

Customer Use of Web-based Energy Usage Data – An Evaluation of California’s Real-Time Energy Metering Program

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ABSTRACT

As a result of funding authorized by the California state legislature, advanced automated meter reading devices have been installed for nearly all customer accounts in the state with billing demands greater than 200 kW. Customer accounts that did not already face time-of-use (TOU) prices were converted to a TOU rate. This paper reports some preliminary findings from an ongoing qualitative and quantitative evaluation of the metering program. The primary objective of the qualitative evaluation is to develop “lessons learned” about the metering technologies, the installation process, communication of information to customers, and customers’ perception and use of the timely information on their energy usage patterns. The *quantitative* evaluation is designed to measure any changes in customers’ demand and energy consumption that can be attributed to the installation of the meters, the availability of new information on their energy usage patterns, and/or the conversion to a TOU price structure.

Introduction

In March 2001, the California Assembly (in AB29X) authorized \$35 million to for the purpose of installing advanced automatic meter reading (AMR) devices for all customer accounts with peak demands greater than 200kW in the state. The original design for the real-time energy metering (RTEM) program was to fund meter installations only for the three major privately-owned utilities. However, the program was ultimately expanded to include municipal and other public utilities. The funding was to be administered by the California Energy Commission (CEC), which decided to install metering systems capable of recording hourly interval data, and communicating the data remotely to the utilities on a timely basis, so that each customer’s daily load data could be made available to them on a secure web site.¹

Most of the eligible customers already faced a time-of-use (TOU) tariff; however, those that did not were converted to a TOU rate. Customers were also provided a package of information by their respective utility with instructions for accessing a web site to obtain timely information on their hourly electricity consumption and methods for taking advantage of that information. Each utility designed its own web site.

The metering expenditures were approved during the period of crisis in the state’s electric power industry, and the original intent of the metering was to support the development of real-time pricing (RTP) rate designs, influence customer electricity usage patterns, and encourage demand response, particularly during periods of high wholesale prices. To date, no extensive RTP program has been approved. However, the infrastructure is now in place, and customers have new timely information on their electricity usage.

¹ Most customer accounts with maximum demands greater than 500 kW already had interval meters installed in their facilities. However, many needed upgrades to install the communication equipment needed to allow remote data retrieval and posting on the web site.

Status

To date, nearly all of the expected 25,000 real-time energy meters (RTEM) have been installed across the state. Nearly half of the meters (12,000) were installed at Southern California Edison (SCE), and more than a quarter (7,800) at Pacific Gas & Electric (PG&E). San Diego Gas & Electric (SDG&E) had already received commission approval to install advanced meters for customers in the 100 to 300 kW range, so it used CEC funding to install approximately 1,400 meters for customers > 300 kW. The remaining meters were installed at municipal utilities, including Los Angeles Department of Water and Power (LADWP), with 3,400, Sacramento Municipal Utility District (SMUD), with 300, and the Southern California Public Power Authority (SCPPA) and Northern California Power Agency (NCPA), which together received approximately 350.

This paper describes preliminary results of a qualitative and quantitative evaluation of the RTEM program. The *qualitative* evaluation is designed to develop “lessons learned” about the metering technologies, the installation process, the communication of information to customers, and customers’ perception and use of the timely information on their energy usage patterns. The *quantitative* evaluation is designed to measure any changes in customers’ demand and energy consumption that can be attributed to the installation of the meters, the availability of new information on their energy usage patterns, and/or the conversion to a TOU price structure.

Web Site Features

Each utility designed its own unique web site interface. The primary functions of the web sites include viewing load data for particular time periods, comparing load data for a particular account (meter) across various possible days or time periods, or for a selected set of accounts across a particular time period, and downloading data and reports to a user’s own computer. PG&E’s web site serves as a useful example. Early every morning, PG&E downloads data in 15-minute intervals for each RTEM customer for the previous day. After registering for an account number, customers may view their load data via a Time Interval Report tool, which uses drop-down menus to allow customers to select a meter and report interval. For more comprehensive analysis, customers can use the Multi-Point Trend Report to compare data for multiple meters and time periods, and also show temperature conditions.

Evaluation Methods

Information to date for the qualitative evaluation has been obtained through telephone interviews with utility project managers and customer account executives. Telephone interviews with samples of customers are scheduled, and a web-based survey is being considered. Research topics include customer perception of the meter installation process, the information package provided by their utility, the instructions for accessing their data on the web site, customers’ use of their energy usage information, and any load-change actions they have taken.

The quantitative evaluation will involve analysis of individual customer hourly load data for a period prior to (*e.g.*, summer 2001) and subsequent to (*e.g.*, summer 2002) the installation of the RTEM equipment, which took place largely from Fall 2001 through Spring 2002. The load data analysis will include both *simple comparisons* of average daily loads by day-type (*e.g.*, weekdays with maximum temperatures in a given range) before and after RTEM installation, as well as *econometric analyses* to take into account the effect of various factors that may have changed between 2001 and 2002, including the switching of some customers to TOU pricing.

Interviews with Utility Project Managers

Christensen Associates conducted telephone interviews with the RTEM program managers at each of the utility organizations that have participated in the RTEM program. These include the three

major privately-owned utilities, the two large municipal utilities (LADWP and SMUD), and SCPPA and NCPA. The interviews were conducted using an open-ended discussion guide that was designed to allow the respondents to tell their story about their participation in the RTEM program. The primary purpose of these interviews was to identify “lessons learned” by program administrators.

Interviews with Customer Account Executives

We also conducted interviews with several key account representatives at three of the utilities. The purpose of these interviews was to obtain a perspective on RTEM customer reactions to the program – in particular how customers were reacting to access to electricity usage data collected by the interval meters. Names of customer representatives were provided by relevant RTEM project managers.

Next Steps – Customer Interviews

We plan a two-stage process of collecting information directly from customers of several of the participating utilities. The first stage will include telephone interviews with a relatively small sample of customers from each of the major utilities. Identification of the appropriate individuals to interview may be accomplished by using the RTEM contact lists maintained by each utility, or by recommendation of selected customer account executives. The second stage will involve a web-based survey of a broader range of customers at several of the participating utilities.

Like focus groups, the telephone interviews will allow us to identify any major customer-perceived issues about the RTEM program, and develop a characterization of typical customer use of and response to the available load data. However, it will not allow us to make a more quantitative assessment of customer reaction to the RTEM program, particularly any differentiation across customer types, such as can be obtained from a survey of a larger and broader group of customers.

Current plans call for conducting a web-based survey of representative samples of RTEM customers across several of the utilities. The primary objective of the survey will be to develop information on customers’ perception of the value of timely access to their usage data, their suggestions for additional features or capabilities of the data interface, their primary use of the data, any changes in operations at their site in response to either the usage data or the shift to a TOU rate, and their reaction to potential dynamic pricing programs, such as RTP and critical peak TOU pricing, or demand response programs.

Next Steps – Quantitative Evaluation

In this portion of the evaluation, we plan to analyze the hourly usage data of samples of RTEM customers to determine whether any changes in their energy consumption can be detected that can be attributed to the presence of the new metering and communication equipment, and their timely access to their consumption data. We are scheduled to receive load research sample data shortly from at least one of the IOUs for the summer of 2002, after the meter installation, and for the preceding two years.

We plan to conduct a number of econometric analyses of the data to explore possible usage changes as a result of the RTEM program. These will involve the construction of appropriate explanatory variables to control for as many other factors as possible that might have affected the customers’ usage patterns. These include weather conditions, level of economic activity, frequency with which customers use their web account to access the meter data, changes in energy prices (in particular, shifts to TOU rates for those customers not already facing TOU prices), and participation in demand response programs. We plan to explore various degrees of time resolution on the data, including monthly, daily, hourly, and peak demand.

Findings from Interviews with Utility Project Managers

Our interviews with the utility project managers produced information on their views on the RTEM project overall objectives, their perspective on customers' reactions to the meters and the access to usage data via website, and any roadblocks they experienced in implementing the project.

Perceived Program Motivation and Goals

At the beginning of the interviews, we asked respondents for their perception of the primary reasons for undertaking the RTEM project. Nearly all identified difficulties in the California power markets during 2000/2001 as the driving factor behind the establishment of the RTEM program. Many of the respondents mentioned their experience with earlier efforts of the CEC to implement demand response programs for large commercial and industrial customers. Those mentioning this earlier effort tended to believe that the previous effort helped them in accomplishing the RTEM project. The previous CEC program allowed utilities to develop expertise in understanding and implementing advanced metering programs and some of this knowledge proved useful in implementing the RTEM program. Items that were typically mentioned included familiarity with metering and communications technologies, and familiarity with potential vendors.

Respondents typically fell into two groups when discussing perceived project goals. The first group tended to define the project goals in terms of accomplishing the specified number of interval meter installations and fulfilling the terms of the contract with CEC. All respondents felt that the program either had, or soon would, accomplish the narrowly defined goal of achieving the specified number of installed interval meters.

A second group of respondents tended to define the project goals in terms of enhancing customers' ability to optimize their electricity use. Several respondents offered examples of what they consider program benefits beyond mere meter installation. Examples included the following:

- *Resolution of bill disputes:* The detailed data provided by the meters allowed utility representatives to better explain customer bills.
- *Identification of energy efficiency opportunities:* Utility representatives and/or customers can use the detailed meter data to identify energy efficiency opportunities.
- *Reduction of Bills:* Some customers may be able to use the detailed meter data to identify ways in which they can modify operations to reduce impacts of demand charges. Typically these opportunities were associated with modifications of a customer's operation to reduce demand charges.
- *Compare and explain relative energy costs across similar facilities:* Some customers had several meters installed. Some of these customers indicated that they were now able to better compare energy use across facilities.

Reported Customer Uses of Metered Data

Most respondents were only able to provide limited specific examples of customers taking advantage of the capabilities of the web sites and access to their usage data. In some cases, respondents were aware of specific actions undertaken by the customers, but in most cases they indicated that they had only second-hand knowledge of customers' use of the usage data. Specific examples reported by respondents included the following:

- One respondent indicated that he/she knew specifically of five customers that had made significant changes in energy use because of the access to their usage data.
- One respondent indicated that "feedback from the customer indicates that they have made changes."

- Another respondent indicated that feedback from customers was positive. This respondent said anecdotal evidence indicated that one customer had used the usage data to help prepare an end-of-year energy budget, and had been able to preserve several jobs as a result. Another customer reported using the energy usage data to develop a company energy policy.

One indicator of the potential value of the data comes from comments by several respondents that some customers requested that all of their current meters be replaced with interval meters. One respondent noted that one customer with multiple facilities liked the information provided through the program so much that they indicated a desire to have all of their meters enrolled in the program. In general, these requests could not be accommodated since the other accounts did not meet the program requirements of a minimum 200 kW demand. However, the existence of these requests provides evidence that at least some customers are finding the data sufficiently useful to believe it would be valuable to have this information for all their accounts.

One respondent reported seeing a significant increase in traffic on its web site during a Stage Two Energy Emergency. This was taken as a possible sign that customers were looking at their data to help change their energy use during an emergency period. Another respondent indicated that a measure of success for his company was that they wanted to implement the program without having any customers contact the Public Utilities Commission with a complaint or concern about the program – a goal that was very nearly accomplished to the best of the respondent’s knowledge. The program did, however, generate three calls to the utility with concerns about mandatory changes to TOU rates that accompanied the new meters.

While the respondents were able to cite some specific examples of how customers were using the data collected by the interval meters, most respondents indicated that it appears that many customers do not actually use the website to obtain usage data. Other comments reflected some doubts about customers’ use of the interval data, or occasional technical problems in implementing the web site. Regarding the number of customers retrieving data from website, one respondent noted, “It just seems to be a product adoption process. People have lots of other things to think about.” This respondent also mentioned that at some times the system seemed to “lock-up” due to some possible problem at the utility end of the communication process. The respondent reported that this issue has been addressed by increasing the frequency with which the communications process was monitored. This allowed problems to be quickly detected and resolved.

Several respondents identified the issue of non-local corporate decision making as a possible barrier to the effective use of usage data by customers. That is, if energy decisions for a large number of facilities (perhaps scattered around the country) are made in a central corporate office, then the decision-maker might have less interest in basing those decisions on usage data (however detailed) for one facility. On the other hand, at least one respondent noted that the ability to access the data from anywhere in the country was appealing to at least one of their customers. “It was great that people in Atlanta could look up the data for their facility in XXXXX.”

Program Roadblocks Encountered

Respondents reported various difficulties experienced in implementing the RTEEM program. One barrier involved difficulties associated with use of telephone lines as the primary means of communications. These difficulties, when mentioned, were typically related to installation difficulties, including the following examples:

- awkward locations of existing telephone lines relative to the meter location,
- difficulties in coordinating meter installation and phone line installation
- difficulties in activating phone lines
- a long time frame required for installation of phone lines.

A few respondents mentioned minor problems with customers that were reluctant to allow physical access for the meter installation. These customers were either suspicious about being moved to a new rate, had worries about possible interruption of service, or had concern about security issues.

Another, and perhaps more subtle, roadblock involved the changing nature of the electricity market in California. One respondent noted that the program was established during a period of “crisis” and that now this crisis had passed. The lack of a sense of crisis may reduce the desire of some customers to closely manage their electricity use. In addition, one respondent noted that the slowing economy has tended to reduce the revenues of some utilities. As a result, the incentives for utilities to aggressively promote the energy and demand savings potential that might be realized by participants with accounts enrolled in the RTEM program may not be as strong as in previous years.

In a similar vein, at least one respondent indicated that customers were currently less worried about high electric bills than they were about high natural gas bills. The implication of this comment was that the lessened sense of “crisis” in the electricity market reduced the value of information about usage to the respondents.

Finally, several respondents mentioned the lack of real-time-prices as an impediment to accomplishing the RTEM project goals in the broadest sense. Even so, these respondents indicated that the installation of the metering and communications technology represented a significant infrastructure investment that would be available to support RTP in the future. While not a direct roadblock, the lack of wide spread real-time prices was mentioned by several respondents as a factor that tended to reduce the benefits that might be obtained from the RTEM program. Respondents mentioning this issue tended to believe that while TOU rates provided some economic incentive to change electricity usage patterns, the presence of real-time prices would greatly enhance incentives to modify energy usage patterns.

Interviews with Customer Account Executives

In general, the interviews with customer account executives confirmed what was heard during the project manager interviews. Many customers receiving meters appear to be relatively indifferent to the RTEM program. This indifference could be explained in terms of two factors: Either customers don’t perceive significant benefits from intensively monitoring their energy usage, or they aren’t aware of how the usage data might be used to reduce their electricity costs. If the latter is the primary factor, it suggests that additional efforts aimed at educating customers about how they might benefit from the usage data would enhance the program benefits. As an example, one account representative prepared usage reports based on data collected as part of the RTEM program and then reviewed these reports with customers. One customer indicated that his/her operation was automatically controlled by an energy management system that shut off equipment as needed. The data from the interval meter suggested that the energy management system perhaps was not functioning in the manner in which the customer thought it was because the interval meter showed some substantial loads in the very early morning hours. In the words of the account representative, the review of actual usage data was “a real eye-opener for some of the customers.”

When asked about customer usage of the website, the account executives indicated that to the best of their knowledge most customers did not visit the website to collect and analyze usage data. For the smaller number of customers who the account executives believe do access the data, they indicated that intensity of use of the website varied across customers. Some customers visited frequently (for example, daily or weekly), while others only viewed their usage data on a less frequent basis. The account executives were able to identify specific instances in which RTEM customers were able to use load data to reduce demand charges and to tie energy usage patterns to specific processes or equipment use.

The account executives reported that customers viewing their usage data generally expressed satisfaction with the RTEM program. One account representative cited a specific RTEM customer that

liked the easy access provided to their energy usage data. After completion of the RTEM program this customer added another facility and asked if they could pay to have an interval meter installed on the new facility.

The customers using the website apparently used their energy usage data in a number of ways. As might be expected, the account executives mentioned some specific examples of customers using the data to actively manage their energy use. For example, one account representative reported that a school district looked at usage data to identify load associated with air conditioning, and then evaluated the possible merits of adjusting the cooling program to reduce energy use.

Interestingly, some uses of the RTEM data may not be motivated solely by a desire of reduce energy bills. For example, the use of the RTEM data to settle billing disputes was mentioned by one account executive. Likewise, another account representative mentioned that a manufacturer used the load data to tie levels of electricity usage to specific time periods in which particular “rush” orders were being prepared. Another manufacturer was able to identify a facility that had low loads during periods when the load was expected to be high. The discrepancy between actual use and expected use allowed the manufacturer to identify a possible problem with employees at a specific facility.

The only negative customer reaction to the RTEM project involved the switch to TOU rates. One customer representative reported that a few customers expressed concerns that the mandatory switch to a TOU rate that accompanied the meter would result in a higher electricity bill.

Lessons Learned

Some aspects of the RTEM program were unique due to the extremely tight timeline imposed by the crisis atmosphere that produced the program in the first place. However, some general conclusions regarding lessons learned may be drawn from the respondents’ comments. First, close attention should be paid to the testing of the interface between the meters, the communications system, and the utility data management system to avoid difficulties during rollout.

Second, the apparent concerns on the part of at least some customers about being transferred to a TOU rate suggests an area of concern if a similar type of metering project were to be undertaken for groups of smaller customers. Mandatory assignment to TOU tariffs would likely cause bill increases for some customers unless modifications to the rate design were made to insure some degree of revenue neutrality at each customer’s pre-participation pattern of electricity usage.

Relatively little information was obtained from the RTEM program managers about customer use of the web sites to obtain information about their energy usage patterns, or what actions they may have taken as a result of having access to this data. Some information of this type was developed in subsequent interviews with a few customer account representatives. However, it appears that comprehensive information on how many customers are actually accessing energy usage data, how valuable they find the data, and how many are modifying their energy usage patterns as a result can only be collected through interviews or surveys of groups of customers.

Although the intended development of dynamic pricing products such as RTP has not yet occurred, the RTEM project has provided the infrastructure necessary to support a range of potential dynamic retail pricing and demand response programs. These have the potential to produce price responsive demand reductions during periods of high wholesale costs and reliability constraints that will be valuable to the California electricity markets.

