before you get home.
- ✓ Draw blinds and close windows to limit cooling losses and heat gain.
- ✓ Turn off and unplug all unnecessary lights and appliances. Lights in particular emit heat which will make your home less comfortable during Critical Peak Events
- ✓ If you can do without hot water for a little while, turn off your electric water heater for more savings! This can be done by shutting off the circuit breaker or setting the tank temperature to it's lowest setting.

"Save Energy" button is activated only from home

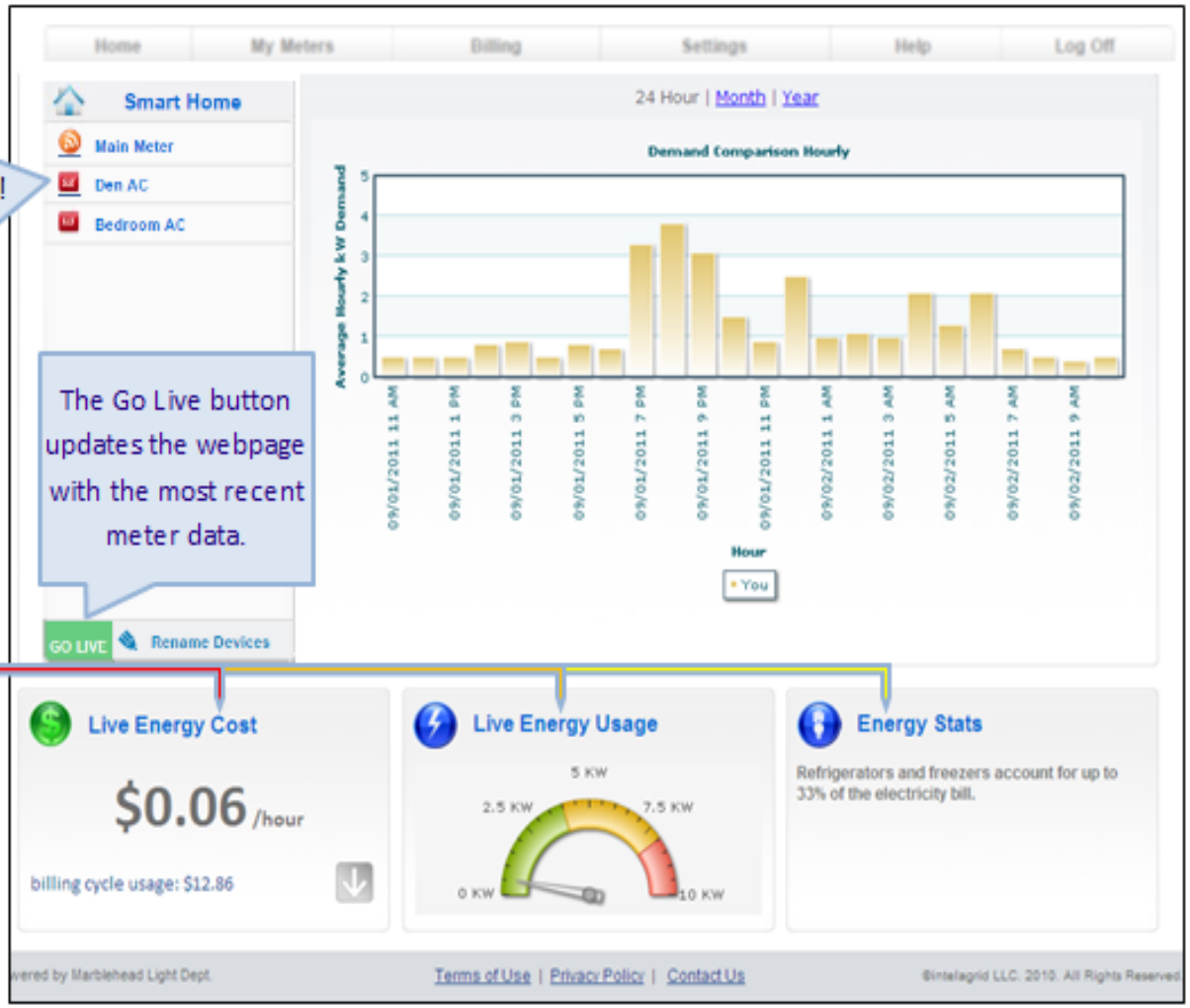
Click here (+) to increase the set temp remotely



Click here (-) to decrease the set temp remotely

Click!

The Go Live button updates the webpage with the most recent meter data.



These are your widgets. They summarize crucial data like current energy usage and cost. Clicking on their titles brings up more detailed information, some of which will be represented on the graph above them. You can change which widgets appear on your portal through the settings menu.

Home	My Meters	Billing	Settings	Help
Brings you back to the screen shown above	Provides access to detailed meter information like: • Real time Energy Usage • Voltage • Advanced Meter Data	Contains billing info such as: • Meter Number • Date of Next Bill • $ and Energy Usage to Date • Estimated Bill	Allows you to control details like: • Profile Details • Home Details • Change Widgets	Provides access to the FAQ as well as customer service contact information

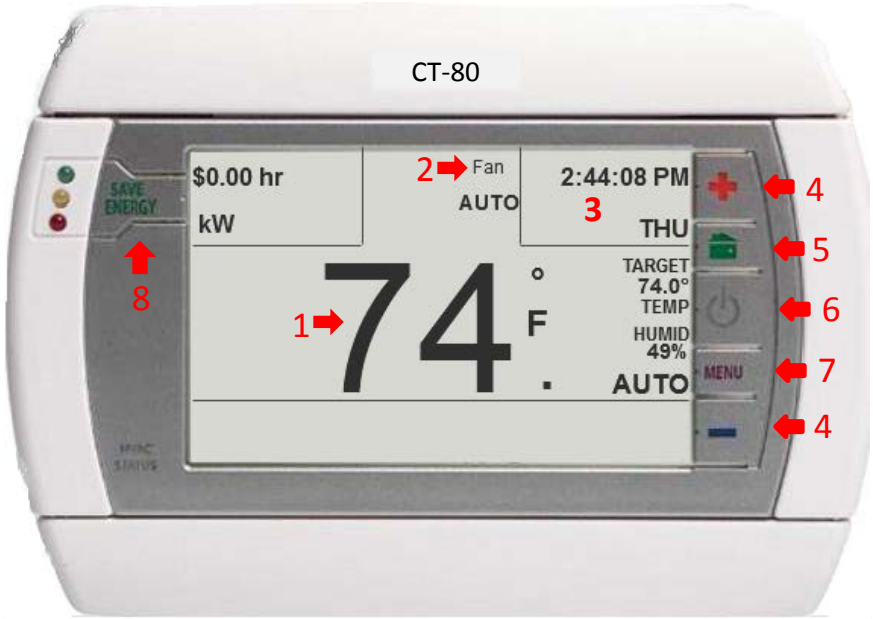
Using Your CT-80 Radio Programmable Thermostat

General Tips and Tricks

- **Touch vs. +/-** : The CT-80 features a *touch* screen. To change a value or access an option normally you must select it by touching it. These changeable values appear in brackets like these: < VALUE >. Once selected, then you can change the option using the + and – buttons to the right of the screen.
- **Home Touch Screen:** The home screen (pictured here) is interactive. By clicking Fan, the Time or Date, or the current Temp you can modify these attributes. All other options come through pushing the ⏻ button, MENU button, or save energy button.

The rest of this guide will use the numbers and corresponding buttons on the graphic to explore key features of the CT-80 Programmable Thermostat.

For more detailed instructions download the full manual:
http://www.radiothermostat.com/documents/CT-80-Operation-20mar09.pdf



1.) **Current Temperature:** This is the current temperature around the thermostat (see reverse side of this sheet for calibration information). By clicking this number you go to the "MANUAL" screen which allows you to manually change the temperature away from the programmed temperature. In the lower left will be the word "temporary" which means the new temperature will revert back to the programmed temperature, or "hold" which maintains the new manual temperature indefinitely. Pushing on these words changes the setting from one to the other.

2.) **Fan:** Clicking the fan icon will bring up three options:
Auto: This mode is the default. The fan runs only while active heating/cooling is taking place.
Circ: In this mode, the fan runs for up to 9 minutes per hour to increase air quality and circulation.
Fresh: If you have a fresh air baffle, clicking this allows fresh air into the HVAC system.

3.) **Time and Date:** Touching these options allow you to change the time and date with the arrow buttons. Accurate time and date will allow for accurate programming of your unit.

4.) **+/- :** From the home screen allows you to change the current target temp. On other screens, allows you to modify entries once they are selected. See "tips and tricks".

5.) **Home:** Returns you to the home screen (pictured).

6.) **Power:** Brings up the mode options "Heat", "Cool", "Auto", and "Off" at the bottom of the screen. Clicking Heat activates heating, cool activates A/C, and auto lets the computer activate either depending on temperatures while the off mode shuts your HVAC system off completely.

7.) **Menu:** Access programming and other options. See reverse side for details.

8.) **Save Energy:** Clicking this button immediately changes the set temp up or down (depending on if you are heating or cooling) to save energy. Modify the temperature change by clicking the button (default is 4 °F).

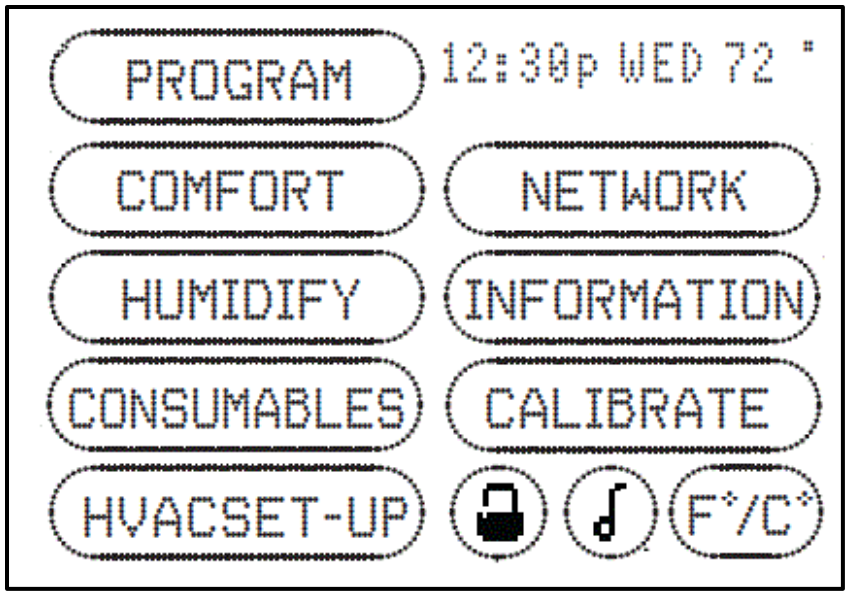
Using Your CT-80 Radio Programmable Thermostat- The Menu

Menu Options:

Program: This is the key to saving energy with your new thermostat. To create a program first make sure you are in the right mode (Heat, Cool, Or Auto, accessed from the ⏻ button). Once you are in the right mode there are *two options* to programming your thermostat…

Interview **:** This is the default but also can be accessed by clicking the  icon . It asks you a series of questions about work schedule/wake up time and creates a program for you. Scroll through questions by clicking and modify answers with +/-. This is the easiest way to program your thermostat.

*Calendar***:** Clicking the  icon lets you create a detailed daily program. For each day of the week you can modify the times and temperatures used. Add a new time slot by clicking on empty lines. Highlighting a timeslot allows you to delete it with the trash button You can cycle through days of the week using the arrows at the top of the screen. Options on the screen allow you to copy the program from one day.



Comfort: The comfort button allows you to set **HVAC Cycling:** This option dictates how far from the set temperature the indoor temperature can vary before activating your heating or cooling system. Change the temperature by pressing on the number an pressing +/-. For example, setting 2°F will allow the indoor temperature to reach 77°F before turning on the A/C if the cooling temperature is set to 75°F. This saves energy.

Humidify: The HUMIDIFY and External DE-HUMID options are relevant only to systems with external humidifiers or de-humidifiers. If you have those systems, refer to the manual. The DE-HUMID BY A/C option lets you set a maximum humidity in your home when you are using you're A/C. Change the max humidity by selecting the percentage and using the +/- buttons. The next option in brackets, < >, lets you choose if you <ALWAYS> want to run your A/C to de-humidify if the humidity gets above your set maximum or if you only want it to de-humidify if the thermostat calls for cooling (<HTS+TST>).

Consumables: This screen keeps track of the maintenance needed on consumable parts such as filters.

HVAC Set-Up: This menu allows you to change the basic set up of your system. The technician who installed the thermostat should have set this up correctly for you. You shouldn't need to modify any of these options.

Network: Network options can be found in the network manual, you should not need to change these options.

Information: This provides information from a network source. Refer to your network manual for more detailed info.

Calibrate: The system comes calibrated to within 1°F of actual temperature. However, you may change the displayed temperature by up to 9°F to match other thermostats in your house for consistency. **This is not recommended.**

🔒: The lock option allows you to lock the controls of your thermostat. Partial lock allows changes +/- 4°F. Unlock by holding the lock button for 10 seconds, then pressing unlock.

♪: Click this to turn the audible chirp on or off.

F°/C°: Click this to change the display temperatures from °F to °C.

APPENDIX E

MARKETING MATERIALS

ORDER:

YEAR 1 ENROLLMENT (CONTROL)

YEAR 1 ENROLLMENT (CPP)

BUSINESS (781) 631-5600 PLANT (781) 631-0240

MARBLEHEAD MUNICIPAL LIGHT DEPARTMENT

80 COMMERCIAL STREET • P.O. BOX 369

MARBLEHEAD, MASSACHUSETTS 01945

ROBERT V. JOLLY, JR.

GENERAL MANAGER

May 3, 2011

Dear Customer,

Thank you again for volunteering to participate in the Marblehead Municipal Light Department's (MMLD) ***EnergySense*** Pilot program. My name is Robert V. Jolly Jr. and on behalf of the MMLD, I would like to officially welcome you to the program. As a participant in our pilot program, you have been randomly selected to receive the reduced electric rate during the summer of 2012. You will be among the first households in town to receive a new "smart" electric meter and access to a dynamic web portal that will allow you to chart your energy consumption online.

This packet includes important information regarding the details of the ***EnergySense*** Pilot program and steps you need to take to confirm your enrollment. We encourage you to review the enclosed materials closely and let us know if you have any questions or concerns. Below is a list of materials included in this enrollment packet:

- ✓ **Pilot Details** – A program overview that includes pilot design, duration and rate details
- ✓ **Pre-Pilot Survey** – This brief, two page survey is important to understand the characteristics of customers participating in this program so we can evaluate and report results back to the U.S. Department of Energy.
- ✓ **Ways you Can Save** – Tips and tactics for limiting energy consumption during critical peak periods so you can take full advantage of the discounted rates during all other hours.

To confirm your enrollment in this program, please take a moment to complete the brief survey included in this packet. Completion of the survey is critically important for us to evaluate the success of the pilot so we ask that you please return the completed survey to us in the pre-paid envelope we have included with this packet. Once you complete and return the survey, we will proceed with scheduling the installation of a smart meter at your home.

Again, welcome to the program and thank you for volunteering to participate in this exciting and cutting edge smart grid initiative. Please do not hesitate to contact us with any questions you may have.

Sincerely,

Robert V. Jolly, Jr.
General Manager

EnergySense Pilot Program Details

Marblehead Municipal Light Department in conjunction with GDS Associates, Inc. and the Department of Energy's Technical Advisory Group has developed the ***EnergySense*** Pilot Program. The goals of the program are to gauge the level of community interest in a Critical Peak pricing program, evaluate demand and energy consumption impacts of a Critical Peak Price program for future planning purposes and to assess the impact of giving consumers access to web based tools that allow them to monitor their personal consumption. The results of this pilot initiative will help inform decisions regarding the smart grid and incentive based pricing programs going forward.

Pilot Design:
The pilot will span for 15 months starting June 1st 2011 and ending August 31st, 2012. Customers who have volunteered to participate are randomly assigned to one of two groups; those who will receive the reduced electric rate during the summer of 2011 and those who will receive the reduced rate in summer of 2012. All participants will be among the first in town to receive a new smart meter.

Rate Details:
Your group has been randomly selected to receive the reduced electric rate during the summer of 2012. For this upcoming summer, you will remain on your current fixed electric rate of approximately 14¢ per kilowatt-hour.

Meter Change:
All participants in the ***EnergySense*** Pilot Program will receive a new smart meter at their home that is capable of transmitting energy use data in near real to you (through the web portal) and to MMLD. The meter change out will cause a momentary disruption in power but the new meter will otherwise function no differently from your current meter. The change will be made during May prior to the start of the pilot in June.

Web Portal:
Participants in both rate groups will have access to a dynamic web portal that will enable them to chart their personal energy consumption online. To gain access to your personal web portal, please visit us at www.marbleheadelectric.com and click on the "View Meter" tab at the top of the page then follow the on-screen instructions.

For questions regarding the details of the EnergySense Pilot Program, Please call

Customer Service at ***(781) 631-5600***

Energy Saving Tips for Your Household

Refrigerators (15%) and other appliances (11%) can account for 26% of the energy consumed in your home (other appliances include dishwashers, clothes washers, dryers, etc.).

- Air dry dishes instead of dishwasher drying cycle
- Wash only full loads of dishes
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- Install aerators on faucets and low-flow showerheads to reduce hot water usage
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- Install a timer to turn off your water heater when less water heat is used, or when cost is highest, such as during the day.
- Take short showers instead of baths

Home electronics can account for 11% of the energy consumed in your home.

- Turn off your computer and monitor when not in use
- Plug home electronics, such as TVs and DVD players, into power strips and turn the power strips off when the equipment is not in use to eliminate "phantom" loads

Air Conditioning can account for 10% of the energy consumed in your home.

- Turn up your cooling set-point to save on energy — try 78° F
- Shut off your air conditioner and try using a fan or opening the windows at night
- Close shades in the summer — your house will block out more radiant heat from the sun in the summer months if the curtains are closed

Lighting can account for 6% of the energy consumed in your home.

- Turn off lights when a room is not being used
- Replace incandescent light bulbs with ENERGY STAR CFLs (up to 75% savings)
- Replace outdoor lighting with ENERGY STAR CFLs, LEDs, or solar powered fixtures

For a complete list of ideas, visit www.EnergyStar.gov and select the link "Save Energy at Home"

This is a quick and easy survey requested by the Department of Energy as part of a Smart Grid Investment Grant received by Marblehead Municipal Light Department. Your answers are protected and will be anonymous

Use a blue or black pen

START HERE

MA1. Do you own or rent your home?

Mark [X] ONE box

- [ ] Own
- [ ] Rent

MA2. What type of residence do you live in? Do you live in a…

Mark [X] ONE box

- [ ] Single-family
- [ ] Duplex or two-family
- [ ] Apartment/condo in a 2-4 unit building
- [ ] Apartment/condo in a >4 unit building
- [ ] Townhouse or row house (adjacent walls to another house)
- [ ] Mobile home, house trailer

MA3. Does your home have central air conditioning?

Mark [X] ONE box

- [ ] Yes
- [ ] No

MA4. Do you have any room air conditioners?

Mark [X] ONE box

- [ ] Yes
- [ ] No (GO TO MA6)

MA5. How many room air conditioners do you have?

[ ][ ]

MA6. Do you have a programmable thermostat?

Mark [X] ONE box

- [ ] Yes
- [ ] No (GO TO MA8)

MA7. Is the programmable thermostat currently set to automatically change temperatures during the day when no one is home?

Mark [X] ONE box

- [ ] Yes
- [ ] No

MA8. Do you have an electric clothes dryer?

Mark [X] ONE box

- [ ] Yes
- [ ] No

MA9. Including yourself, how many adults, 18 or older, currently live in your household?

[ ][ ]

MA10. And how many of these adults are over 65?

[ ][ ]

MA11. How many children under the age of 18 live in your household at least part of the week?

[ ][ ]

MA12. Do you or does anyone in your household have a chronic illness or disability that requires regular or occasional in-home medical treatment?

Mark [X] ONE box

- [ ] Yes
- [ ] No

MA13. Is there someone home Monday to Friday sometime between 1 PM and 5 PM at least one day a week?

Mark [X] ONE box

- [ ] Yes
- [ ] No

MA14. Is there anyone in your household working full time for pay?

Mark [X] ONE box

- [ ] Yes
- [ ] No (GO TO MA16)

MA15. Do you or anyone in your household have a job where you work at home at least one weekday a week rather than go into an office or some other location?

Mark [X] ONE box

- [ ] Yes
- [ ] No

TURN OVER AND CONTINUE →

MA16. Do you remember receiving information from your electric utility asking you to participate in a utility pilot program?

Mark [X] ONE box

- ☐ Yes
- ☐ No (GO TO MA18)

MA17. Was the information useful in helping you decide whether or not to participate in the pilot?

Mark [X] ONE box

- ☐ Yes
- ☐ No

MA18. What is the primary language spoken in your home?

Mark [X] ONE box

- ☐ English
- ☐ Spanish
- ☐ Chinese
- ☐ Korean
- ☐ Vietnamese
- ☐ Russian
- ☐ Other

MA19. Last year -- that is, in 2010 -- what was your total household income from all sources, before taxes?

Mark [X] ONE box

- ☐ Less than $10,000
- ☐ $10,000 to less than $20,000
- ☐ $20,000 to less than $30,000
- ☐ $30,000 to less than $40,000
- ☐ $40,000 to less than $75,000
- ☐ $75,000 to less than $90,000
- ☐ $90,000 to less than $100,000
- ☐ $100,000 to less than $150,000
- ☐ $150,000 or more

MA20. What is the LAST grade or class that you COMPLETED in school?

Mark [X] ONE box

- ☐ None, or grade 1-8
- ☐ High School incomplete (grade 9-11)
- ☐ High School graduate (grade 12 or GED certificate)
- ☐ Technical, trade or vocational school AFTER high school
- ☐ Some college, no four-year degree (includes associate degree)
- ☐ College graduate (B.S., B.A., or other four-year degree)
- ☐ Post-graduate or professional schooling after college (e.g., towards a Master's degree or Ph.D; law or medical school)

BUSINESS (781) 631-5600 PLANT (781) 631-0240

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MARBLEHEAD, MASSACHUSETTS 01945

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Dear Customer,

Thank you again for volunteering to participate in the Marblehead Municipal Light Department's (MMLD) ***EnergySense*** Pilot program. My name is Robert V. Jolly Jr. and on behalf of the MMLD, I would like to officially welcome you to the program. As a participant in our pilot program, you have been randomly selected to receive the reduced electric rate during the summer of 2011. You will be among the first households in town to receive a new "smart" electric meter and access to a dynamic web portal that will allow you to chart your energy consumption online.

This packet includes important information regarding the details of the ***EnergySense*** Pilot program and steps you need to take to confirm your enrollment. We encourage you to review the enclosed materials closely and let us know if you have any questions or concerns. Below is a list of materials included in this enrollment packet:

- ✓ **Pilot Details** – A program overview that includes pilot design, duration and rate details
- ✓ **Pre-Pilot Survey** – This brief, two page survey is important to understand the characteristics of customers participating in this program so we can evaluate and report results back to the U.S. Department of Energy.
- ✓ **Ways you Can Save** – Tips and tactics for limiting energy consumption during critical peak periods so you can take full advantage of the discounted rates during all other hours.

To confirm your enrollment in this program, please take a moment to complete the brief survey included in this packet. Completion of the survey is critically important for us to evaluate the success of the pilot so we ask that you please return the completed survey to us in the pre-paid envelope we have included with this packet. Once you complete and return the survey, we will proceed with scheduling the installation of a smart meter at your home.

Again, welcome to the program and thank you for volunteering to participate in this exciting and cutting edge smart grid initiative. Please do not hesitate to contact us with any questions you may have.

Sincerely,

Robert V. Jolly, Jr.
General Manager

EnergySense Pilot Program Details

Marblehead Municipal Light Department in conjunction with GDS Associates, Inc. and the Department of Energy's Technical Advisory Group has developed the ***EnergySense*** Pilot Program. The goals of the program are to gauge the level of community interest in a Critical Peak pricing program, evaluate demand and energy consumption impacts of a Critical Peak Price program for future planning purposes and to assess the impact of giving consumers access to web based tools that allow them to monitor their personal consumption. The results of this pilot initiative will help inform decisions regarding the smart grid and incentive based pricing programs going forward.

Pilot Design:
The pilot will span for 15 months starting June 1st 2011 and ending August 31st, 2012. Customers who have volunteered to participate are randomly assigned to one of two groups; those who will receive the reduced electric rate during the summer of 2011 and those who will receive the reduced rate in summer of 2012. All participants will be among the first in town to receive a new smart meter.

Rate Details:
Your group has been randomly selected to receive the reduced electric rate during the summer of 2011. This upcoming summer, your electric rate will drop from 14¢ down to 9¢ per kilowatt-hour for all non-critical peak pricing hours (roughly 97% of the time!). There will be up to 12 critical peak pricing periods during the summer, occurring only on non-holiday weekdays from 12:00pm to 6:00 pm. All other hours on weekdays and all hours during weekends and holidays are considered Non-CPP hours. Customers will be notified by 5pm the day before a Critical Peak Event so that they may take steps to reduce personal consumption and save money during these periods. During critical peak periods, the cost of electricity will increase sharply to $1.05 per kilowatt hour.

Meter Change:
All participants in the ***EnergySense*** Pilot Program will receive a new smart meter at their home that is capable of transmitting energy use data in near real to you (through the web portal) and to MMLD. The meter change out will cause a momentary disruption in power but the new meter will otherwise function no differently from your current meter. The change will be made during May prior to the start of the pilot in June.

Web Portal:
Participants in both rate groups will have access to a dynamic web portal that will enable them to chart their personal energy consumption online. To gain access to your personal web portal, please visit us at www.marbleheadelectric.com and click on the "View Meter" tab at the top of the page then follow the on-screen instructions.

For questions regarding the details of the EnergySense Pilot Program, Please call

Customer Service at ***(781) 631-5600***

Energy Saving Tips for Your Household

Refrigerators (15%) and other appliances (11%) can account for 26% of the energy consumed in your home (other appliances include dishwashers, clothes washers, dryers, etc.).

- Air dry dishes instead of dishwasher drying cycle
- Wash only full loads of dishes
- Run clothes washer using cold water to conserve hot water
- Dry heavier loads separately from lighter materials, routinely empty lint filter, check exhaust connection for lint
- Don't keep your refrigerator or freezer too cold
- Recommended temperatures are 37° to 40°F for the fresh food compartment of the refrigerator and 5°F for the freezer section
- Unplug second refrigerators or freezers if they are not necessary

Water heating can account for 15% of the energy consumed in your home.

- Install aerators on faucets and low-flow showerheads to reduce hot water usage
- Reduce set point temperature on your water heater to 120° F
- Install a timer to turn off your water heater when less water heat is used, or when cost is highest, such as during the day.
- Take short showers instead of baths

Home electronics can account for 11% of the energy consumed in your home.

- Turn off your computer and monitor when not in use
- Plug home electronics, such as TVs and DVD players, into power strips and turn the power strips off when the equipment is not in use to eliminate "phantom" loads

Air Conditioning can account for 10% of the energy consumed in your home.

- Turn up your cooling set-point to save on energy — try 78° F
- Shut off your air conditioner and try using a fan or opening the windows at night
- Close shades in the summer — your house will block out more radiant heat from the sun in the summer months if the curtains are closed

Lighting can account for 6% of the energy consumed in your home.

- Turn off lights when a room is not being used
- Replace incandescent light bulbs with ENERGY STAR CFLs (up to 75% savings)
- Replace outdoor lighting with ENERGY STAR CFLs, LEDs, or solar powered fixtures

For a complete list of ideas, visit www.EnergyStar.gov and select the link "Save Energy at Home"

Tips for Avoiding High Cost (Critical Peak) Periods

Shift you chores - Perform household chores requiring power-hungry appliances—like washers, dryers, dishwashers, pool pumps, and vacuums—before 12 p.m. or after 6 p.m.

Prepare easy meals - Prepare afternoon snacks that don't require opening the fridge or using the stove or oven. Dinner is as easy as a quick microwave meal or a summer evening barbeque in the back yard.

Pre-cool - Cool your home by a few extra degrees in the morning before it gets hot outside, so your air conditioner won't have to work so hard – and your home begins the event at a lower temperature.

Keep hot air out - Draw your shades to keep the sun's rays out and seal air leaks around windows with low-cost weather stripping to keep pre-cooled air inside.

Enjoy an afternoon out - System events might be just the excuse you needed to get out of the house. Set the thermostat to 80 (or higher if you want!) and head to the mall, the library or beach, or even take in a summer movie with the kids.

Programmable thermostat - Set the air conditioning to turn on after 6 p.m. if you use a programmable thermostat.

Unplug - Unplug non-essential devices such as computers, printers, and entertainment electronics while you are home or before you leave. Power strips make it easy to turn off multiple devices with the flip of a switch

Use timers - Install plug-in or hard-wired timers on outdoor lights, pumps, dehumidifiers and other large appliances.

Use online tools - Use your MMLD web portal tools to check your meter usage data online at www.marbleheadelectric.com and click "view meter".

This is a quick and easy survey requested by the Department of Energy as part of a Smart Grid Investment Grant received by Marblehead Municipal Light Department. Your answers are protected and will be anonymous

Use a blue or black pen

START HERE

MA1. Do you own or rent your home?

Mark [X] ONE box

- [ ] Own
- [ ] Rent

MA2. What type of residence do you live in? Do you live in a…

Mark [X] ONE box

- [ ] Single-family
- [ ] Duplex or two-family
- [ ] Apartment/condo in a 2-4 unit building
- [ ] Apartment/condo in a >4 unit building
- [ ] Townhouse or row house (adjacent walls to another house)
- [ ] Mobile home, house trailer

MA3. Does your home have central air conditioning?

Mark [X] ONE box

- [ ] Yes
- [ ] No

MA4. Do you have any room air conditioners?

Mark [X] ONE box

- [ ] Yes
- [ ] No (GO TO MA6)

MA5. How many room air conditioners do you have?

[ ][ ]

MA6. Do you have a programmable thermostat?

Mark [X] ONE box

- [ ] Yes
- [ ] No (GO TO MA8)

MA7. Is the programmable thermostat currently set to automatically change temperatures during the day when no one is home?

Mark [X] ONE box

- [ ] Yes
- [ ] No

MA8. Do you have an electric clothes dryer?

Mark [X] ONE box

- [ ] Yes
- [ ] No

MA9. Including yourself, how many adults, 18 or older, currently live in your household?

[ ][ ]

MA10. And how many of these adults are over 65?

[ ][ ]

MA11. How many children under the age of 18 live in your household at least part of the week?

[ ][ ]

MA12. Do you or does anyone in your household have a chronic illness or disability that requires regular or occasional in-home medical treatment?

Mark [X] ONE box

- [ ] Yes
- [ ] No

MA13. Is there someone home Monday to Friday sometime between 1 PM and 5 PM at least one day a week?

Mark [X] ONE box

- [ ] Yes
- [ ] No

MA14. Is there anyone in your household working full time for pay?

Mark [X] ONE box

- [ ] Yes
- [ ] No (GO TO MA16)

MA15. Do you or anyone in your household have a job where you work at home at least one weekday a week rather than go into an office or some other location?

Mark [X] ONE box

- [ ] Yes
- [ ] No

TURN OVER AND CONTINUE →

MA16. Do you remember receiving information from your electric utility asking you to participate in a utility pilot program?

Mark [X] ONE box

- ☐ Yes
- ☐ No (GO TO MA18)

MA17. Was the information useful in helping you decide whether or not to participate in the pilot?

Mark [X] ONE box

- ☐ Yes
- ☐ No

MA18. What is the primary language spoken in your home?

Mark [X] ONE box

- ☐ English
- ☐ Spanish
- ☐ Chinese
- ☐ Korean
- ☐ Vietnamese
- ☐ Russian
- ☐ Other

MA19. Last year -- that is, in 2010 -- what was your total household income from all sources, before taxes?

Mark [X] ONE box

- ☐ Less than $10,000
- ☐ $10,000 to less than $20,000
- ☐ $20,000 to less than $30,000
- ☐ $30,000 to less than $40,000
- ☐ $40,000 to less than $75,000
- ☐ $75,000 to less than $90,000
- ☐ $90,000 to less than $100,000
- ☐ $100,000 to less than $150,000
- ☐ $150,000 or more

MA20. What is the LAST grade or class that you COMPLETED in school?

Mark [X] ONE box

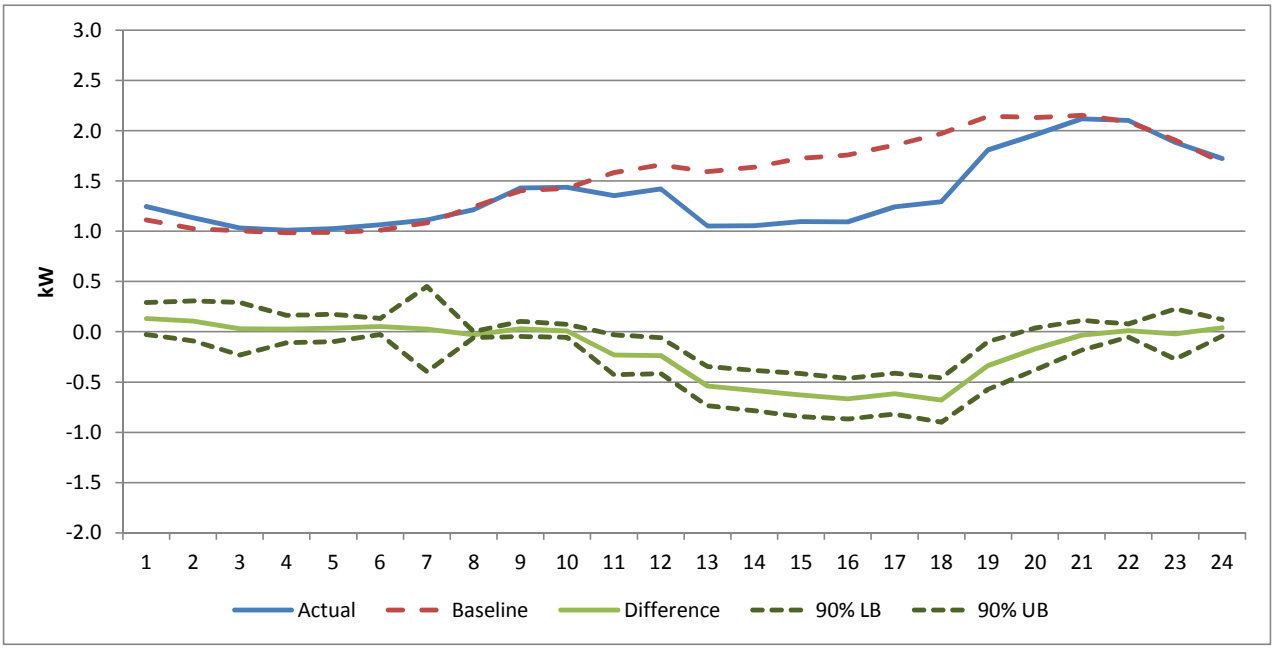
- ☐ None, or grade 1-8
- ☐ High School incomplete (grade 9-11)
- ☐ High School graduate (grade 12 or GED certificate)
- ☐ Technical, trade or vocational school AFTER high school
- ☐ Some college, no four-year degree (includes associate degree)
- ☐ College graduate (B.S., B.A., or other four-year degree)
- ☐ Post-graduate or professional schooling after college (e.g., towards a Master's degree or Ph.D; law or medical school)

APPENDIX F

ANALYSIS METHODOLOGY AND RESULTS

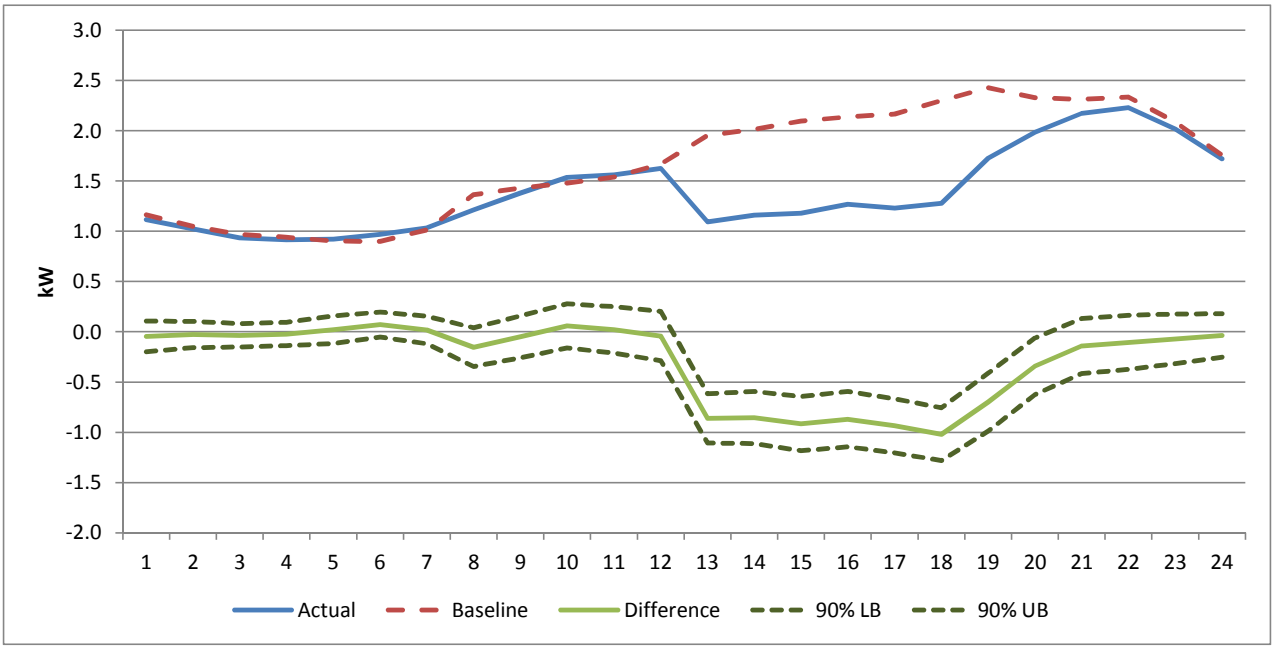
MARBLEHEAD MUNICIPAL LIGHT DEPARTMENT
INDIVIDUAL EVENT DAY IMPACT
JULY 12, 2011

	Temperature					90% CI on Impact kW	
Hour Ending	°F	Event kW	Baseline kW	Impact kW	% Impact	Lower	Upper
1	79	1.25	1.11	0.13	11.9%	(0.03)	0.29
2	78	1.13	1.03	0.11	10.5%	(0.09)	0.31
3	78	1.03	1.00	0.03	3.0%	(0.23)	0.29
4	78	1.01	0.99	0.03	2.7%	(0.11)	0.16
5	78	1.03	0.99	0.04	3.8%	(0.10)	0.17
6	77	1.06	1.01	0.05	5.3%	(0.03)	0.13
7	77	1.11	1.08	0.03	2.6%	(0.40)	0.45
8	79	1.22	1.24	(0.03)	-2.3%	(0.06)	0.00
9	82	1.43	1.40	0.03	2.1%	(0.04)	0.10
10	84	1.44	1.43	0.01	0.7%	(0.06)	0.08
11	88	1.35	1.58	(0.23)	-14.5%	(0.43)	(0.03)
12	90	1.42	1.66	(0.24)	-14.3%	(0.41)	(0.06)
13	92	1.05	1.59	(0.54)	-33.9%	(0.74)	(0.34)
14	93	1.05	1.64	(0.58)	-35.6%	(0.78)	(0.38)
15	94	1.10	1.73	(0.63)	-36.5%	(0.84)	(0.42)
16	94	1.09	1.76	(0.67)	-37.8%	(0.87)	(0.46)
17	94	1.24	1.86	(0.62)	-33.1%	(0.82)	(0.41)
18	93	1.29	1.97	(0.68)	-34.4%	(0.90)	(0.46)
19	91	1.81	2.14	(0.33)	-15.6%	(0.57)	(0.10)
20	90	1.96	2.13	(0.17)	-8.1%	(0.38)	0.04
21	88	2.12	2.15	(0.04)	-1.6%	(0.18)	0.11
22	86	2.10	2.09	0.01	0.6%	(0.05)	0.08
23	85	1.88	1.91	(0.02)	-1.1%	(0.27)	0.23
24	83	1.72	1.68	0.04	2.3%	(0.04)	0.12
Energy	**85.5**	**32.92**	**37.18**	**(4.27)**	**-11.5%**	**(7.43)**	**(1.11)**
HE 13-18 (Event Hours)	**93.3**	**1.14**	**1.76**	**(0.62)**	**-35.2%**	**(0.82)**	**(0.41)**



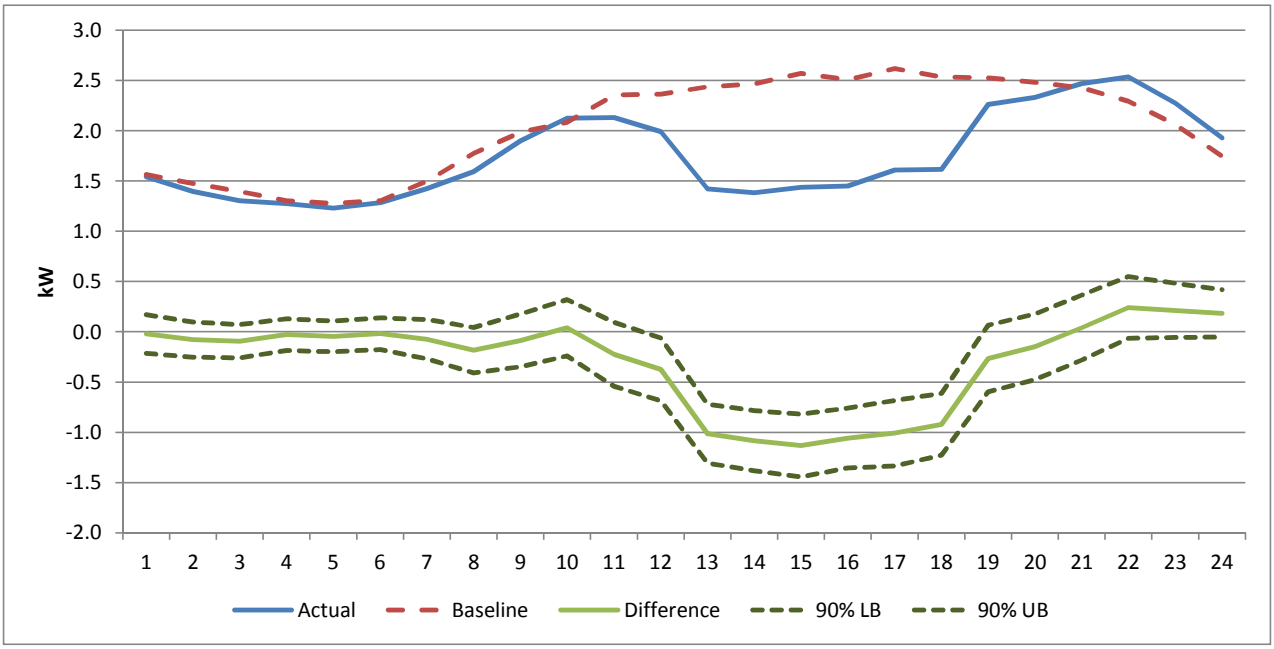
MARBLEHEAD MUNICIPAL LIGHT DEPARTMENT
INDIVIDUAL EVENT DAY IMPACT
JULY 21, 2011

	Temperature					90% CI on Impact kW	
Hour Ending	°F	Event kW	Baseline kW	Impact kW	% Impact	Lower	Upper
1	75	1.12	1.16	(0.05)	-4.0%	(0.20)	0.11
2	74	1.02	1.05	(0.03)	-2.5%	(0.16)	0.10
3	73	0.94	0.97	(0.04)	-3.6%	(0.15)	0.08
4	73	0.92	0.94	(0.02)	-2.4%	(0.14)	0.09
5	73	0.92	0.90	0.02	2.2%	(0.12)	0.16
6	73	0.97	0.90	0.07	8.0%	(0.05)	0.20
7	74	1.03	1.01	0.02	1.7%	(0.12)	0.16
8	77	1.21	1.36	(0.15)	-11.2%	(0.34)	0.04
9	82	1.38	1.43	(0.05)	-3.5%	(0.26)	0.16
10	84	1.54	1.48	0.06	4.0%	(0.16)	0.28
11	88	1.56	1.54	0.02	1.3%	(0.21)	0.25
12	91	1.63	1.67	(0.04)	-2.6%	(0.29)	0.20
13	94	1.09	1.95	(0.86)	-44.1%	(1.11)	(0.62)
14	97	1.16	2.01	(0.85)	-42.4%	(1.11)	(0.60)
15	96	1.18	2.10	(0.92)	-43.7%	(1.18)	(0.65)
16	96	1.27	2.14	(0.87)	-40.7%	(1.15)	(0.60)
17	95	1.23	2.17	(0.94)	-43.2%	(1.20)	(0.67)
18	93	1.28	2.30	(1.02)	-44.4%	(1.28)	(0.76)
19	90	1.73	2.43	(0.70)	-28.8%	(0.99)	(0.41)
20	89	1.98	2.33	(0.34)	-14.8%	(0.62)	(0.06)
21	88	2.17	2.31	(0.14)	-6.1%	(0.41)	0.13
22	85	2.23	2.33	(0.11)	-4.5%	(0.38)	0.17
23	84	2.02	2.09	(0.07)	-3.4%	(0.32)	0.18
24	83	1.72	1.76	(0.04)	-2.1%	(0.25)	0.18
Energy	**84.5**	**33.29**	**40.33**	**(7.04)**	**-17.5%**	**(11.33)**	**(2.76)**
HE 13-18 (Event Hours)	**95.2**	**1.20**	**2.11**	**(0.91)**	**-43.1%**	**(1.17)**	**(0.65)**



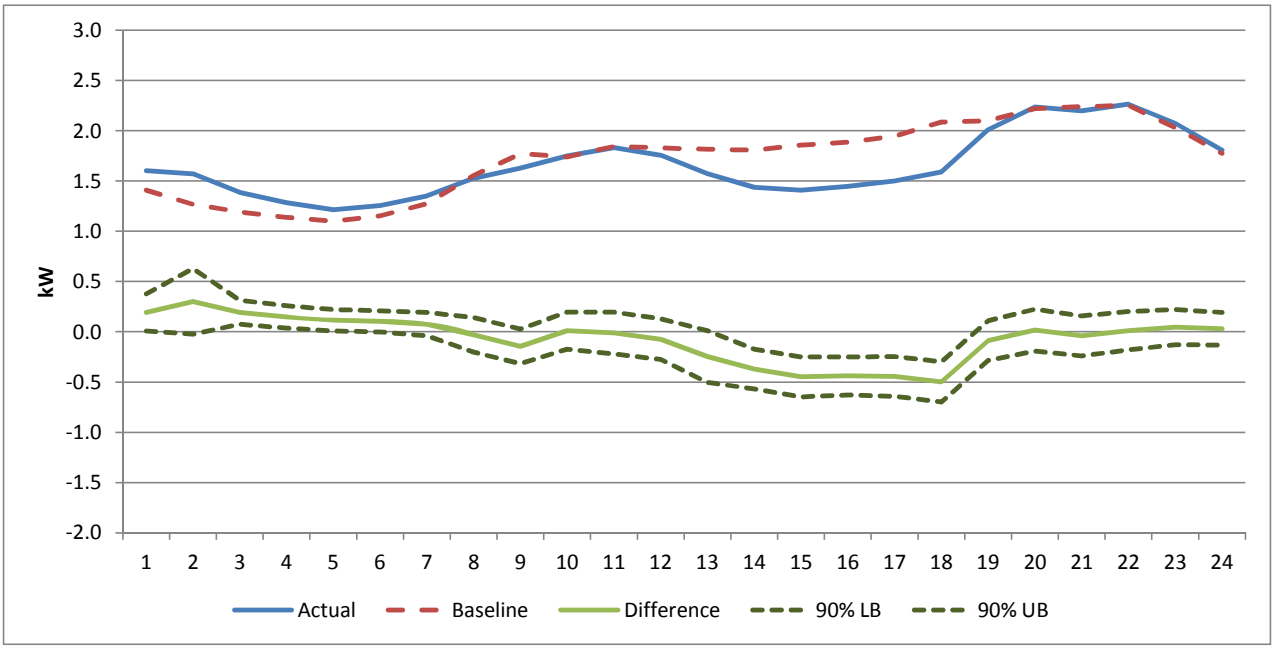
MARBLEHEAD MUNICIPAL LIGHT DEPARTMENT
INDIVIDUAL EVENT DAY IMPACT
JULY 22, 2011

	Temperature					90% CI on Impact kW	
Hour Ending	°F	Event kW	Baseline kW	Impact kW	% Impact	Lower	Upper
1	82	1.54	1.57	(0.02)	-1.4%	(0.21)	0.17
2	82	1.40	1.47	(0.08)	-5.3%	(0.25)	0.10
3	82	1.30	1.40	(0.09)	-6.7%	(0.26)	0.07
4	82	1.28	1.30	(0.03)	-2.1%	(0.18)	0.13
5	82	1.23	1.28	(0.05)	-3.5%	(0.20)	0.11
6	82	1.28	1.30	(0.02)	-1.4%	(0.18)	0.14
7	84	1.42	1.50	(0.07)	-5.0%	(0.27)	0.12
8	88	1.59	1.78	(0.18)	-10.3%	(0.41)	0.04
9	91	1.90	1.98	(0.09)	-4.4%	(0.35)	0.18
10	94	2.12	2.08	0.04	1.9%	(0.24)	0.32
11	96	2.13	2.36	(0.22)	-9.5%	(0.54)	0.09
12	98	1.99	2.36	(0.37)	-15.8%	(0.69)	(0.06)
13	98	1.42	2.44	(1.01)	-41.6%	(1.31)	(0.72)
14	100	1.38	2.47	(1.08)	-44.0%	(1.38)	(0.79)
15	102	1.44	2.57	(1.13)	-44.0%	(1.44)	(0.82)
16	102	1.45	2.51	(1.06)	-42.2%	(1.36)	(0.76)
17	102	1.61	2.62	(1.01)	-38.6%	(1.34)	(0.68)
18	101	1.61	2.53	(0.92)	-36.3%	(1.23)	(0.61)
19	99	2.26	2.53	(0.27)	-10.5%	(0.60)	0.07
20	96	2.33	2.48	(0.15)	-6.0%	(0.48)	0.18
21	93	2.47	2.43	0.04	1.7%	(0.28)	0.36
22	91	2.54	2.30	0.24	10.5%	(0.07)	0.55
23	90	2.27	2.06	0.21	10.3%	(0.06)	0.48
24	88	1.93	1.75	0.18	10.5%	(0.05)	0.42
Energy	**91.9**	**41.91**	**49.05**	**(7.14)**	**-14.6%**	**(11.12)**	**(3.17)**
HE 13-18 (Event Hours)	**100.8**	**1.49**	**2.52**	**(1.04)**	**-41.1%**	**(1.34)**	**(0.73)**



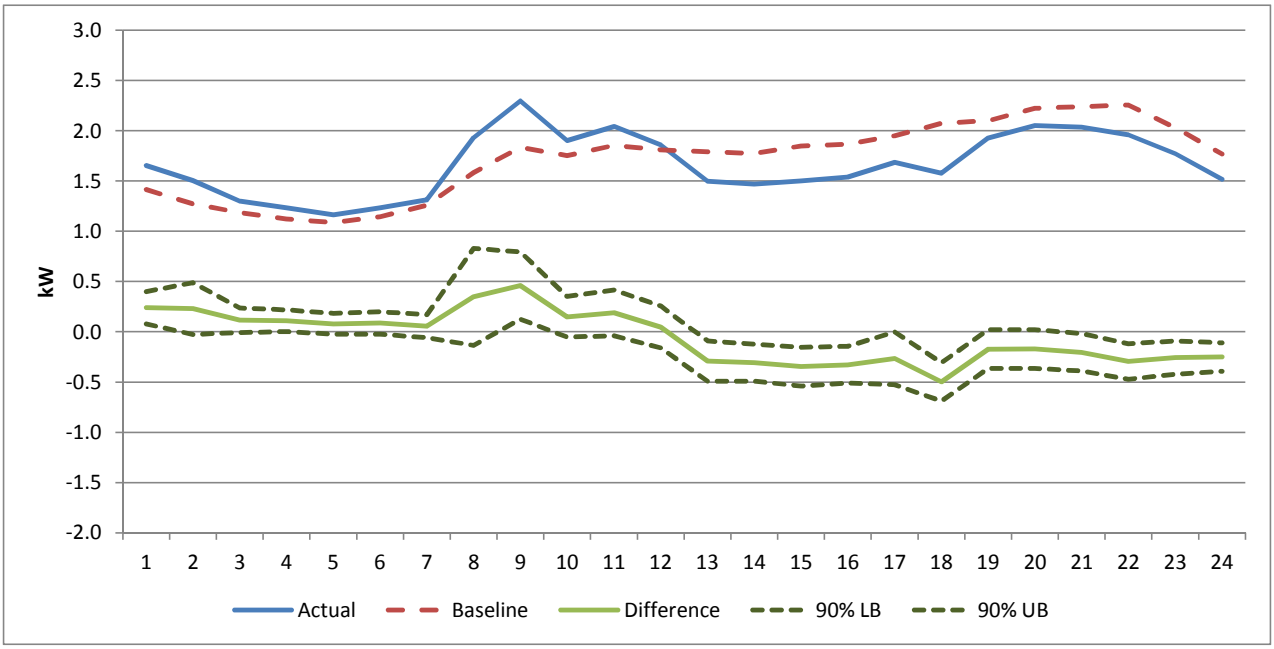
MARBLEHEAD MUNICIPAL LIGHT DEPARTMENT
INDIVIDUAL EVENT DAY IMPACT
JUNE 21, 2012

	Temperature					90% CI on Impact kW	
Hour Ending	°F	Event kW	Baseline kW	Impact kW	% Impact	Lower	Upper
1	84	1.60	1.41	0.19	13.7%	0.01	0.38
2	83	1.57	1.27	0.30	23.8%	(0.02)	0.63
3	82	1.39	1.19	0.19	16.2%	0.07	0.31
4	80	1.28	1.14	0.15	13.0%	0.04	0.26
5	80	1.22	1.10	0.12	10.5%	0.01	0.22
6	82	1.26	1.15	0.10	8.9%	(0.00)	0.21
7	84	1.35	1.27	0.08	6.0%	(0.04)	0.19
8	87	1.53	1.56	(0.03)	-1.9%	(0.20)	0.14
9	89	1.63	1.77	(0.15)	-8.2%	(0.32)	0.03
10	91	1.75	1.74	0.01	0.6%	(0.18)	0.20
11	92	1.83	1.85	(0.01)	-0.7%	(0.22)	0.20
12	93	1.76	1.83	(0.07)	-4.0%	(0.28)	0.13
13	95	1.57	1.82	(0.25)	-13.6%	(0.50)	0.01
14	93	1.44	1.81	(0.37)	-20.5%	(0.57)	(0.17)
15	91	1.41	1.86	(0.45)	-24.1%	(0.65)	(0.25)
16	92	1.45	1.89	(0.44)	-23.3%	(0.63)	(0.25)
17	93	1.50	1.95	(0.44)	-22.8%	(0.64)	(0.25)
18	93	1.59	2.09	(0.50)	-23.8%	(0.70)	(0.30)
19	92	2.01	2.10	(0.09)	-4.2%	(0.29)	0.11
20	89	2.24	2.22	0.02	0.7%	(0.19)	0.23
21	88	2.20	2.24	(0.04)	-1.8%	(0.24)	0.16
22	87	2.26	2.25	0.01	0.5%	(0.18)	0.20
23	86	2.08	2.03	0.05	2.2%	(0.13)	0.22
24	85	1.81	1.78	0.03	1.7%	(0.13)	0.19
Energy	**88.0**	**39.70**	**41.30**	**(1.59)**	**-3.9%**	**(2.49)**	**3.92**
HE 13-18 (Event Hours)	**92.8**	**1.49**	**1.90**	**(0.41)**	**-21.5%**	**(0.61)**	**(0.20)**



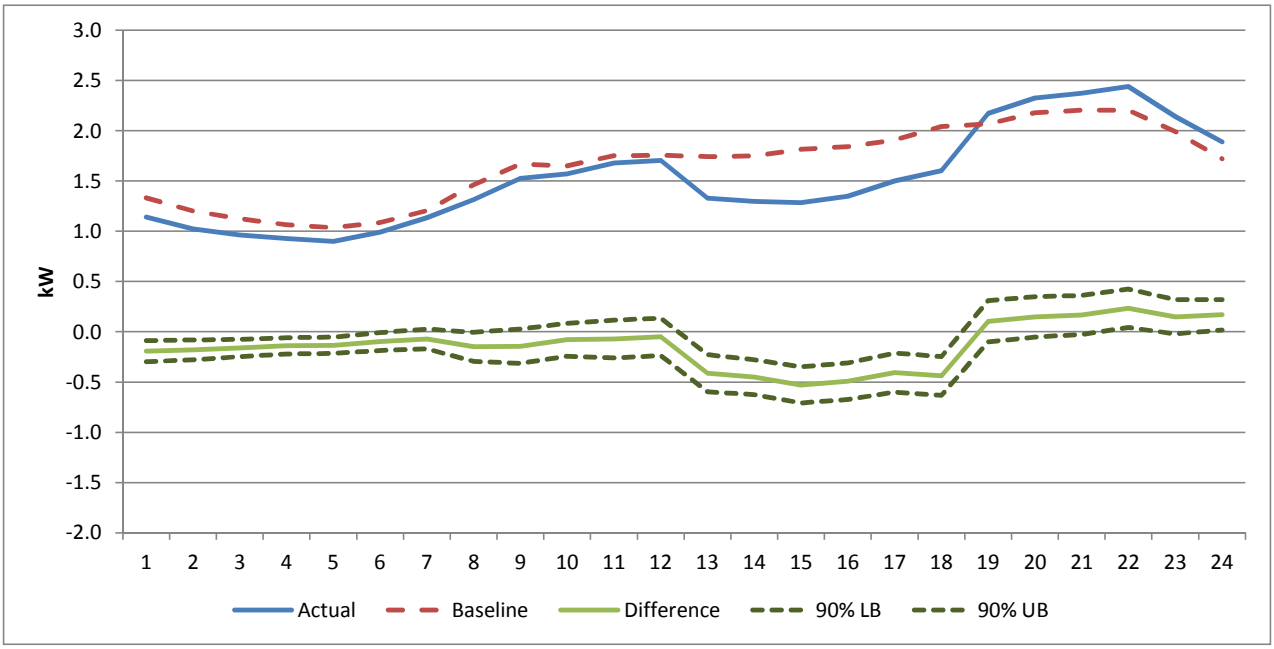
MARBLEHEAD MUNICIPAL LIGHT DEPARTMENT
INDIVIDUAL EVENT DAY IMPACT
JUNE 22, 2012

	Temperature					90% CI on Impact kW	
Hour Ending	°F	Event kW	Baseline kW	Impact kW	% Impact	Lower	Upper
1	84	1.66	1.42	0.24	16.9%	0.08	0.40
2	82	1.50	1.27	0.23	18.2%	(0.03)	0.49
3	81	1.30	1.19	0.11	9.7%	(0.01)	0.24
4	80	1.23	1.12	0.11	9.7%	0.00	0.22
5	80	1.16	1.09	0.08	7.3%	(0.02)	0.18
6	82	1.23	1.14	0.09	7.6%	(0.02)	0.20
7	84	1.31	1.26	0.06	4.4%	(0.06)	0.17
8	88	1.93	1.58	0.35	21.9%	(0.14)	0.83
9	89	2.30	1.84	0.46	25.1%	0.13	0.80
10	90	1.90	1.75	0.15	8.5%	(0.05)	0.35
11	91	2.04	1.85	0.19	10.2%	(0.04)	0.42
12	94	1.86	1.81	0.05	2.6%	(0.16)	0.25
13	94	1.50	1.79	(0.29)	-16.3%	(0.49)	(0.09)
14	94	1.47	1.78	(0.31)	-17.3%	(0.49)	(0.12)
15	93	1.50	1.85	(0.35)	-18.7%	(0.54)	(0.15)
16	91	1.54	1.87	(0.33)	-17.6%	(0.51)	(0.15)
17	90	1.68	1.95	(0.26)	-13.6%	(0.53)	(0.00)
18	79	1.58	2.07	(0.50)	-24.0%	(0.69)	(0.31)
19	75	1.93	2.10	(0.17)	-8.2%	(0.37)	0.02
20	74	2.05	2.22	(0.17)	-7.7%	(0.36)	0.02
21	76	2.04	2.24	(0.20)	-9.1%	(0.39)	(0.02)
22	76	1.96	2.26	(0.30)	-13.1%	(0.47)	(0.12)
23	77	1.77	2.03	(0.26)	-12.7%	(0.42)	(0.09)
24	75	1.52	1.77	(0.25)	-14.2%	(0.39)	(0.11)
Energy	**84.1**	**39.96**	**41.24**	**(1.28)**	**-3.1%**	**0.08**	**0.40**
HE 13-18 (Event Hours)	**90.2**	**1.54**	**1.88**	**(0.34)**	**-18.0%**	**(0.54)**	**(0.14)**



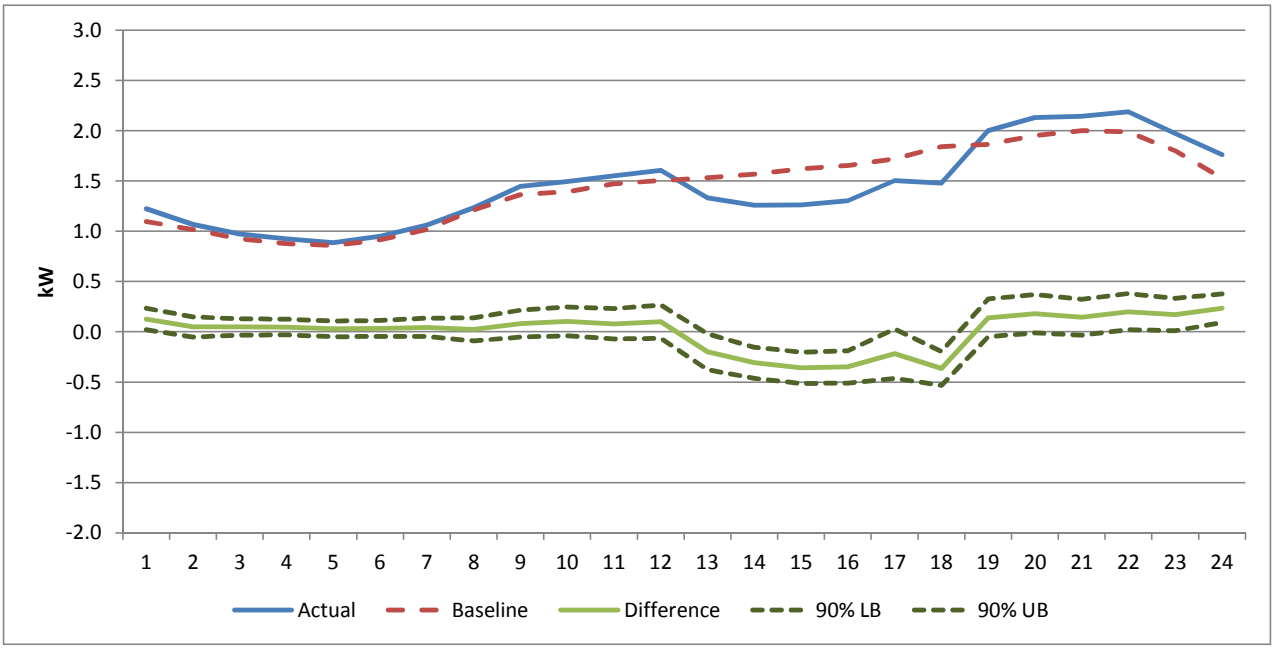
MARBLEHEAD MUNICIPAL LIGHT DEPARTMENT
INDIVIDUAL EVENT DAY IMPACT
JULY 17, 2012

	Temperature					90% CI on Impact kW	
Hour Ending	°F	Event kW	Baseline kW	Impact kW	% Impact	Lower	Upper
1	79	1.14	1.33	(0.19)	-14.4%	(0.30)	(0.09)
2	78	1.02	1.20	(0.18)	-14.9%	(0.28)	(0.08)
3	77	0.96	1.13	(0.16)	-14.3%	(0.25)	(0.07)
4	76	0.93	1.07	(0.14)	-13.1%	(0.22)	(0.06)
5	76	0.90	1.04	(0.13)	-13.0%	(0.22)	(0.05)
6	79	0.99	1.09	(0.10)	-8.9%	(0.19)	(0.01)
7	81	1.13	1.21	(0.07)	-5.9%	(0.17)	0.03
8	84	1.31	1.46	(0.15)	-10.2%	(0.29)	(0.01)
9	88	1.53	1.67	(0.14)	-8.6%	(0.31)	0.03
10	90	1.57	1.65	(0.08)	-4.8%	(0.24)	0.09
11	91	1.68	1.75	(0.07)	-4.2%	(0.26)	0.12
12	93	1.71	1.76	(0.05)	-2.9%	(0.24)	0.14
13	95	1.33	1.74	(0.41)	-23.6%	(0.60)	(0.23)
14	95	1.30	1.75	(0.45)	-25.8%	(0.63)	(0.28)
15	96	1.29	1.81	(0.53)	-29.1%	(0.71)	(0.35)
16	94	1.35	1.84	(0.49)	-26.7%	(0.67)	(0.31)
17	92	1.50	1.91	(0.41)	-21.3%	(0.60)	(0.21)
18	91	1.60	2.04	(0.44)	-21.5%	(0.63)	(0.25)
19	89	2.17	2.07	0.10	5.1%	(0.10)	0.31
20	87	2.33	2.18	0.15	6.8%	(0.05)	0.35
21	86	2.37	2.21	0.17	7.5%	(0.03)	0.36
22	85	2.44	2.21	0.23	10.6%	0.04	0.42
23	85	2.14	1.99	0.15	7.5%	(0.02)	0.32
24	86	1.89	1.72	0.17	9.8%	0.02	0.32
Energy	**86.4**	**36.58**	**39.81**	**(3.23)**	**-8.1%**	**(3.86)**	**2.02**
HE 13-18 (Event Hours)	**93.8**	**1.39**	**1.85**	**(0.45)**	**-24.6%**	**(0.64)**	**(0.27)**



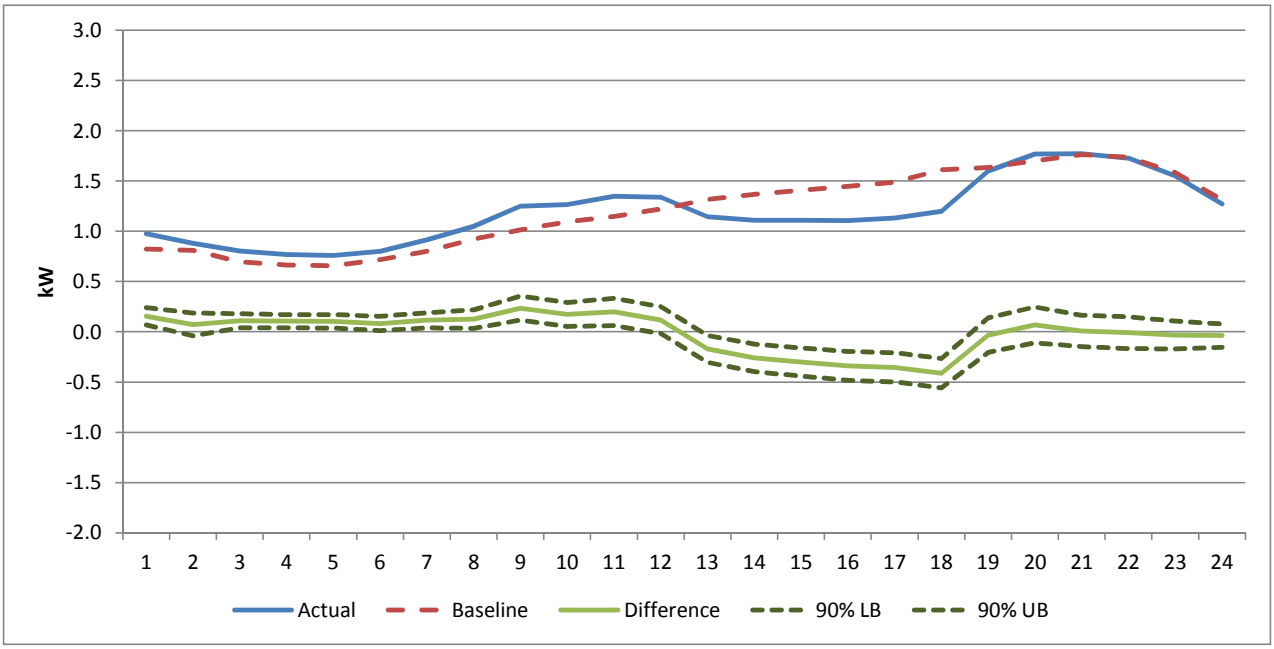
MARBLEHEAD MUNICIPAL LIGHT DEPARTMENT
INDIVIDUAL EVENT DAY IMPACT
AUGUST 3, 2012

	Temperature					90% CI on Impact kW	
Hour Ending	°F	Event kW	Baseline kW	Impact kW	% Impact	Lower	Upper
1	75	1.22	1.10	0.13	11.6%	0.02	0.23
2	73	1.07	1.02	0.05	4.8%	(0.05)	0.15
3	73	0.97	0.93	0.05	5.2%	(0.03)	0.13
4	73	0.93	0.88	0.05	5.4%	(0.03)	0.13
5	72	0.89	0.86	0.03	3.3%	(0.05)	0.11
6	73	0.95	0.92	0.03	3.6%	(0.05)	0.11
7	76	1.06	1.02	0.04	4.3%	(0.05)	0.13
8	80	1.23	1.21	0.02	1.9%	(0.09)	0.14
9	84	1.45	1.37	0.08	5.9%	(0.05)	0.21
10	87	1.50	1.39	0.10	7.5%	(0.04)	0.25
11	87	1.55	1.47	0.08	5.4%	(0.07)	0.23
12	90	1.61	1.50	0.10	6.7%	(0.06)	0.27
13	91	1.33	1.53	(0.20)	-12.9%	(0.38)	(0.02)
14	91	1.26	1.57	(0.31)	-19.7%	(0.46)	(0.15)
15	92	1.26	1.62	(0.36)	-22.1%	(0.51)	(0.20)
16	91	1.30	1.65	(0.35)	-21.2%	(0.51)	(0.19)
17	90	1.50	1.72	(0.22)	-12.6%	(0.46)	0.03
18	88	1.48	1.84	(0.36)	-19.7%	(0.53)	(0.19)
19	84	2.00	1.86	0.14	7.4%	(0.05)	0.33
20	84	2.13	1.95	0.18	9.2%	(0.01)	0.37
21	83	2.14	2.00	0.14	7.2%	(0.03)	0.32
22	81	2.19	1.99	0.20	10.1%	0.02	0.38
23	80	1.97	1.80	0.17	9.5%	0.01	0.33
24	79	1.76	1.53	0.23	15.2%	0.09	0.38
Energy	**82.4**	**34.76**	**34.72**	**0.03**	**0.1%**	**(0.35)**	**4.92**
HE 13-18 (Event Hours)	**90.5**	**1.36**	**1.66**	**(0.30)**	**-18.1%**	**(0.48)**	**(0.12)**



MARBLEHEAD MUNICIPAL LIGHT DEPARTMENT
INDIVIDUAL EVENT DAY IMPACT
AUGUST 17, 2012

	Temperature					90% CI on Impact kW	
Hour Ending	°F	Event kW	Baseline kW	Impact kW	% Impact	Lower	Upper
1	72	0.98	0.82	0.15	18.7%	0.07	0.24
2	71	0.88	0.81	0.07	9.0%	(0.04)	0.19
3	70	0.80	0.70	0.11	15.7%	0.04	0.18
4	70	0.77	0.66	0.11	16.0%	0.04	0.17
5	70	0.76	0.66	0.10	15.6%	0.04	0.17
6	70	0.80	0.72	0.08	11.4%	0.01	0.15
7	70	0.92	0.80	0.12	14.4%	0.04	0.19
8	75	1.05	0.92	0.13	13.6%	0.03	0.22
9	80	1.25	1.01	0.24	23.2%	0.12	0.35
10	82	1.27	1.09	0.17	15.7%	0.05	0.29
11	84	1.35	1.15	0.20	17.2%	0.06	0.33
12	85	1.34	1.22	0.12	9.5%	(0.02)	0.25
13	85	1.15	1.32	(0.17)	-13.0%	(0.31)	(0.04)
14	85	1.11	1.37	(0.26)	-18.9%	(0.40)	(0.12)
15	86	1.11	1.41	(0.30)	-21.3%	(0.44)	(0.16)
16	85	1.11	1.45	(0.34)	-23.4%	(0.48)	(0.19)
17	82	1.13	1.49	(0.35)	-23.8%	(0.50)	(0.21)
18	81	1.20	1.61	(0.41)	-25.7%	(0.56)	(0.27)
19	80	1.60	1.63	(0.03)	-2.0%	(0.20)	0.14
20	78	1.77	1.70	0.07	4.0%	(0.11)	0.25
21	79	1.77	1.76	0.01	0.5%	(0.15)	0.16
22	75	1.73	1.74	(0.01)	-0.5%	(0.17)	0.15
23	74	1.55	1.58	(0.03)	-2.0%	(0.17)	0.11
24	72	1.27	1.31	(0.04)	-2.9%	(0.15)	0.08
Energy	**77.5**	**28.65**	**28.93**	**(0.28)**	**-1.0%**	**(0.24)**	**4.20**
HE 13-18 (Event Hours)	**84.0**	**1.13**	**1.44**	**(0.31)**	**-21.3%**	**(0.45)**	**(0.17)**



APPENDIX G

DATA DESCRIPTION

FORMAT OF RAW ENERGY USE DATA

lname	fname	account	device_tstamp	ekw	kwh	volts
DOE	JOHN	1234567	7/1/2011 2:06	0.79	245.8993	239
DOE	JOHN	1234567	7/1/2011 2:27	0.597	246.1878	239
DOE	JOHN	1234567	7/1/2011 2:48	0.925	246.5114	240
DOE	JOHN	1234567	7/1/2011 3:09	0.904	246.8331	240
DOE	JOHN	1234567	7/1/2011 3:30	0.643	247.0888	242
DOE	JOHN	1234567	7/1/2011 3:51	0.63	247.3552	240