Summer Initiative
Expansion of the AB970
Small Commercial Demand-Responsiveness Pilot Program

Study ID: SCE0239.02

Process Evaluation of the
2004 SCE Energy$mart Thermostat[SM] Program
Summer Initiative Expansion

November 18, 2005

Prepared for:

Southern California Edison
2244 Walnut Grove Avenue, Quad 1A
Rosemead, CA 91770

Prepared by:

RLW Analytics, Inc.
1055 Broadway Suite G
Sonoma, CA 95476
707-939-8823

Acknowledgements

This 2004 AB970 SCE Energy$mart Thermostat[SM] Program process evaluation was performed on behalf of Southern California Edison Company and was managed by Mark S. Martinez, manager of load control programs. RLW would like to thank Mr. Martinez for his contributions and commitment to the success of the evaluation.

Many others contributed their time and expertise to this evaluation. Thanks to all of the SCE E$T staff who provided a great deal of information to us including Myrna Saenz, Crystal Marquez, David Ritchie, and Diana Miller. We'd also like to thank all of the program contractors who were very cooperative in explaining their program processes to us including Joe O'Malley, MDI, Dale Conklin, Honeywell DMC, and Moira Buckley, Carrier.

RLW would also like to thank our subcontractors. Chris Ann Dickerson and Josh Bode of Freeman Sullivan contributed the cost effectiveness chapter to this report. Their team had the difficult tasks of determining the most appropriate benefit (avoided cost) measure and the best method of quantifying costs and benefits for the E$T program. The methods for computing the cost effectiveness of demand response programs are not well established and are currently being researched by LBNL and the CPUC, making the task that much more difficult. Geltz Communications contributed high quality participant interview data. Additionally, Geltz provided valuable insight into the use of diffusion theory and other creative techniques that work for energy and demand response program marketing.

RLW would also like to acknowledge the three hundred plus small commercial customers that took the time to complete phone surveys with RLW and Geltz personnel. The information that they provided is invaluable for making improvements to the program.

Lastly, I would like to acknowledge the dedication and long hours that RLW's April Garcia contributed to the analysis and writing of this report.

Stacia Okura

RLW Project Manager

Contact Information:

Mark S. Martinez

Manager, Program Development

Southern California Edison

2244 Walnut Grove Avenue, Quad 1A

Rosemead, CA 91770

Voice (626) 302-8643

Mark.S.Martinez@sce.com

Table of Contents

1. Executive Summary

This document is the final report for Southern California Edison's SCE Energy$mart Thermostat[SM] Program (E$T) Process Evaluation for program year 2004. This process evaluation was conducted by RLW Analytics, Inc. during early 2005. This report documents the program operations and provides recommendations on how SCE can increase the program's efficiency to increase peak demand reduction and improve cost-effectiveness.

E$T Program Summary

The SCE Energy$mart Thermostat[SM] Program provides small commercial customers in SCE's service territory with Carrier two-way programmable "smart" thermostats. SCE uses a software program to remotely curtail the air-conditioning usage of the participants during critical periods by sending out a radio signal that is received by the smart thermostat.

When the curtailment is activated, the thermostat raises the cooling set-point by a specified number of degrees (referred to as "the temperature offset") thereby reducing load on the air-conditioning system. The thermostat sends a radio signal back indicating that it has received the signal and has triggered the temperature "setback". The thermostats also report back on curtailment overrides, and have the capability of storing and sending hourly air-conditioner run time data.

The E$T program was initiated by the CPUC in March 2001 under Assembly Bill 970. The initial program goals were to install at least 5,000 thermostats at small commercial businesses in Southern California Edison service territory, and to provide at least 4 MW in peak demand reduction by the end of 2002. SCE exceeded the goal by over 9 MW with 4,500 thermostats in both 2002 and 2003, during a series of tests that were part of the pilot program.

In July 2004, the CPUC approved SCE's request to expand the existing program by an additional 4,000 thermostats to help with potential resource challenges for the summer of 2004. It was anticipated that this expansion would reduce peak demand by an additional 4 – 6 MW by the end of 2004, raising the total program demand reduction to 15 MW.

The program was marketed under a very accelerated schedule. SCE paid customers a $150 incentive per thermostat to participate in the program, with a maximum of 12 curtailments in 2004. Customers were able to override the curtailments at any time; however $10 would be deducted from their incentive each time they did a manual overrode. SCE called a total of 12[1] curtailments between July 15th and October 14th 2004.

Process Evaluation Objectives

The three *main* objectives of this process evaluation were to:

> **Objective 1:** Examine and document the program logic and assess it against the program tasks; document all other aspects of the program including management, marketing, installation, data tracking, thermostats, and other services.
>
> **Objective 2:** Provide recommendations for improving the program design, implementation, and other operations in order for SCE to offer a more cost effective program that achieves maximum demand reduction.

[1] SCE called two events in succession on 10/14/04, which SCE deemed one event.

Objective 3: Write a program operations guide for SCE management that integrates the recommendations from Objective 2 and details each of the program processes SCE should consider when administering the program.

Approach

This process evaluation is the culmination of the review and integration of interviews with key utility and vendor contractors, relevant program materials, and participant and non-participant customer surveys. RLW visited the key actors with a generic interview guide and obtained the bulk of the program materials during the interviews. RLW began a thorough review of the materials once the interviews were completed. The bulk of the interviews took place during February 2005. RLW wrapped up the interviews in March 2005. In person interviews were conducted at the following locations with the following program personnel:

- Southern California Edison, Rosemead, CA, 2/15/2005
    - Mark S. Martinez, Program Manager
    - Myrna Saenz, Program Operations
    - Crystal Marques, Customer Service Representative
    - Diana Miller, Customer Experience Marketing
- Mad Dash Incorporated (MDI), Pomona, CA, 2/16/2005
    - Joe O'Malley, Project Manager
    - Karl Immenhausen, Operations
- Honeywell DMC, El Segundo, CA, 2/16/2005
    - Dale Conklin, Project Manager
    - Debbie Stevenson, Operations
- Carrier Corporation, Syracuse, NY, 3/2/2005
    - Moira Buckley, Project Manager

Numerous program materials were collected throughout the process evaluation and include the following items:

- Internal SCE flow charts (procedures and processes),
- Contractor procedures and installation guidelines,
- Personnel job descriptions,
- Marketing materials,
- Program training materials
- Program participant letters,
- Contracts and budgets, and
- Installation tracking data.

The customer surveys were administered to both participants and non-participants of the program. The participant surveys were conducted concurrently with the non-participant surveys in April 2005. Geltz Communications, a subcontractor to RLW, completed 200 participant

surveys and RLW Analytics completed 164 non-participant surveys. The survey methodology is explained in more detail in the survey methodology section.

Organization of Report

The report includes the five sections described below:

- **Program Overview & Background** – This section is an overview of CPUC Decision 01-03-073, which ordered SCE to implement the Small Commercial Demand-Responsiveness Pilot Program. It contains exact words from the Decision that state the CPUC requirements on the technology, target markets, utility and third party roles, application, and other processes, and overall program objectives that SCE had to comply with.
- **Phases of Implementation & Timeline** – This section summarizes the major milestones of the E$T program from 2001 through 2004, beginning with the initial program signup and ending with the 2004 summer expansion activities.
- **Program Logic and Operations** – This section presents the overall E$T program flow and detailed descriptions of each of the processes undertaken in implementing the E$T program. Specific recommendations to improve E$T program operations are included in this section.
- **Operations Guide** – This is a step by step description, similar to a manual, for future program managers interested in understanding the scope and best methods of implementing similar small commercial demand-response programs.
- **Survey Methodology** – This section describes the process of selecting the sampling frames for the participant and non-participant surveys. This section also summarizes the sample design, survey instrument design, and the survey analysis.
- **Participant Survey Results –** This section presents participant survey data tabulations on call outcomes, demographics, motivations for participation, knowledge about the program, satisfaction with the program, and recommendations from program participants.
- **Non-Participant Survey Results** – This section presents non-participant survey data tabulations on demographics, call outcomes, and a few other non-participant statistics.
- **Program Cost-effectiveness -** This chapter presents an analysis of program cost-effectiveness. The first section contains a discussion of the benefit/cost methodology and a description of the baseline program characteristics used in the analysis. In the next section, several different scenarios for operating the program going forward are modeled. Sensitivity analyses are conducted to identify the main factors that affect the cost-effectiveness of the program. A brief discussion of the technical potential for implementing the program in SCE's service territory follows.

Key Observations and Recommendations

RLW made numerous observations about the SCE E$T Program through the course of performing this process evaluation; we also provided recommendations that aim to improve the efficiency of the program. Our **primary recommendation** to improve the impacts and cost effectiveness of the program is to develop a better data management infrastructure to improve productivity in data transfer and tracking. The current data management infrastructure hinders program managers since data for the same customer are stored in multiple locations, which

slows down reporting, installations, and customer issue resolution. There are also numerous challenges with accurate and timely data transfers due to the reliance of effective program reporting on two external competitive service providers, as well as SCE internal data management personnel.

Some of our more specific observations and recommendations are summarized below.

Program Management

Provide more lead time for regulatory authorization. We have observed here and in other parts of the country that utilities and public commissions sometimes make decisions to implement summer peak load management programs well into late spring. Since summer peak loads typically occur from June through September, this creates pressure to implement a program before critical peak demand events occur. While this time pressure is not insurmountable, it does come at a price of additional start up costs and inconsistency in the quality of service that would not be suffered given a more reasonable timeframe.

In the case of the E$T program extension in 2004, the CPUC authorized SCE to expand the program in July 2004, and wanted to achieve the demand reduction goals by the end of 2004. We recommend that the CPUC provide SCE with an earlier authorization, preferably early winter or very early spring, in order to more cost effectively meet the demand response goals desired.

Secure a dedicated management team. In the original Decision, the CPUC ordered SCE to outsource installation and as many other aspects of program administration and implementation as feasible. SCE did that by outsourcing the entire project originally through a competitive bid process, while maintaining project oversight. However, as the program has progressed, SCE has taken on the majority of the direct customer service and program management responsibilities. Program management should be performed by a utility employee or a contractor who has a vested interest and/or ultimate responsibility in delivering the demand response goals. The current (Carrier) turnkey team's profit comes from margin on the product and their primary motivation is to sell more of the product, not delivering demand response. They are not currently set up to deliver a complete load control program package, which would include thorough reporting and regular communication with SCE. The current turnkey manager's role should be a product supplier and thermostat control provider only. To best maintain this program, all other outsourced management should be in sourced by SCE.

Marketing

The 2004 E$T program expansion had a goal of 4,000 added thermostats. Traditional marketing using mass mailers were sent to 200,000 SCE customers. The mailers resulted in over 5,000 customer applications, a response rate of 2.6%. Below are some recommendations that may improve the response rate by making the marketing appeal to a larger customer base.

Refine the key marketing messages. Community benefit should be emphasized in order to increase response. Other utilities and market research on this program has found that the "*keep the lights on*" message greatly increases program acceptance. Research has also shown that small businesses place comfort and service first and energy is a secondary matter, at best. Customers should know that they retain *full control* of their AC units and they can ensure that their business operations are not interrupted. Additionally, SCE should use recycled paper and print double sided when communicating with customers. A small fraction of customers will respond to subtle *green* messaging, while all non-green consumers will not be turned off by the effort.

Reinforce behavior using examples from the 2000 – 2001 California energy crisis. Consumers modified their behavior to include energy efficiency during and shortly after the California energy crisis occurred. As time goes by, customers should be reminded about the shortage, particularly the peak demand shortage, and how they can contribute to the solution by participating in this program. Research has shown that since the crisis, customers have found it very easy to slip back into their old ways; from their viewpoint, the lights are still on, thus there is no pressing need for conservation.

Deemphasize "High-tech cool" marketing slogan. The cutting edge technology message in the marketing materials may have unintended consequences, such as deterring people who are not early adopters of technology. SCE could alter the message to emphasize that these thermostats are the not necessarily cutting edge, but that the main technology is tried and true and the load control is what is different, yet they still retain control. The large majority of participants say that the main reason that they signed up for the program is to save money and conserve energy.

Utilize multiple marketing methods. For the 2004 program expansion, SCE only utilized mass mailings to recruit customers. SCE should employ multiple marketing approaches such as newspaper advertisements, radio announcements, face-to-face contacts, internet websites, newsletters, and bill inserts to improve their reach. These methods are likely more costly, but the added increase in recruitment rates and the integrated public affairs benefit could offset the higher cost.

Utilize word of mouth marketing. Satisfied participants can be a good source of marketing and may be willing to pass brochures on to their neighbors if given the opportunity. An incentive for businesses to sign up other businesses would likely increase enrollment.

Analyze readability of program materials. RLW performed a readability analysis of the program description in the marketing brochure. The analysis indicated that readers would need a 12th grade education to best understand the material. If SCE reworked the brochure, they could make it more accessible to customers for whom English is a second language, and more far reaching to customers who do not have a high reading level.

Refine program branding. SCE has service marked the name of the program in order to make sure that the program was consistently referenced and marketed. The marketing team should consider other tactics for increasing interest in the program such as developing a logo that is included on every printed piece of marketing material, or establishing a network of influential sources that will publicly endorse the program, or design and distribute character logos such as a bobble-head or another children's toy with the logo that clearly promotes the program.

Consider target market non-response trends. SCE filtered their customer database to identify a list of 200,000 potential E$T participants out of their small commercial service accounts. We surveyed 150 of the non-participants that received mailers and found that over 50% of the customers were not qualified to participate in the program. Many did not have air conditioning, some were multi-family residences (with commercial service accounts), some planned to move soon, etc. If SCE has the ability to better target their marketing by applying additional filters, they can reduce their marketing costs by eliminating unqualified customers from the list. If this is not an option, then SCE should adjust their mass mailing procedure and plan for a response rate of about 2%, compared to the 4% response that they typically expect for programs that are open to all customers.

Target customers with high AC usage and greater capacity. SCE should target customers that have high AC loads throughout the summer months. A simple billing data analysis could be performed to identify those customers. Customers in warm climate zones are more likely to

utilize air conditioning during peak periods. Larger AC units with greater capacity offer more load per dollar spent on the thermostat and should also be targeted.

Market in geographic waves. Marketing efforts should be stratified by geographic region. This will ensure that applications will be received by SCE in a similar stratification; therefore installers can focus on installing in clusters while still ensuring that applications are responded to in the order that they were received. This could be an effective method of reducing installation costs.

Expand program offering to include other services. HVAC tune-ups are becoming more common in program offerings. Some studies show that a tune up can reduce the energy consumption of a unit by up to 30%. Consider integrating tune-ups into the program offering. Participants will be easier to recruit, since this is a valuable non-monetary incentive mechanism. From a utility perspective, this approach would likely improve program reliability and resulting demand reduction.

Additionally, integrating this demand response program with energy efficiency components would greatly improve the cost effectiveness of the program. One simple thing that the program managers could do is remind customers to program their thermostats and also provide assistance with this task. A correctly programmed thermostat will ensure that the program not only achieve load reduction when SCE calls a curtailment, but the program and ratepayers will achieve energy savings from correctly programmed thermostats all year long. SCE should send out periodic letters reminding customers of this issue and they should also train all CSRs and contractors to check programming when in contact with participants.

The current program structure requires SCE to physically control the units when load reduction is needed and to pay customer incentives to sustain the benefit of that load control. If other energy benefits such as HVAC tune-ups, periodic thermostat programming, or even CFLs could be integrated into E$T, the program could buy down the cost of the demand response through more cost effective energy efficiency measures that persist even if SCE elects not to curtail the thermostats.

Incentives

Reward, do not punish. Utilize positive reinforcement for withstanding the curtailment instead of a negative punishment for not being able to withstand the curtailment. Participants would get a slightly smaller upfront incentive, but also are informed that they will receive an additional incentive per each curtailment, that could equal the large incentive. Participants will respond better to a reward than a punishment and are more likely to reduce overrides if they know that they are earning money for their actions. This will lead to greater energy and demand reductions during the curtailment period.

Lower annual incentive. Continue lowering incentive as program continues. The incentive has already been decreased from $300 minus $5 for overrides in 2001 (up to 50 events) to $150 minus $10 in overrides in 2004 (up to 12 events). LIPA originally offered a $75 signing incentive and the thermostat to customers, but they determined that was too generous and successfully reduced their signing incentive to $0.

Send regular customer letters. SCE sends a customer letter to existing E$T participants at the beginning of each summer that informs them about the incentive and override rate amounts for the upcoming summer. SCE also sends a letter at the end of the year that informs customers about their incentive. In order to reinforce the desired behavior of the program – allowing SCE to remotely control their thermostat – SCE should reward customers who withstand the curtailment as soon after each curtailment as possible. We suggest that SCE

send monthly letters during the summer which let customers know which curtailments they overrode and how much their incentive is decreased (or increased) by, reinforcing the need to reduce load.

Incorporate capacity and willingness to tolerate curtailments. The amount of the incentive should be based upon the amount of controlled cooling capacity since the larger units provide more load response. Incentives could also be structured to offer participants a varied number of days that they could sign up for, paying more to customers who are willing to be subjected to a larger number of curtailments.

Data and Inventory Management

Overhaul data management system. At the time of the evaluation**,** a minimum of four databases were used to manage the E$T program data. SCE customer service representatives have to utilize at least two databases when they need to resolve customer call center issues. Many times these issues are urgent and the multiple databases impede the ability of the representatives to complete their job efficiently. A new database is core to the improvement of customer service and ensuring that the program can retain all of their existing customers (maximizing load impact) by expediting service. The call center representatives will be able to resolve problems quicker, which will also reduce the amount of labor that goes into researching each customer issue.

SCE and contractors need to design one database that incorporates all the information that is currently housed in the four separate databases. The program operations manager should play a key role in architecting the relevant reports and summaries that are presented. In addition, all E$T contractors that need to share information on the customers with SCE should have access to the database.

Revise installation leads process. The current setup is that SCE sends the list of new thermostats to install (leads) to Carrier, who then uploads the list into their database, and then forwards them to the installers. Once the installers complete an install, they upload the information back to the Carrier database and Carrier pays them for the install. SCE should directly send the leads to the installers since they have ultimate responsibility to install the thermostats. SCE and the installer can interact and ensure that all of the customers are appropriately managed.

Track thermostat inventory. SCE was originally receiving all thermostats from Carrier and shipping the inventory to the installers. As the installation timeframe became more pressed, Carrier began shipping the thermostats directly to the installers. They did not require any form of communication from the installers that the product was received. Our recommendation is that the installation contractors should continue to directly receive the thermostats from the manufacturer. They should be required to create and implement a more formal shipping and receiving process.

Installation

Ensure sufficient installation staffing. Contractor teams with thermostat installation skills are in short supply in the Southern California area during the summer. Most HVAC contractors are considerably busier during the warmer months when air-conditioning and refrigeration service calls sharply increase. SCE has historically had a difficult time locating a stable team of installation contractors for the E$T program. Part of the difficulty is that the CPUC rulings have come out in late spring and SCE has been required to do the majority of their installations during the summer. As a result, the installation teams have been left short of personnel. SCE should ensure that their contracted installation teams have adequate staff *in place* to complete the

installations. Installation costs would likely be lower if done during cooler months since this is a time when HVAC contractors are less busy defeating cooling service calls. The contracts could be more competitively bid with a larger pool of contractors.

Thoroughly train installers. Installers need to be thoroughly trained in order to ensure that the thermostats are installed properly and that the thermostats are tracked and uploaded into the database to allow SCE to control them. At one point during the expansion, the unit tonnage, a critical component of the impact analysis, was not being recorded (often difficult since AC units are not readily labeled). A thorough training will ensure that more installation visits are completed in accordance with established protocols, which will reduce program costs and ensure that the maximum amount of load is controlled.

Program all thermostats at every opportunity. During the 2004 expansion, the installers were under pressure to get the 4,000 installations completed before the end of the summer season. Therefore, the installers were instructed by their supervisors not to program the thermostats, rather they were instructed to tell customers to call the SCE call center, which had been staffed up to meet the higher volume of calls. Some surveyed participants said that they would have appreciated more information on how to program the thermostat. The installers should be *required and trained* to program the thermostats at the site. The value of the initial rapport that the installer earns from the customer will greatly improve long term program satisfaction. The participant surveys indicate that around 5% of participants use the internet to program their thermostats.

Use non-traditional installation methods. The E$T program had difficulty in assembling an installation team to effectively handle the large number of installations required under short order. SCE should consider leveraging the installation and travel resources allocated to programs that target similar customers such as third party programs or utilize surplus installers working on similar programs such as the Summer Discount Plan. The program may also benefit through coordination with mass marketed HVAC tune-up programs, or other programs offering programmable thermostats as a program measure.

Schedulers should work during SCE business hours. One of the contractors scheduled their workers from their home office located in the mid-West. Installation or repair work should be scheduled from a similar time zone. This will alleviate problems that arise when the schedulers can not be reached in different time zones.

Prepare leave behinds. Carrier is currently in charge of managing and paying the installation contractors. They assign all of the installations to the installation teams. In the past three years of the program, which included over 9,000 installed thermostats, the only program reference material that Carrier provided to the installers was a small card with programming instructions that came with the thermostat. They did not provide a thermostat manual, no program introduction letter, no welcome package, not even a program brochure for customers. Since the thermostat information materials are not effectively being coordinated by Carrier, SCE should design a welcome package for participants that contains, at a minimum, a thermostat operations manual and a program introduction letter. Additionally, we believe that it should contain a short postcard survey, a program brochure, and materials that the participants can place around their businesses to alert both customers and employees that they are participants in an SCE efficiency (or “keep the lights on”) program.

Calling Curtailment Events

Program goals determine curtailment triggering. If the program is converted into a tariff, the curtailments should be triggered based upon SCE peak load or ISO peak load, depending on the goals of the program, or a similar consistent emergency trigger with other programs.

Time, temperature, and length of curtailment events. The most promising period for a curtailment can be expected to be the two-hour period from 2 pm through 4 pm. The hours of coincidence with peak price or system peak may be later in the afternoon, from 4 pm to 6 pm, and should also be considered for curtailment. During the pilot program, the program manager should call curtailments when the temperature is forecast to be 93-94 degrees or greater in the San Bernardino/Riverside area for some curtailment days. Four-degree offsets should be used for all curtailments. Most curtailments should be called for 2 hours to maximize program impacts and minimize customer intrusion.

Technology

Change thermostat curtailment indicator. In the past, program participants have indicated that they would like a more visible indicator to alert them that a curtailment is taking place. The current indicator is a small line of text reading 'Curtailment' in the thermostat's LCD window. There are two schools of thought on curtailment indicators. On the one hand, a discrete indicator does not draw attention and therefore people may not notice that a curtailment is taking place. On the other hand, a non-discrete indicator draws attention and may discourage people from overriding a curtailment that they would otherwise override. In subsequent programs SCE might test two different types of indicators and analyze what kinds of behavioral trends occurred.

Costs

Extend funding and implement changes to make program cost-effective. Analyses suggest that it would be difficult to make the existing program cost-effective based on legacy-installations alone without new, more cost-effective thermostat installations. The cost-effectiveness of the program improves dramatically in scenarios that incorporate a few reasonable design assumptions, especially by expanding the program, tailoring the offering to customers with relatively high cooling loads, and by operating the program 5-10 years – long enough to recover initial investments and capture achievable demand reduction benefits over time.

The program also becomes much more cost effective if year-round energy efficiency savings are included in the analysis. The significant impact of this issue on program cost-effectiveness presents an opportunity for regulators to develop policies that support demand-side management as a key energy resource.

2. Program Overview and Background

On March 27, 2001, the California Public Utilities Commission (CPUC) issued Decision 01-03-073, which ordered SCE to implement the Small Commercial Demand-Responsiveness Pilot Program[2] with a goal of 5,000 installed thermostats. SCE successfully implemented the Program and conducted a number of curtailment tests during the summers of 2002, 2003, and 2004 to identify the overall effectiveness of the program. On July 8, 2004, the CPUC issued Resolution E-3879 that authorized the expansion of the SCE pilot program by 4,000 thermostats.

In order to provide a background for the program activities and the expansion, we first summarize the sections of the original 2001 Decision in this section. We review the initial program goals, implementation, and achievements during the first two years of the program's existence. In the next chapter, we summarize the events leading up to Resolution E-3879 that were pertinent to the operation of the Program. In both chapters we focus on the parts of the Decision and the Resolution that relate to SCE. Wherever possible, we used the exact words of the Decision and Resolution in these narratives.

Summary of Decision D.01-03-073

The Decision consisted of the following five parts:

1. Section 1. Summary, Pages 1 - 5
2. Sections 2 - 5. Background, recommendations of the Energy Division, discussion and comments, Pages 6 - 38
3. The findings of fact and conclusions of law, Pages 39 - 47
4. The Decision itself, Pages 47 - 55
5. Attachment 1, giving the details of each program

Technology

Ordering Paragraph (OP) 11 of the Decision dealt with the technology. OP 11 gave SCE flexibility to select the specific technologies employed in the small commercial demand-responsiveness program. However, the technology was required to include the following features:

- *Provide customers some level of control (e.g., thermostat setting override) over their own heating, ventilation and air-conditioning equipment,*
- *Provide interactive information for consumers to make consumption decisions (e.g., via the thermostat or a computer internet connection), and*
- *Allow the administrator to verify actual interruption of the individual device at the customer site, including duration and level of kW demand reduction."*[3]

In the Attachment, the Commission restated these requirements and spelled out that "*The preferred technologies eligible to be included in this program should be programmable HVAC thermostats with two-way Internet connectivity*."[4]

---

[2] Decision 01-03-073, March 27, 2001. "Interim Opinion: Implementation Of Public Utilities Code Section 399.15(B), Paragraphs 4-7; Load Control and Distributed Generation Initiatives." (R0206001)

[3] Decision 01-03-073, page 51.

Marketing and Promotion

The Attachment provided the following direction to SCE for marketing and promotion: *At a minimum, information about the program should be made available to target small commercial customers through the utility web site and bill inserts. Community-based organizations and small business associations should also be involved in program marketing and outreach to the extent feasible. In addition, utility representatives should work with the program delivery contractor to contact and recruit interested customers.*

Utility Role

OP 4 instructed SCE to outsource program implementation and administrative activities as directed below:[5]

- *All installation of technologies (hardware and software) at customer sites shall be done by independent contractors and not utility personnel.*
- *Program administrators shall also outsource as many other aspects of program administration and implementation as feasible. In particular, the majority of program marketing and outreach activities should be outsourced, to the extent feasible, although the program administrator shall actively participate and assist contractor efforts for this purpose.*
- *Program administrators shall outsource to independent consultants or contractors all program evaluation activities.*

OP 11 of the Decision also stated that program administrators for the demand-responsiveness programs shall have flexibility within the adopted program funding levels to:

1) Select the design and level of customer incentive,

2) Establish monthly consumption threshold levels for defining the high consumption target groups, and

The Attachment spelled out the utility role in somewhat greater detail:

- *Collecting and accounting for program funding*
- *Fine tuning program design and implementation*
- *Contracting with a third party for program services and equipment*
- *Acting as a contract administrator for program delivery*
- *Conducting customer recruiting for program participation, including posting information on utility web site*
- *Providing marketing assistance and facilitation to contractor(s) providing program delivery*
- *Performing regulatory reporting functions for the program*
- *Contracting with independent evaluator(s) to conduct a process evaluation in 2001 and a load impact evaluation after 2002, and annually thereafter (exact schedule to be determined).*

---

[4] Decision 01-03-073, Attachment 1, page 12.

[5] Decision 01-03-073, page 49.

Third Party Role

According to the Attachment, the third party implementation contractor will provide:

- *Connected HVAC programmable thermostats for small commercial customers*
- *Data services and software*
- *Installation services*
- *System administration*
- *Communications services*
- *Settlements and/or reporting of program activity.*

Verification

The Attachment discussed program verification as follows: *The purpose of program verification is to ensure that the technologies installed at small commercial sites through the program are installed and operating properly, and have the potential to deliver energy and peak demand savings. Verification should also produce the information necessary to estimate the energy and peak demand savings delivered at each customer site. Evaluation of the aggregate energy and demand savings achieved by the program should be the responsibility of the independent evaluator hired by the utility.*

OP 12 of the Decision stated the evaluation requirements for the small commercial demand-responsiveness pilot program shall be evaluated during and after the program period. The Decision specified that *"SCE shall conduct a process evaluation during 2001 and an energy savings and peak demand savings impact study at the end of 2002."*[6] The Attachment reiterated this requirement.

Other Program Processes

The Attachment discussed other steps that SCE should follow in the program as follows: *The first step in the pilot program process is for the utility to issue an RFP and select a contractor or team of contractors to handle technology* ***installation*** *at customer sites, as well as* ***software setup*** *at the utility site. The contractor or contractors should be competitively selected through an open solicitation process. Once this contractor is selected, the utility and contractor can jointly begin to recruit small commercial customers for program participation.*

Application *-* ***No application*** *from individual customers should be required for this program, except a signed affidavit from the customer agreeing to have the equipment installed at their site and that they understand the terms and conditions of the pilot program. The contractor should have the authority to interact with the customer to make sure the necessary paperwork and program understanding is accomplished with each and every participating small commercial customer.*

Installation *- The contractor should also coordinate with individual consumers to arrange installation and setup of equipment. The utility may either manage this process or ask that the contractor handle the scheduling and coordination of equipment installations.*

Operation *- Once equipment has been installed at the customer's site, the program can be activated by setting a customer's thermostat to a preset default for a maximum time period to be determined at the outset of the program. Each interruption period will be considered an "event."*

---

[6] Decision 01-03-073, page 52. Due to the late start of the program, these studies were rescheduled for 2002 and 2003 respectively.

A maximum number of events during an annual program period should also be determined at the beginning of the program and communicated to the customer. A customer should have the ability to override the thermostat setting at any time during an event. The program operators may also wish to vary the thermostat settings and/or the numbers of hours over which each event occurs to test consumer tolerance and reactions to different operating procedures or schedules.

***Payment** - Customers will receive free equipment and installation at the beginning of program participation. At the end of each year of participation, the utility should pay the applicable program incentive to the customer.*

Program Rationale and Objectives

The Decision stated that this program was chosen over other small commercial load control program options for the following reasons:[7]

- *Potential for peak demand reduction through control of small commercial HVAC appliances*
- *Probability of customer acceptance*
- *Utilization of internet platform, which ensures likelihood of forward compatibility of technology*
- *Data collection ability for measurement and evaluation purposes*
- *Ability to test customer response to energy market demand and price fluctuations.*

Objectives

The Decision also stated that AB 970, signed by the Governor on September 6, 2000, required the Commission to initiate certain load control activities. In particular, AB 970 required: [8]

- *Incentives to equip commercial buildings with the capacity to automatically shut down or dim nonessential lighting and incrementally raise thermostats during peak electricity demand period.*
- *Evaluation of installing local infrastructure to link temperature setback thermostats to real-time price signals.*

OP 1 of the Decision instructed SCE to implement the programs described in the Attachment to the Decision. The attachment itself[9] summarized the AB 970 objectives slightly differently:

- *Equip commercial buildings with the capacity to automatically control thermostats,*
- *Evaluate installation of local infrastructure, and*
- *Provide incentives for load control.*

The Attachment also specified other assumptions of interest to the PUC, namely:

- *Consumer participation and behavior patterns in the program*
- *Consumer satisfaction with newer interactive load control technologies*

---

[7] Decision 01-03-073, Appendix 1, page 10.

[8] Decision 01-03-073, page 6.

[9] Decision 01-03-073, Appendix 1, page 10.

- *Responsiveness of small commercial customer load to price or system demand signals*
- *Ability of such programs to deliver reliable and verifiable energy and demand savings*

Target markets

In the Eligibility section of the Attachment, the Commission recommended targeting three distinct small commercial customer groups:[10]

1. *Small commercial customers with high average monthly consumption in the summer;*
2. *Small commercial customers in geographical areas in SCE service territory known to have high electricity consumption due to climate; and*
3. *Customers located in small cities or rural areas.*

The Decision went on to state that small commercial customers are precluded from participating in both the §399.15(b) demand responsiveness programs and other demand responsiveness programs offered by other state agencies or the interruptible programs being considered in R.00-10-002.

Utility Compliance with the Decision

SCE complied fully with the technology, marketing, installation, verification, evaluation, and administrative approaches outlined in the Decision. SCE identified suitable technology, marketed the program aggressively to the segments targeted in the Decision, and used third-party contractors extensively. In addition, SCE launched and maintained the program well within the approved $5.94 million budget. Although the initial goal was to install 5,000 thermostats to achieve 4 MW in peak demand reduction, SCE was able to greatly exceed the demand savings goal with fewer thermostats than originally proposed.

[10] Decision 01-03-073, Appendix 1, page 12.

3. Phases of Implementation and Timeline

Summary of the E$T Program through 2003

Figure 1 summarizes the major milestones of the Energy$mart Thermostat program from years 2001 through 2003. The CPUC handed down Decision 01-03-073 on March 27, 2001, approving the SCE Energy$mart[SM] Thermostat program and budget through December 31, 2004. The Decision ordered SCE to implement the program without delay. At the onset, SCE's key goal was to install all 5,000 thermostats by May 2002 so that testing could begin for the summer of 2002. The initial marketing effort was initiated in October 2001, but a weak customer response led SCE to redesign their marketing strategy that December. Two additional mailings went out early in 2002 with weak responses, so by May, SCE had installed and tested just 250 thermostats (merely 5% of their goal). SCE continued receiving applications and installing thermostats throughout summer 2002 – the time when the program was supposed to be in operation. SCE persistently worked with Carrier and the installation contractors, and by December, there were a total of 4,200 devices in the E$T program. The applications continued to arrive at the SCE offices, so a backlog started to accrue as time went on. The backlog was sufficient enough that SCE was able to supply leads to the installation contractor(s) through 2003 as well.

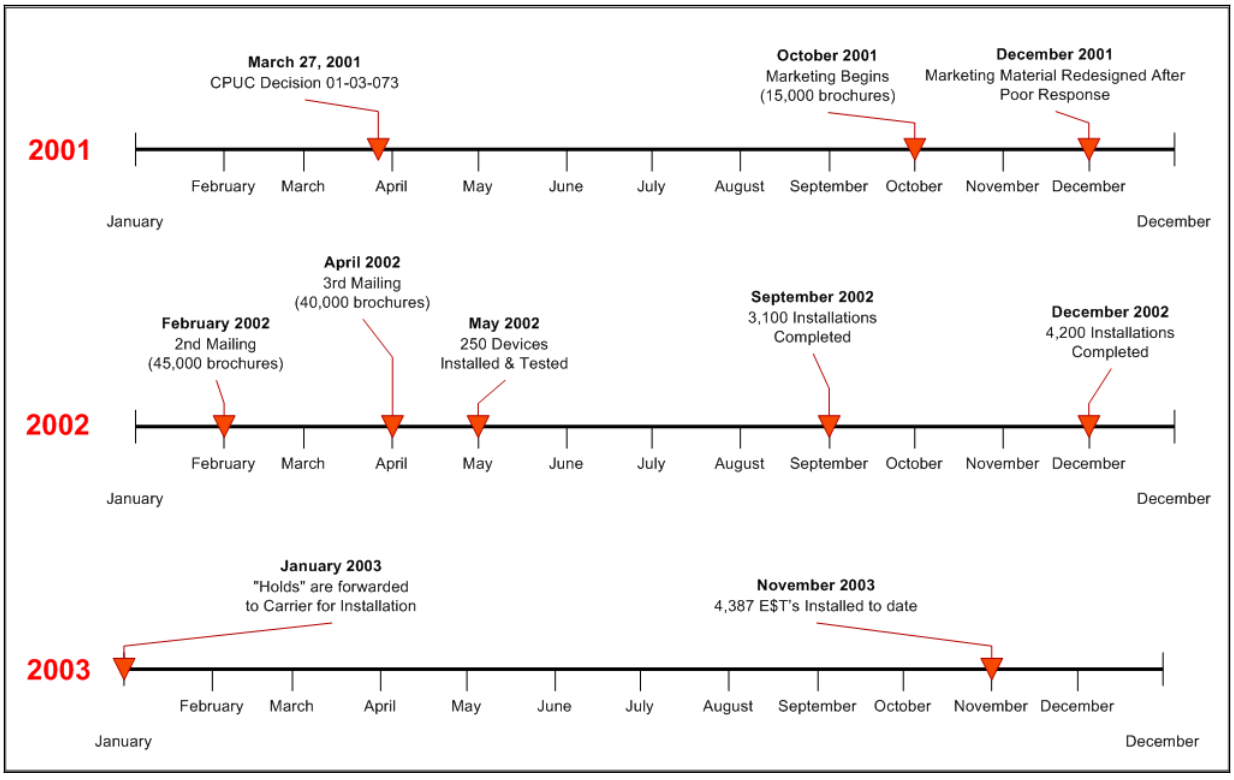


Figure 1: Milestones of the E$T Program, 2001-2003

SCE successfully conducted a number of curtailment tests during the summers of 2002 and 2003. During this period the number of program participants stayed steady at approximately 4,600 thermostats. Impact evaluations followed shortly thereafter, and it was determined that the program design of adjusting the temperature setpoint was effective at reducing peak demand. With verification that the Smart Thermostat technology was useful in reducing peak

demand, SCE started making preparations to move the program to operations once the pilot activities ended in 2004. Because the program would no longer be funded by AB970, it would be necessary to reduce the operating costs so that SCE could continue program in maintenance mode in future years.

Events Leading Up to the 2004 Summer Expansion

Making the Program More Efficient

Throughout the life of the program, SCE varied the number of curtailment events, the incentive payment, and the penalty amount for overriding to assess different program design concepts. Each evaluation provided estimates of the peak demand reduction achieved by the program. SCE conducted the last impact evaluation at the conclusion of the 2004 program[11]. An overview of all three program years is summarized in Table 1.

	Program Year		
	2002	**2003**	**2004**
# of Thermostats	4,325	4,600	4,600
# of Events Called	14	19	12
Incentive Amount	$300.00	$300.00	$150.00
Penalty Amount	$5.00	$10.00	$10.00
Peak Demand Reduction	10.0 MW	9.3 MW	9.0 MW

Table 1: Summary of the E$T Program, Years 2002-2004

By early 2004, SCE made the program more efficient by:

- Cutting the annual incentive in half (from $300 in 2002-03 to $150 in 2004)
- Capping the number of devices to five per business,
- Setting up automated processes in data entry and data management.

The Coachella Valley Mini-Project

By early 2004, SCE had reduced the cost of the E$T Program, which by this time was primarily in maintenance mode. By partnering with Carrier and Honeywell DMC, SCE had streamlined much of the maintenance process and was preparing to transfer the program to operations. However, the program was short of the total number of thermostats authorized by the Decision (5,000). The E$T program manager saw this as an opportunity to complete the program goal, and install the remaining devices in the Coachella Valley, a desert region in Southern California with high air conditioning load, which includes the city of Palm Springs.

In order to test a new program design, SCE modified the incentive and penalty amounts in its marketing messages, as well as informing them that they would be able to override their thermostat in the case of an event (as in previous marketing messages). In April and May of 2004, the utility began marketing the SCE Energy$mart Thermostat[SM] program to small businesses in the Coachella Valley. Prime Energy, a New Jersey-based consulting firm that provides project support and installation services, was the primary contractor selected to perform the installation work.

[11] The 2004 Impact Report excluded customers who were installed after July 8, 2004. Therefore, the demand savings does not include Summer Initiative customers.

The Coachella Valley mini-project turned out to be a fortunate event for SCE. The marketing material that SCE developed for the Coachella project only needed slight modifications for the summer expansion, which was authorized shortly afterwards. This saved time and costs for SCE in the rollout since all official SCE correspondence normally goes through extensive approvals by the utility's legal department. Another advantage was that the mini-project allowed SCE to provide cost estimates fairly quickly for the Advice Letter filing since the summer expansion budget factors were based on the Coachella Valley project. SCE was able to take the same inputs and easily calculate costs for the summer expansion.

Although some activities from the Coachella Valley mini-project are presented throughout this report, the Process Evaluation does not examine the marketing and installation activities conducted in the Coachella Valley since these pursuits began prior to receiving approval for the Summer Initiative (SI) expansion from the CPUC.

Assigned Commissioner's Ruling, R.02-06-001, June 4, 2004

On June 4th, the Assigned Commissioner, Michael Peevey, issued a Ruling (ACR) in R.02-06-001 which addressed concern about a potential energy shortage in the 2004 summer season. The ACR invited, but did not require, the three investor owned utilities (Pacific Gas and Electric, Southern California Edison and San Diego Gas and Electric) to submit proposals to implement programs that would achieve demand response through Advance Load Control (as proposed by SCE in their March 31, 2004 filing in R.02-06-001) and through expansion of the E$T Program (as proposed by SCE and SDG&E). The objective of the ACR was to examine whether the load control programs proposed by the IOUs for Summer 2005 in R.02-06-001 should be considered for implementation for at least part of the Summer 2004, as a way to address the concern for potential energy supply shortage.

The ACR specified the following technical and program proposal requirements[12]:

> *1) the control and communication technology for the proposed load control programs should have the capabilities to receive both price and load control signals, customer override signals, and upward/forward compatibility with advanced meters and control systems; and*
>
> *2) the program proposals need to include details necessary for full evaluation of the program design, including strategies for marketing and roll-out, technical specifications and detailed cost information, at a minimum.*

Advice Letter 1804-E, June 8, 2004

In response to the ACR, on June 8, 2004, SCE filed Advice Letter 1804-E, outlining a portfolio of programs designed to achieve energy savings through demand response. Among those programs was an expansion of the SCE Energy$mart Thermostat℠ (E$T) pilot program, funded by Assembly Bill (AB) 970. SCE outlined that the expansion would include an additional 4,000 thermostats installed at small commercial and industrial sites. Advice 1804-E included SCE's implementation strategy to target potential new participants. Particularly, the target market would encompass C&I customers:

- *With demands below 200 kW,*
- *In hot climate and rural areas,*
- *And having air conditioning (AC) units with capacities of 4 tons or greater.*

[12] ACR pgs. 1 and 2.

Under the proposed program design offering, the Smart Thermostat technology would be provided at no cost to the customer. SCE would have the capability to remotely control the thermostat by up to 4 degrees during hot days, but the customer would be allowed to override the curtailment. At the end of the program year, the customer would receive an incentive payment of $150 per thermostat with a $10 penalty fee per override[13].

SCE proposed that the expansion of the E$T program in the summer of 2004 could deliver an additional 4 MW of peak demand reduction for a price-tag of $2.7 million. In Advice Letter 1804-E, SCE explained that the program, still funded under Assembly Bill 970 (AB970), would not require additional funding[14] by the CPUC. Rather, SCE requested approval to reallocate the AB970 funding and increase the 5,000 installed devices authorized under the original Decision by an added 4,000 thermostats.

Resolution E-3879, July 8, 2004

The CPUC waited 30 days to allow for public time to review the advice filing. On July 8th, the Commission issued Resolution E-3879, approving SCE's request to expand the AB970 Smart Thermostat Program during the summer of 2004[15]. On page 7 of the Resolution, the CPUC stated that SCE should undertake the following activities:

- *Increase the customer participation limit set in D.01-03-073 by 4,000 accounts, and*
- *Report to the Energy Division the monthly implementation and operational costs associated with the ST program expansion.*

In the 30 days between the Advice Letter filing and the Resolution, SCE was able to complete some preparatory work in anticipation of the expansion. During this interim period, the E$T Program Manager had discussions with potential contractors, examined current inventory, and began requesting pricing quotes for added thermostats. However, in absence of the Resolution, SCE could not begin other preliminary planning activities, such as designing additional marketing tools. SCE was limited to these activities because there was some risk involved in initiating other processes that would require more resources dependent on the CPUC's approval of the E$T expansion. If the Resolution had been issued a few months earlier, SCE would have had better time resources to begin the planning steps. With more lead time, SCE would have begun earlier on the ramp up activities, such as ordering additional thermostats and marketing the program to potential participants.

[13] In Advice 1804-E, SCE expressed that it would like to maintain customer participation with a reduced incentive and fewer curtailments than previous program cycles (p. 5).

[14] At the time of the Advice Letter, the E$T program was receiving $5.94 million in annual balance account funding through AB970. SCE had unspent funds in the account (AMDRMA) when they proposed the 2004 summer expansion.

[15] Resolution E-3879 also approved SCE's request to reopen schedule 20/20 for C&I customers and to increase enrollment in the Residential Air Conditioning Cycling Program (ACCP).

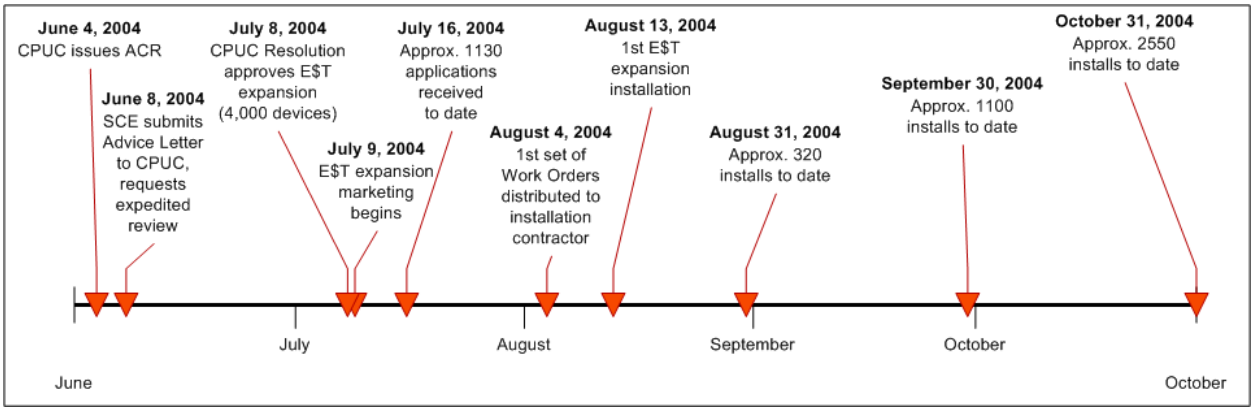


Figure 2: E$T Summer Expansion Timeline (2004)

The remainder of this report contains a detailed analysis of the program processes in the 2004 Summer Initiative (SI).

4. Program Logic and Operations

This chapter of the report first presents the overall program flow and logic model. The chapter continues with a detailed description of each of the main program processes and contains recommendations for optimizing program processes.

Program Logic

Through multiple interviews with the SCE project manager and the contractors, RLW developed the logic model of the E$T Program[16]. The purpose of the logic model is to aid the Process Evaluation by providing a framework whereby the evaluator can:

- Test causal relationships,
- Determine if the desired outcomes are being accomplished, and
- Identify aspects of the program that can be made more efficient.

Figure 3 is the logic model that graphically depicts the interaction between and amongst the program actors, activities, and outcomes. The logic model is organized in terms of a flow of resources and the outputs from each program activity.

- ***Inputs*** are the resources that are required to start and maintain a program. For the E$T Program, *inputs* include:
    - Program funding,
    - SCE staff,
    - Contractors, and
    - Qualified participants.
- ***Program activities*** are those actions that initiate a sequence of events with the purpose of meeting some goal. In the case of the E$T Program, all activities eventually lead to the ultimate goal – **demand reduction**. Some examples of the activities in the E$T program are:
    - Recruit and screen customers,
    - Procure and install thermostats,
    - Track thermostat inventory and installations,
    - Activate curtailment events, and
    - Estimate program impacts.
- ***Outputs*** of the logic model are the immediate effects of a program activity. For example, when SCE identifies and recruits potential participants, a target list and marketing material are produced (*output*). Other examples of outputs are:
    - Tracking database that is developed to maintain the participant list,
    - Marketing materials that are produced to recruit customers into the program, and
    - Work orders that are generated for each qualified site that an installer must visit.

[16] RLW developed a Logic Model in the manner prescribed in *The California Evaluation Framework*, June 2004.

- ***Short-term outcomes*** are the program's intended mini-goals. The E$T Program has three distinct short-term outcomes[17]:
    - Committing participants,
    - Installing the thermostats, and
    - Controlling participant AC systems.
- ***Intermediate outcomes*** are the program's intended medium-term goals. The Program has four distinct intermediate outcomes:
    - Accrual of backlog of applicants,
    - No-cost thermostat and installation for customers,
    - Customer saves energy and lowers bills with programmable thermostat, and
    - Incentive paid to customer.
- ***Long-term outcomes*** are the program's intended ultimate goal. Again, the final goal of the program is to achieve immediate and reliable summer peak demand reduction.

Each of these activities and outcomes are discussed in the subsequent chapters of this document.

[17] This report discusses each of these short-term goals in the Marketing, Installation & Curtailment sections.

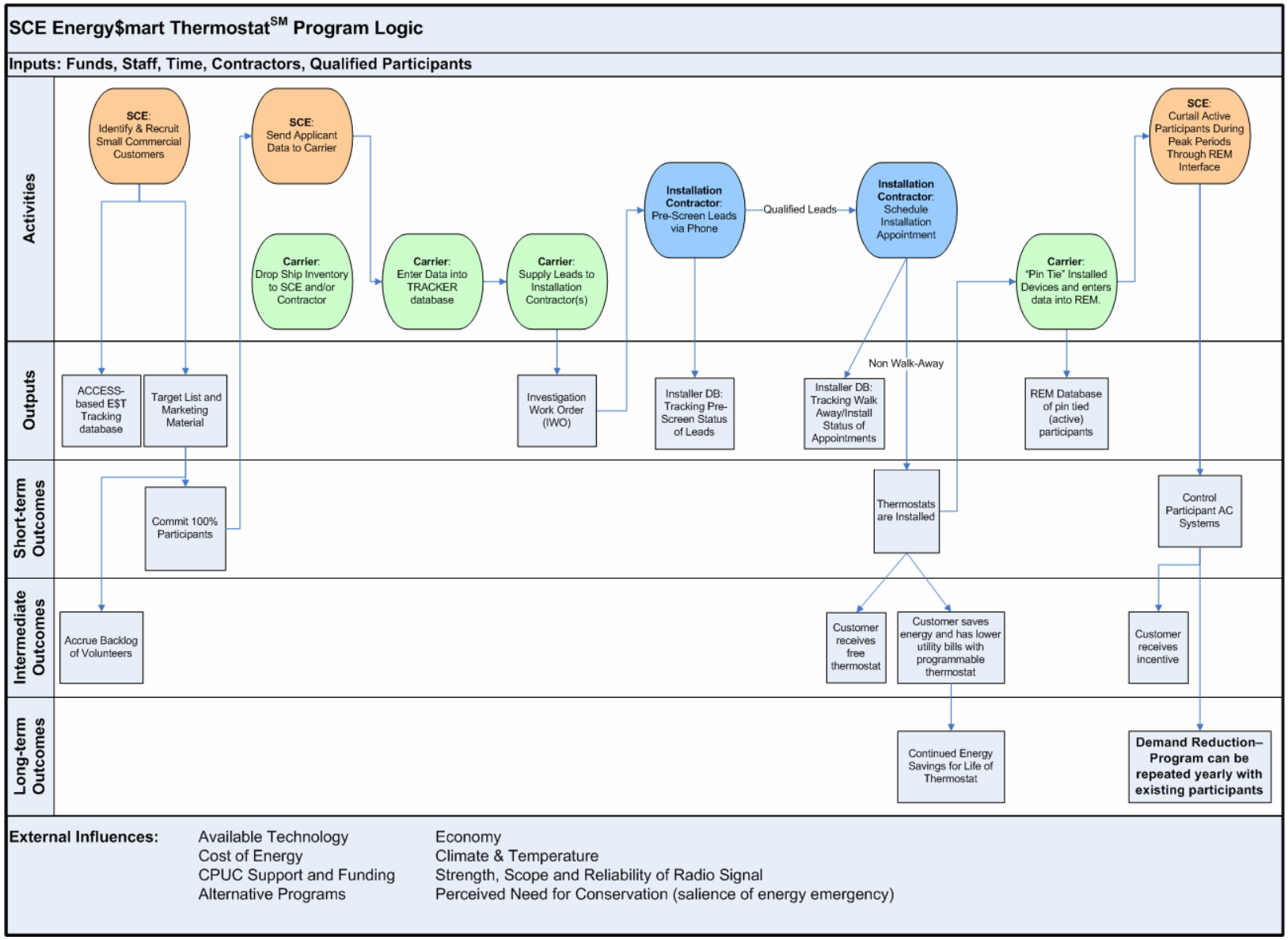


Figure 3: SCE E$T Program Logic

Organizational Structure and Program Management

At the beginning of the program, SCE began developing the program scope and plan after being required by the CPUC to implement the small commercial demand response program in March 2001. The CPUC decision stated that in addition to the installation of technologies, "Program administrators shall also outsource as many other aspects of program administration and implementation as feasible*".* A feasibility study was conducted to investigate eligible technologies that would satisfy the technical requirements of the project. SCE released a request for proposals in May 2001 in order to select a turnkey implementation contractor for the program.

The RFP stated the technical requirements almost verbatim from the Decision. In short, the RFP asked bidders to provide the best solution that they could to comply with the technical requirements stated in the Decision. SCE received ten proposals, and interviewed the three most competitive respondents. An SCE evaluation team determined that the proposal from Carrier Corporation ("Carrier") had the most comprehensive solution and was the most cost effective of all ten bids that had been submitted. The contract was awarded to Carrier in August of 2001 and has been extended each year through 2004. Their contract was again extended to include the 2004 Summer Initiative (SI) program expansion.

Initially, Carrier arranged for the installations to be completed by their dealers (approximately 20 within the E$T program area). However, Carrier discovered that these dealers did not have the necessary level of dedication towards performing the smart thermostat installations, possibly because these jobs were not as profitable compared to the other types of product installations. In 2003 and 2004, the installation function was contracted to Honeywell-DMC as the prime installer. After SCE received CPUC Resolution E-3879 in 2004, SCE management asked Carrier to include Mad Dash Inc. (MDI) as a second installation contractor to meet the installation goal of 4,000 installed thermostats. This was a good request since MDI is smaller and more nimble and eventually provided many installs for the program.

Itron (previously Silicon Energy until its purchase by Itron in 2003) is an ancillary partner in the program delivery. They provide the REM software that allows Carrier to "tie in" the personal identification number of each thermostat to the correct customer. Silicon Energy also has the communications software that converts and sends the curtailment signal from SCE (via the REM database) to Skytel. Skytel, a provider of wireless messaging products and services, in turns transmits the signal to the thermostats. Figure 4 depicts the program management relationship between each of the major performers that are contracted by SCE to assist in program implementation.

The initial contract placed Carrier in charge of the installations and managing all reporting functions. In the three years that Carrier has been contracted to provide a turnkey program, they have primarily functioned as a product supplier and installer. SCE assumed the main program management role, but program funding was still allocated to Carrier for management of the installations and for maintaining the program, handling service calls and special requests.

Recommendation: Management of the installation process should be performed directly by a utility employee or a contractor who has a vested interest in achieving the demand response goals. Product manufacturers are primarily concerned with selling product, as opposed to labor hours for delivering an entire program. Their profit comes from margin on the product and their primary motivation is to sell more of the product; delivering demand reduction to utilities is viewed as a vehicle towards that primary motivation.

This does not make any implementation function of a manufacturer inherently deficient, but it does require the contracting entity (i.e. SCE) to ensure that detailed implementation tasks and

quality assurances protocols are built into the delivery portion of the contract. The utility will save time and money by ensuring that the turnkey program manager is prepared to carry out all management-related activities.

Carrier was not originally set up to deliver a full turnkey program. Carrier has produced a database that is difficult to navigate and produces reports with results that are inaccurate. They are not needed to manage the installation process. It is our recommendation that SCE renegotiate the Carrier contract to reduce any management responsibilities other than the oversight of the thermostat inventory and the load curtailment tool.

*Recommendation: CPUC filing requirements are very extensive and require a person who is closely connected with the utility to produce these reports. This person should be an SCE or contract employee, or a subcontractor whose **main** function is to oversee the entire program operation. This person(s) should also manage and track all installation functions, including inventory.*

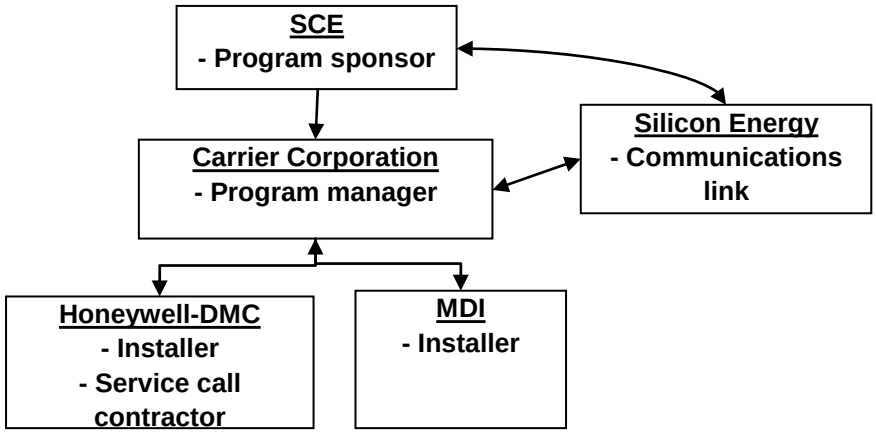


Figure 4: E$T Program - Management Relationship

Recommendation: Ensure that the installation team has adequate staff resources to complete the work on time and on budget. A winter installation period is better than summer since HVAC contractors are busier in the summer with service calls. This is also a better approach to implementing a program since the thermostats are in place when demand is needed.

When planning for the 2004 Summer Initiative (an expansion of the program), SCE determined that they would need to provide a significant portion of the initiative's design and management because they were faced with a challenging timeframe. A program team was set up to perform the program marketing and implementation tasks. This team was comprised of the following staff members along with the primary program staff:

Position, Person	Role(s)
Program Manager Mark Martinez, SCE	- Overall program design, management, and budgeting - Prime supervisory position for all E$T program staff within SCE
Program Operations Manager Myrna Saenz Contract employee	- Daily management of program flow - Tracks installations, inventory, assess walk-away status and installation contractor payments - Daily, weekly, and monthly monitoring/reporting of program inventory, installation, expenditures, inbound/outbound calls

Customer Service Specialist Crystal Marques, Contract employee	- Daily supervision and management of customer service staff and inbound/outbound calls - Prime supervisor to handle extraordinary calls forwarded by customer service representatives
Customer Service Representatives (CSR) (approximately 10), contract employees	- Fields all incoming program calls from customers; documents and codes resolution of calls; performs outbound calls as needed to resolve application gaps or service inquiries
Marketing Team Jan Barret, SCE Diana Miller, SCE Jonathan Ellis, SCE	- Researches and decides upon optimal marketing strategy - Designs all marketing material - Pulls marketing list with input from program manager - Delivers marketing campaign
Systems Analyst David Ritchey, SCE	- Designs tracking database - Responds to all program data requests - Periodically QCs the database to ensure proper tracking
Installation Managers Dale Conklin and Debbie Stevenson (Operations), Honeywell DMC Joe O'Malley and Karl Immenhausen (Operations), MDI	- Designs and manages installation project - Hires installers or reassigns installation staff from other company locations - Oversees inventory - Ensures that installation information is transferred to Carrier
Dispatcher, for Honeywell DMC and MDI each	- Daily coordination, scheduling, and communication with installers - Contacts customers and schedules installation visits - Issues work orders to installers
Installers Honeywell DMC and MDI	- Performs installations per application requests and daily scheduling - Performs warranty and service calls (primarily Honeywell)
Carrier Corporation Program Manager Moira Buckley Carrier, Syracuse, NY	- Technology procurement - Contracting with installers - Maintains inventory tracking database - Maintains thermostat communications network
Carrier Database Consultant Joanne Clifford Contract worker at Carrier	- E$T database design and management - Supports work in software development and training

Marketing and Customer Recruitment

Figure 5 depicts the model that SCE applies to the E$T marketing and recruitment efforts, with the main goal of acquiring participants. SCE performs two main activities: identifying and recruiting customers and sending the application data to Carrier. The tangible items produced

by marketing and recruitment are the E$T tracking database, the target list, and marketing material.

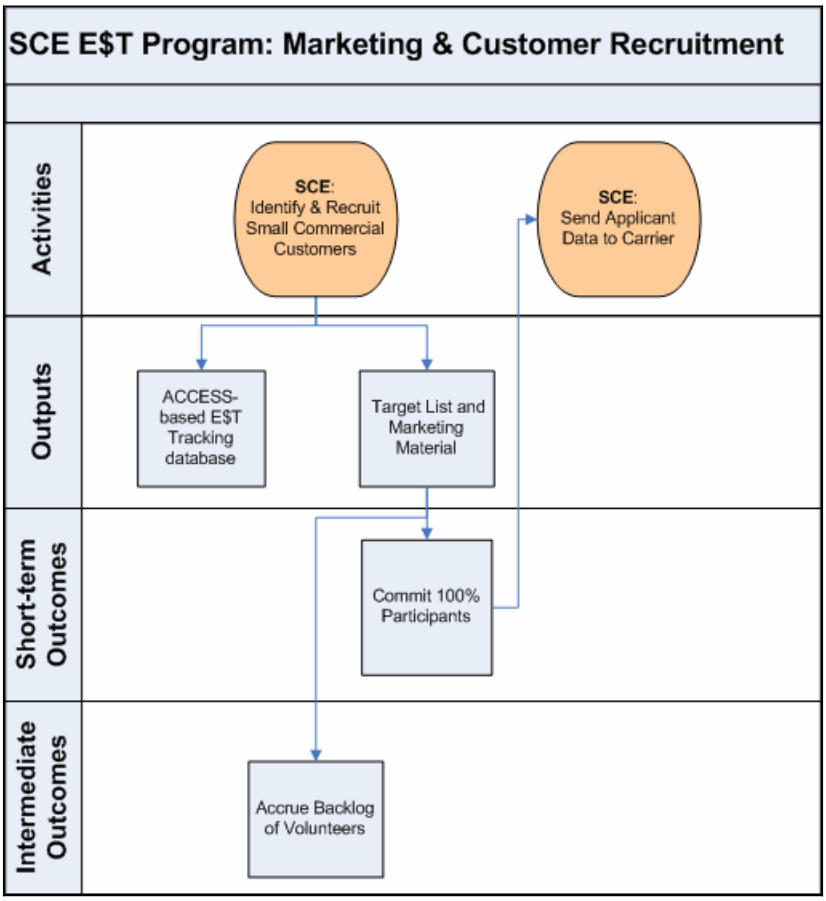


Figure 5: Marketing & Customer Recruitment Model for the E$T Program

Developing the Targeted Mailing List

SCE made a considerable effort to market the program to the segments recommended by the CPUC. From the billing data, SCE selected the parameters and generated a mailing list. SCE operationally defines "small commercial" as all customers in its GS-1 and a portion of the GS-2 rate classes, typically having less than 200 kW demand. Therefore, non-GS tariffs and accounts with more than 200 kW demand were excluded from the population. The final marketing list for the summer expansion also excluded:

- APS tariffs (Air Conditioner Cycling Program Participants)
- CEC Zone 6 service zip codes (coastal area)
- Palm Springs E$T mailing service accounts[18]
- Current E$T service accounts
- Duplicate mailing addresses
- Areas without two-way paging capabilities[19]

[18] Coachella Valley customers were not contacted again for the summer expansion since they had already been sent a letter in April/May 2004.

[19] SCE calls this the Skytel Exclusion List. Skytel, the radio provider, provides a zip code list of all areas that are not

Recommendation: SCE is limited to marketing to customers that fall within Skytel's paging capabilities. SCE used Skytel because the CPUC required that the technology have two-way paging capabilities. Because of this limitation, no thermostats could be installed in the Upper Desert (Antelope Valley), North San Bernardino County, or the San Joaquin Valley. All three areas are ideal candidates for the Energy$mart Thermostat program as they are characterized by hot climates during the summer and have growing populations, with an emerging commercial segment. Excluding these regions also excludes potential energy savings.

Other technologies exist that utilize one-way paging. SCE should explore one-way paging options to determine how much the coverage area could be expanded. According to the E$T program manger, one-way paging appears to offer 97% coverage of SCE's service area. More coverage translates into more participants and increased energy savings for the program.

Recommendation: Additionally, mapping software can be used to target specific feeders or substations that require load relief.

Setting the Incentive Level

The incentive levels are determined prior to the start of the program for budgeting purposes. As a result, SCE is able to inform customers of the incentives they can receive for participating; in turn, this information helps SCE improve program marketing success and recruiting rate.

The current design of the E$T program allows a customer with a Smart Thermostat to either participate in a curtailment event or not participate by overriding the curtailment. This program feature was mandated by the Decision[20]. In addition, the Decision states that SCE should have the flexibility to adjust the customer incentive levels[21] and it further specifies that the customers are to be paid the applicable incentive at the end of the program year[22].

Although each commercial customer has the option to manually override each curtailment, the program achieves maximum demand reduction if no participants override their thermostats during the curtailment event. Therefore a method of deterring overrides is critical to the performance of the program. To meet this challenge, SCE developed a payment schedule intended to motivate customers to accept the curtailment events. Even with the incentive and penalty structure in place, 54% of all 2004 E$T participants had overridden their thermostats at least once[23].

In 2002, SCE paid participants up to $300 per thermostat, reducing this annual incentive by $5 for every override committed during the program period. The program allowed SCE to call a maximum of 50 curtailments. If the participant overrode every event, their incentive payment would be reduced by $250 ($5 x 50). Thus, it was possible for a customer to make a net profit of $50 ($300 - $250) even if they overrode every curtailment. In 2003, SCE retained the incentive amount but raised the penalty to $10 while simultaneously reducing the maximum number of events to 25. In that year, participants could still make a minimum of $50 just for participating. Market research conducted in 2004 established that customers would still

covered by its two-way paging system. As of 2004, approximately 15% of SCE's territory is out of Skytel's range.

[20] Decision, p.52.

[21] Decision, p.51

[22] Decision, p.9

[23] AB970 Small Commercial Demand-Responsiveness Pilot Program, Overrider Survey Final Report, November 23, 2004.

participate with a lower annual incentive payment of $150. For the summer of 2004, SCE lowered the incentive to $150 with an override penalty of $10. The utility offset these changes by agreeing to call no more than 12 curtailments, which then made it still possible for a participant to make a net profit ($30) even if they overrode every curtailment. The Summer Initiative had the same incentive structure as the AB970 program. Table 2 summarizes the historical payment structures of the E$T program.

Year	Incentive Amount	Penalty Amount	Max. # of Events	Max. Penalty	Min. Profit
2002	$300	$5	50	$250	$50
2003	$300	$10	25	$250	$50
2004	$150	$10	12	$120	$30

Table 2: E$T Payment Structure, Years 2002-2004

Research conducted by RLW and others has indicated that these payment structures are favorable to participants. In every year of the pilot program, it has been possible for participants to make money even if they overrode every single curtailment. Focus group research conducted in 2002 by Flexo Hiner & Partners, Inc. found that some customers compute their net gain before deciding to participate. The participant surveys administered for this process evaluation reveal that participants are satisfied with both the incentive level and the penalty amount; however, if given a choice, participants would prefer not to be penalized for overriding their Smart Thermostats[24]. This pattern indicates that the customers view the incentive as something they are entitled to just for signing up.

The current arrangement essentially punishes customers for committing overrides, and employs what is known to behavioral psychologists as a negative punishment contingency[25]. In other words, SCE takes away something valuable (i.e., a portion of the monetary incentive) when the participant overrides their thermostat during curtailment. An alternative to negative punishment is positive reinforcement in which a person receives an appealing reward when they display the desired behavior. If positive reinforcement is applied, a customer would get paid the incentive for withstanding the curtailment period. Thus, the incentive would become something earned through participation.

Recommendation:

It is advisable that SCE alter the incentive structure so that customers do not make a profit if they override every event. This can be achieved by balancing the incentive amount against the penalty amount multiplied by the number of curtailments. An example of this would be to change the incentive structure to an incentive of $120 with an override penalty of $10, with SCE agreeing to call no more than 12 curtailments. The net gain would be zero and the program incentive costs would decrease.

Consider rearranging the payment structure so that the customer is not penalized for overriding; instead the customer would be rewarded for participating. This option would eliminate the penalty for overriding, which is more favorable from the participant's perspective. Using a reward philosophy, the incentive would be incrementally earned by the participant, rather than

[24] AB970 Small Commercial Demand-Responsiveness Pilot Program, Participant Survey Final Report, December 30, 2004

[25] Research shows that punishment is not an effective means to changing behavior and may instead lead the individual to avoid punishment (or the *punisher*). See B.F. Skinner's 1938 book *The Behavior of Organisms: An Experimental Analysis* for a discussion.

incrementally taken away. This arrangement would be more cost effective for SCE as well since the net gain would not be included in the offering.

Furthermore, it is our recommendation that SCE reward customers who withstand curtailment as soon after each curtailment as possible[26]. If the customer must be paid at the end of the program year, SCE can send occasional notifications to inform the customer exactly how much money (how many rewards) they have accrued. Over time, this should reinforce the desired behavior of the program – allowing the utility to remotely control the thermostat.

Recommendation: Customer incentives should be structured similar to the Summer Discount Plan. Higher ton AC units should be paid more since they provide more load reduction. Customers could also be given choices about how many curtailments they are willing to tolerate each summer, and be paid accordingly.

Marketing Message

Time, experimentation, and experience have played a role in determining the message that SCE has chosen to convey about the E$T program to their small commercial customers. When the pilot program began in 2001, SCE emphasized the free thermostat and energy savings. However, customers did not respond significantly to this information. SCE then hired Flexo Hiner to conduct market research to learn more about customer perceptions on the program, and afterwards revised its marketing strategy. Following Flexo's recommendation, SCE highlighted the monetary incentive in subsequent years within the marketing material.

By 2004, SCE had refined the message it conveyed about the program to potential commercial customers to emphasize the incentive. In addition, SCE began to take into account sociological and psychological barriers to participation. As the program manager explained,

> "We have a very, very low participation [rate] with small commercial customers because *they are not willing to give up their air conditioning*... They have human resource issues [and] retail sales issues... with losing air conditioning. When this program came along, and we started testing it…we told customers that we would be controlling their air conditioner, but *they would still have full control with override.* [When the customer hears that,] *they say 'Sign me up'*."

The main letter that was sent out with the program brochure to prospective participants highlighted the following four aspects of the program:

- *$150 participation bonus per thermostat*
- *Up to five SCE Energy$mart Thermostats[SM] installed and programmed for free*
- *Up to 20%-30% savings on heating and cooling bills*
- *Internet access for your own remote thermostat adjustments*

In the text of the letter under these bullets, SCE goes on to say that by participating, the customers are helping to "reduce the likelihood of rotating power outages during peak electrical shortages".

Recommendation: Highlight the local assistance message that by participating they are keeping everyone's lights on in the community.

---

[26] See Ivan Pavlov's discussion on "contiguity theory" in his 1927 book *Conditioned Reflexes*.

Recommendation: Emphasize the fact that the customer retains full control over their cooling system. This will encourage more hesitant business owners

The letter and the program brochure contained a marketing message that the E$T program manager decided to incorporate that highlights the technology. In 2004, SCE's main marketing slogan for the E$T program was "*Be Cool. Be High-Tech Cool*". This slogan appears to be intended to appeal to people who:

- Desire to manage their businesses environment via technology
- Seek opportunities to use cutting edge technology

Recommendation: The cutting edge technology message may have unintended consequences such as deterring people who are not early adopters of technology. Maybe alter the message to emphasize that these thermostats are the not necessarily cutting edge, but that the main technology is tried and true and the load control is what is different.

Recommendation: The messages conveyed to the customer about the program are appropriate to what SCE is offering. The utility should continue to use these messages in future marketing efforts. Additionally, it is recommended that SCE employ subtle messaging techniques, such as printing material on recycled paper, which provide further cues that reinforce the "green" message of energy conservation that underlies the Energy$mart Thermostat program.

Recommendation: As time passes, it may be necessary to remind customers about the 2001 energy crisis that prompted programs like this one, so that the program remains relevant in the minds of the customers. SCE can address that issue more directly by including in the marketing material an estimate of how much energy the program has saved since the program started in 2001.

Developing Marketing Material

When the program was in its infancy, SCE had time to explore several channels for reaching potential customers. In addition to the targeted mailing, the utility took out newspaper advertisements, purchased radio time, and hired representatives to visit small businesses in person. These avenues were carried out in part because one of SCE's goals was to access the hard-to-reach segment of ethnic multi-cultural and non-English speaking small business owners. Several of the marketing approaches were translated into Korean, Vietnamese, Spanish, and Chinese. The mailer, although desirable as a low cost choice of marketing options, was also the least effective.

SCE did not have the luxury of time to conduct similar activities when the CPUC approved the summer expansion in July of 2004. Accordingly, the utility chose to target potential customers through a mass mailing of a letter and brochure. The program manager met with the Marketing and Communications Department who advised him to send out 100,000 mailers with the expectation that they would observe a 5% return rate, or 5,000 returned applications.

Based upon previous program experience, the program manager knew that approximately 30% of applications, for various reasons, would not result in an installation. It was estimated that 5,000 customer responses would be sufficient if the program's goal was to install 4,000 additional thermostats by the end of summertime.

Recommendation: When possible, it is recommended that SCE employ several approaches to reach potential customers. General knowledge and awareness of the program should be built by utilizing traditional marketing approaches such as newspaper advertisements, bill inserts, radio announcements, internet websites, and newsletters. Press releases with success stories could build public confidence in the program.

Face-to-face contact such as attendance at chamber of commerce meetings, door-to-door visits, and co-promotions at other SCE program events should also be used to reinforce the mass media campaigns and to directly market the program. Face-to-face contact provides advantages over mass marketing because the application is completed correctly, eliminating customers that would be pre-screened later, reducing follow up phone calls and future costs. SCE should also strive for reaching the growing, hard-to-reach segments by translating information into languages other than English.

Other creative marketing methods should also be considered such as giveaways at public events such as professional baseball games, school marketing campaigns, or the development of a character mascot and logo that clearly promotes the program.

Engaging the support of local opinion leaders can also be a powerful influence on the adoption of innovations[27]. An example is a letter from the local Chamber of Commerce on Chamber letterhead that encourages people to sign up to benefit the community.

Additionally, an incentive could be offered to satisfied participants who are willing to sign their neighbors up for the program if given the opportunity. An incentive for businesses to sign up other businesses would likely increase enrollment at low cost to SCE.

Customer Response

The E$T Program Manager monitored the application returns as they arrived for processing. The first drop (i.e. the mailed out batch) of 100,000 mailers on July 9th yielded just over 20% of the desired amount of returns within the first week (1,127 applications). The SCE marketing team quickly decided to drop an additional 100,000 mailers in order to bring in the 5,000 applications that the program manager needed. The second mailing was sent in two batches, 60,000 and 40,000 pieces, separated by two days. As before, the customer response was low in the days after the second mailing. Another 400 applications were received the following week.

Eleven days after the second set of mailers went out, the mail room delivered over 800 applications to the program manager. It was discovered later that the mail room had held onto the applications since they did not have a billing code for the postage paid forms. Three days later the mail room delivered another 1,100 applications. The applications continued to come in throughout July and August, and the program manager ultimately had over 5,000 applications to work with in September.

Figure 6 graphically depicts the customer response to the marketing effort; Table 3 shows the cumulative number of applications received over the marketing period.

---

[27] Geltz, Christine and Martinez, Mark, Diffusion in the Desert: Adoption of Demand Response Technology by Rural Small Businesses, ACEEE Summer Study 2004, Panel 7

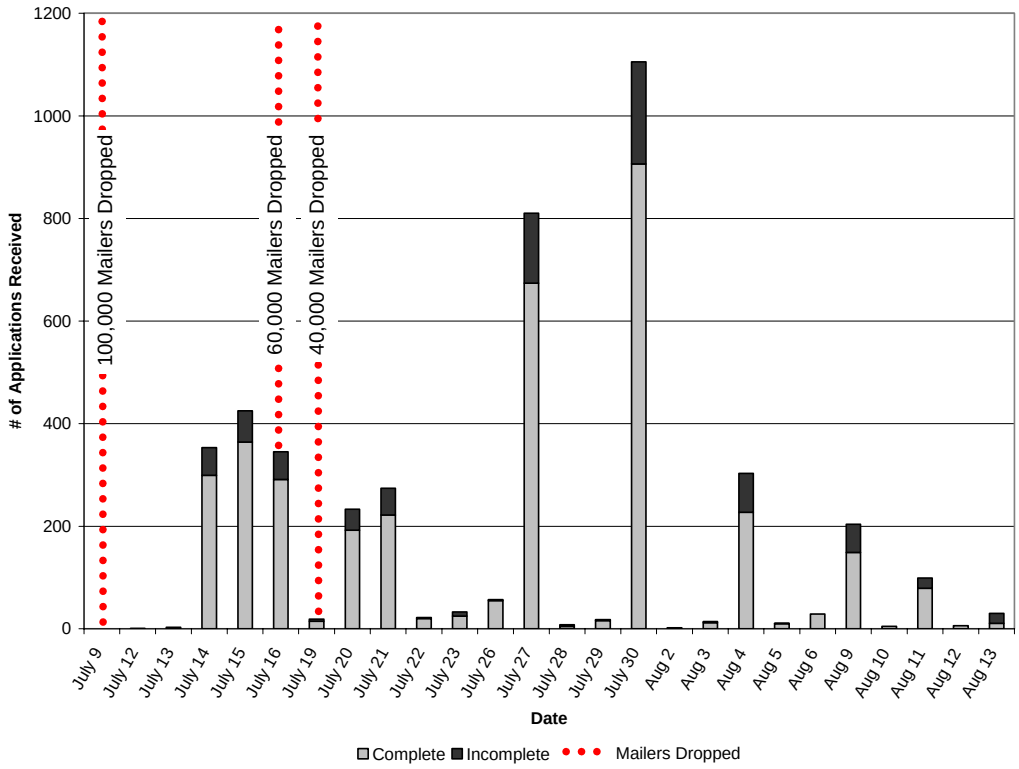


Figure 6: Response to the Summer Initiative Marketing Effort (first 5 weeks)

Table 3 shows that, as of January 5, 2005, 5,162 applications were received by SCE. That equates to a *response rate of 2.6%,* about half the response rate that was originally anticipated by the SCE Market Management & Communications department.

Recommendation: When deciding how many mailers to send out, SCE needs to consider that some businesses will not qualify to participate in the E$T program for technical and non-technical reasons. On these grounds, the utility should not expect the typical response rate of 5%; the response rate may be more like that of the Summer Initiative marketing effort (2.6%).

Week	Days in 2004	Received Applications	
		Weekly	Aggregated
1	Jul 12 - Jul 16	1,127	1,127
2	Jul 19 - Jul 23	581	1,708
3	Jul 26 - Jul 30	1,998	3,706
4	Aug 02 - Aug 06	359	4,065
5	Aug 09 - Aug 13	344	4,409
6	Aug 16 - Aug 20	252	4,661
7	Aug 23 - Aug 27	94	4,755
8	Aug 30 - Sep 03	105	4,860
9	Sep 07 - Sep 10	79	4,939
10	Sep 13 - Sep 17	21	4,960
11	Sep 20 - Sep 24	63	5,023
12	Sep 27 - Oct 01	20	5,043
13	Oct 04 - Oct 08	9	5,052
14	Oct 11 - Oct 15	25	5,077
15	Oct 18 - Oct 22	18	5,095
16	Oct 25 - Oct 29	21	5,116
17	Nov 01 - Nov 05	7	5,123
18	Nov 08 - Nov 12	4	5,127
19	Nov 15 - Nov 19	1	5,128
20	Nov 22 - Nov 24	4	5,132
21	Nov 29 - Dec 03	2	5,134
22	Dec 06 - Dec 10	4	5,138
23	Dec 13 - Dec 17	8	5,146
24	Dec 20 - Dec 23	4	5,150
25	Dec 27 - Dec 30	6	5,156
26	Jan 03 - Jan 05	6	5,162

Table 3: Applications Received, Weekly Counts

Recommendation: Supply mail room with a billing code or secure a Post Office Box for all applications to ensure that they are received in a timely manner. This will eliminate any confusion as to how productive the marketing is and eliminate any unnecessary marketing efforts that are undertaken if the applications are waiting in the mail room, but remain undelivered for a period of time.

Over 4,200 applications were completely filled out and processed by the SCE Customer Service Representatives. However, 904 of those applications (18%) could not be processed immediately because they were incomplete (e.g., no signature, not filled in completely, or unreasonable number of thermostats requested), see Table 4.

Returned Applications	Count	Percent of Returned Applications
Complete	4,258	82%
Incomplete	904	18%
Total	5,162	

Table 4: Summer 2004 E$T Returned Application Characteristics

In an attempt to understand how the marketing effort can be improved to achieve a higher response rate, RLW conducted a survey of non-participants (customers who received a mailer but did not enroll in the program). RLW sampled 150 non-participants to assess what these customers thought of the E$T program and the marketing material that they received in the

summer of 2004. Prior to the phone survey, customers selected as the non-participant sample received a copy of the original program marketing brochure, along with a letter explaining that they would be contacted to gain their feedback about the program information. The non-participant survey appears in Appendix SRO of this report.

The non-participant survey was developed under the assumption that customers did not respond to SCE's offer because the marketing material may not have been understandable or not persuasive enough. RLW quickly learned that most non-participants were actually able to determine that they were not qualified to participate in the E$T program and, therefore, did not apply, i.e., 35% cite non-technical reasons and 21% cite technical reasons why they were not qualified (see Figure 7). About a quarter of the non-participants reported that they did not recall ever receiving the initial mailer and program application. The 'Other' category included a handful of people who claimed to be participating or program walk-aways.

Ten percent of the non-participants we surveyed say that they remember the original mailer, but chose not to apply to be in the program because they did not want to have their AC controlled, they were suspicious of the offer, or they simply did not have time to fill out the application.

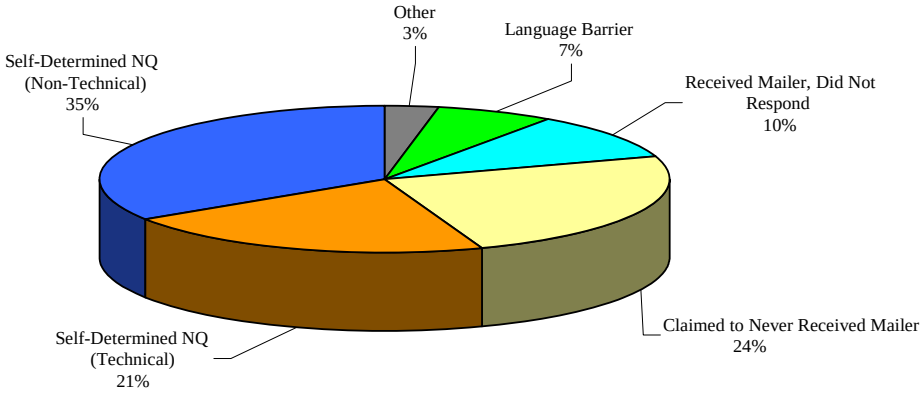


Figure 7: Non-Participant Survey Outcomes

Table 5 shows a breakdown of technical and non-technical reasons why non-participants deemed themselves not qualified for the program. Of the technical non-qualified customers, 77% of the customers did not have air conditioning.

Self-Determined Not Qualified		
Technical	**Count**	**%**
No A/C	27	77%
Don't Use A/C	5	14%
No Thermostat	2	6%
Recently Installed New Thermostat	1	3%
Total	*35*	*100%*
NonTechnical	**Count**	**%**
Non-Commercial	31	55%
Moving/Selling Business	11	20%
Not Authorized	7	13%
Corporate Barriers	3	5%
Leaser/Owner - non-tenant	3	5%
Vacant	1	2%
Total	*56*	*100%*

Table 5: Breakdown of Technical and Non-Technical Non Qualifications

In addition, 7% did not respond because of a language barrier (the Summer Initiative marketing material was printed in English only). RLW performed a readability analysis[28] of the copy, which indicated that readers would need a 12th grade education to best understand the text. If SCE chose to make the brochure more accessible to customers where English is a second language, the text could be reworked to accommodate these types of readers, as shown in the alternative copy below.

Original Copy:

> *Designed specifically to help businesses manage their cooling comfort and costs, the SCE Energy$mart Thermostat Program is available for a limited time to select businesses. The program provides financial incentives and programmable digital thermostats to accepted participants.*
>
> *Upon installation of your new SCE Energy$mart Thermostat, SCE will program it to operate your air conditioning at the setting you typically use. During various weekday afternoons through October, SCE will remotely raise your thermostat setting 4 degrees for up to a four-hour period. You can override the adjustment, but you will forfeit $10 of the $150 you're entitled to receive, each time you override the setting. Thermostat settings will be adjusted no more than 12 times during the year.*
>
> *The test program ends December 31, 2004 at which time you'll be sent your participation payment of $150, less any amounts forfeited for overrides. You may also keep any SCE Energy$mart Thermostat installed at your facility (valued at $300 each).*
>
> **Flesch-Kincaid Reading Grade Level: 12.0**

Alternative Copy:

> *The SCE Energy$mart Thermostat Program is designed to help businesses manage their cooling comfort and costs. It is available for a limited time to select businesses. You'll get up to $150 and a programmable digital thermostat for participating.*
>
> *SCE will program your new thermostat to run your air conditioning at the temperature you typically use. During select weekday afternoons through October, SCE will raise your thermostat setting by 4 degrees. This may be for as long as four hours. You can switch off this remote control (called an "override"), but each time you do, you will lose $10 from the $150 you could receive. SCE will remotely adjust your thermostat no more than 12 times during the year.*
>
> *The program ends on December 31, 2004. After that date, SCE will send your payment of $150 minus any amount for overrides. You can keep all of the SCE Energy$mart Thermostat(s) at your facility (valued at $300 each).*
>
> **Flesch-Kincaid Reading Grade Level: 9.9**

Recommendation:

The application appears to be straightforward enough for most customers to be able to fill out and return the form without any problem. It is our recommendation that SCE continue to use the same application form, perhaps with added fields such as business name and best time to contact, to make it easier for the Customer Service Representative and the installation contractor to schedule appointments or follow up with additional questions. The text should be analyzed for readability ease before the print media is approved and submitted for printing.

---

[28] The Flesch-Kincaid readability score is calculated by the following formula: (0.39 x the average number of words per sentence) + (11.8 x the average number of syllables per word) - 15.59. The analyses appearing here were carried out using an application in Microsoft Word. Similar scoring tests are used in a number of states in determining the acceptable threshold of readability and understandability of documents, particularly for forms and materials used by insurance firms.

Figure 8 shows the volume of calls handled by the SCE call center in 2004. Not surprisingly, the greatest volume of calls came in during July, coinciding with the 200,000 mailers that were sent out. During the July peak, a total of 1,314 calls were handled by the call center. In prior months, when the program was in maintenance mode, fewer than 100 calls were handled by the call center. The quantity of calls dropped by more that 50% from July to August, with only 574 calls coming in during August. The calls continued to drop to a November and December low of approximately 250 calls.

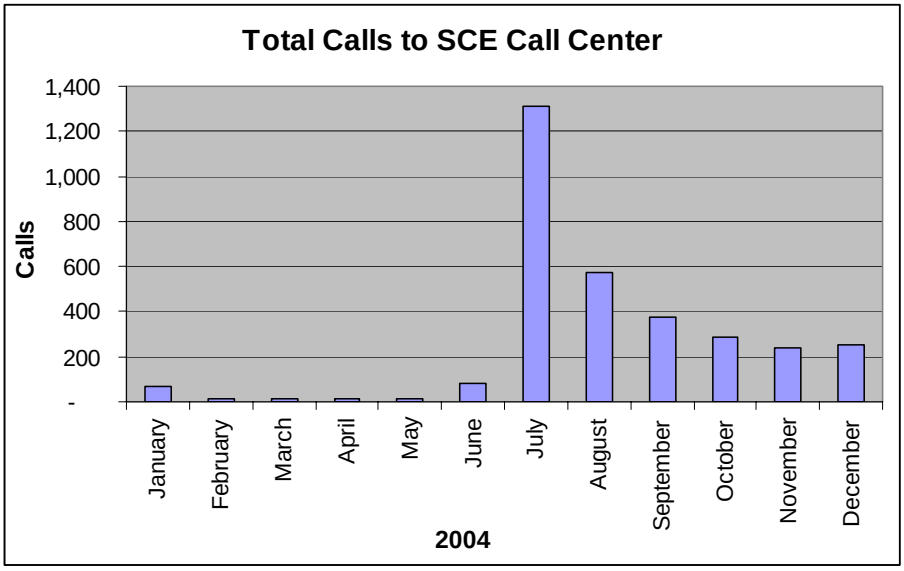


Figure 8: Total Calls to SCE Call Center by Month

Table 6 shows the type of incoming calls that came in since the beginning of the program. The greatest volume of calls that came in consisted of general questions about the program (this is due to the fact that detailed call tracking did not begin until late 2004). The second most common type of calls were regarding customer's AC units that were malfunctioning after a thermostat installation. Thermostat issues were the third most common type of call and were referred to Carrier. Some other call types that were received were customers calling to check on the status of their submitted applications, questions on how to program their thermostat, and calls to provide SCE with information missing from their applications.

Incoming Calls	YTD	%
General Question*	2,068	63.8%
AC Malfunctioning	183	5.6%
Thermostat Issue (Carrier)	171	5.3%
Application Status	170	5.2%
Programming Question	165	5.1%
Incomplete Application	123	3.8%
Incentive Question	62	1.9%
Appointment Missed	54	1.7%
Website Question	42	1.3%
Additional Device Request	41	1.3%
Mailed Brochure from Call	40	1.2%
Reschedule Appointment	35	1.1%
Complaint	34	1.0%
Opt Out	26	0.8%
Problem Resolved	10	0.3%
Event Question	8	0.2%
Acct Info Update	4	0.1%
Reenrollment Request	2	0.1%
Other	2	0.1%
Billing Question	1	0.0%
Total	**3,241**	**100.0%**

Table 6: SCE Call Center Issues Handled Since Inception

*note – specific call tracking did not occur prior to 2005

Data Management

Data management is a critical component of the E$T program. The current data management system is in need of a significant overhaul in order to greatly increase the efficiency of SCE CSRs and management. Currently, a minimum of *five* databases are used to manage the E$T program data:

- SCE has an E$T MS Access-based database that they use to track applicants.
- SCE references the main Customer Service Database to ensure that applicant is not a Summer Discount Plan or another conflicting program participant
- Carrier has its own Tracker database that was designed specifically to track and manage installation leads.
- Installation tracking is managed by the installation contractor in another database[29].
- Finally, SCE uses the Itron REM web-based database to communicate with the installed thermostats.

Figure 9 shows the overall flow of data from one database to the next. SCE receives the applications and sends the information to Carrier; the information is then transferred to the installation teams and relayed back to SCE and Carrier. Carrier uploads the data to REM to enable load curtailment. These steps are described below in more detail.

[29] The number of installer databases is dependent on the number of contractors involved in the project.

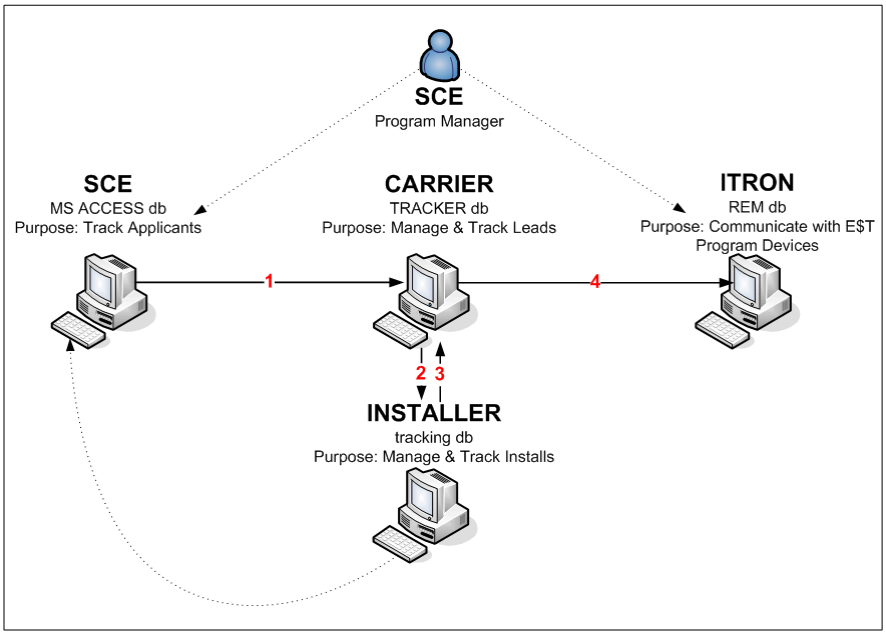


Figure 9: Data Management of the SCE E$T Program

SCE Data Management

SCE updates and manages an MS Access based E$T database. SCE has been responsible for tracking applications and tracking maintenance requests. During a new application/install period, all of the applications are entered into the database by the CSRs along with a receipt date. Each evening this list is emailed to Carrier by the systems analyst.

Recommendation: Assign a duplicate person to this task to ensure that there is a backup. Better yet, make this an automated process by integrating databases.

The CSRs receive calls throughout the duration of the program from participants that have various thermostat issues that need resolution. A common call is from participants needing programming assistance. Each CSR has a thermostat at their desk that they use to help the caller program their thermostat. They can also provide the caller with the Carrier website where they can program their thermostat.

If the customer is experiencing a problem, the call center representatives attempt to diagnose the nature of the problem on the spot. They first have to figure out if the problem is with the AC equipment or the thermostat itself. They can examine the thermostat setpoint on the internet programming site for that customer.

Recommendation: CSRs need a basic knowledge of compressors, breakers, and the thermostat functionality to most effectively perform their jobs. The SCE manager should hold periodic training sessions for new representatives and for other representatives to refresh their knowledge. They should be provided a flow chart for problem diagnosis that probes the caller for information such as:

- *Is there air coming out of the registers?*
- *Is the air cold?*
- *Can you hear the fan?*

Pre-determined answers should be provided to the CSRs that assist them with diagnosing the systems and the appropriate resolution.

If the CSRs identify a problem that they can not resolve, the CSRs enter a description of the problem into the customer's record in the E$T database. They then email the Customer Specialist who investigates the problem and either decides that they need their thermostat fixed/replaced, or that they are having an unrelated HVAC problem.

Recommendation: Email is not the optimal way to handle data transfer. A query could be written that pulls up the account number for each customer needing problem resolution. A button to run this query could be added to the main form. This could at a minimum be used to double check that there are no customers with open issues.

If the thermostat is not the problem, the Customer Specialist calls the customer and explains that they should call their HVAC technician to look at their system. If the customer agrees to call their HVAC technician, then the Customer Specialist closes the issue by typing their initials and the date resolved. On the seldom occasion when the participant still thinks that it is their thermostat that is causing the problem, SCE issues a dispute resolution form and passes the problem on to that department.

If Customer Specialist determines that it is a thermostat problem, they call the customer and explain that a contractor will be calling to schedule a visit in the near future. The Customer Specialist then requests a work order issuance for that customer in the E$T database. Each evening this list is emailed to Carrier by the systems analyst.

Carrier Data Management

Once Carrier receives the SCE system analyst's email with the new list of work orders, this list is uploaded into the Tracker database. Carrier then turns around and issues Investigation Work Orders (IWO's) to the designated installation contractor by either email or fax. This process is being managed by one person at Carrier and has been known to take up to a few days to complete.

Recommendation: Ensure that work orders are issued every day, either by automating the system or ensuring that there are backup personnel who can complete this task. The best method would to have SCE directly issue the work orders to installers.

Over the years, Carrier made some modifications that made the data management process more efficient. The most significant change came with the development of Tracker, which was created between the 2003 program year and the 2004 summer expansion. Prior to that time, the installation leads were tracked using MS Excel (in 2001) and an MS ACCESS database (in 2002 & 2003). Tracker was designed to perform the following functions for Carrier:

- Work Order generation & tracking
- Production of reports on installation leads and outcomes
- Communication with handheld devices, enabling installers to access the work orders electronically while in the field – not currently functional
- Inventory management

Carrier has been working on tracker for over a year. Insufficient training has been provided to the SCE E$T staff who do not use Tracker to track leads and outcomes. More importantly, no input was solicited from SCE E$T operations staff when Tracker was being designed. Some reports that Tracker outputs do not match REM output on the number of installed thermostats.

Recommendation: At a minimum, SCE CSRs should have the functionality to pull a list of work orders they issued, and easily determine when the IWOs were issued to the service technicians and resolved. Ideally this should be automatically updated in the Access E$T database. Another reason why Tracker and the E$T databases should be integrated.

Recommendation: On a monthly basis, SCE should check the E$T database against the REM database to ensure that all the customers that are signed up for the program are being curtailed or are responding to the heartbeat tests. This will also catch any customers that are being curtailed that may not be in the program, such as customers who dropped out of the program.

Recommendation: SCE should maintain Tracker (or at a minimum, Tracker's functions) as a component of their own data management system. SCE would then be responsible for reconciling the data tracking and ensuring that they are achieving their load response goals.

Carrier also developed an identification system for tracking multiple thermostat requests. Since the program allows the customer to request more than one device, it was becoming increasingly difficult for Carrier to monitor and track "one building-multiple account" situations. Their solution was to develop a new identification system that would eliminate the need to file separate work orders for every thermostat request.

Figure 10 is an example of this identification scheme. Carrier starts with a portion of the SCE customer account number and calls it the "Parent ID". Then for each thermostat requested, Carrier generates a "Child ID", i.e. simply the Parent ID with a letter at the end. This type of coding offers flexibility in the field since the installer can expand or collapse the "child" accounts to reflect what is found at the site. If the installer needs to add another thermostat, s/he can simply add another Child ID to the work order. In addition, this system permits Carrier to generate one work for every customer even if they request multiple thermostats since the information can be grouped by Parent ID.

SCE customer account number	S12345A
Parent ID	S12345A
Child ID (Thermostat 1)	S12345A**A**
Child ID (Thermostat 2)	S12345A**B**
Child ID (Thermostat 3)	S12345A**C**
Child ID (Thermostat 4)	S12345A**D**

Figure 10: Example of Carrier's Thermostat Identification Scheme

Carrier attempted to make ongoing improvements to the Tracker system while the summer expansion was underway, but this introduced many problems for the installation contractors. The work order format and content changed during the program expansion period. For example, one of the crucial pieces of information that SCE tracks is tonnage information on the AC unit. At an early point during the summer expansion, however, tonnage was not a required field to complete on the work order data entry.

*Recommendation: Have the database and all data collection materials and technology developed, tested, and modified **prior** to the installation period. The E$T program should continue to use Carrier's method for identifying multiple thermostat requests. The program manager of the E$T program should be involved in discussions involving alterations to the data collection materials, such as the work order. This will ensure that the goals of the E$T program are met.*

Installer Data Management

Once the installation contractor receives the work order form Carrier, they schedule the work and then distribute the work orders to the field technicians. Once the field work is completed, the installation managers update each installation outcome in their own installation data tracking system (typically Excel).

Recommendation: The installers should have the ability to directly enter their installation outcomes into Tracker. Then SCE and Carrier would immediately know when a customer issue has been resolved. Additionally, the schedulers should also have access to Tracker. They can record each of the calls that they make to contact a customer, as well as the time, date, and technician assigned to the scheduled appointment. If SCE also had access to Tracker, and a customer called them saying that a contractor missed an appointment, they would be able to determine who was supposed to be at the location and contact them immediately without having to go through the central dispatch location, which might be closed for the day. They could also immediately issue a work order for an available technician to take care of the customer.

The installation contractor then sends the work order outcomes to both Carrier and SCE. SCE uses the install information for reporting purposes.[30] Carrier uses the installer feedback to "tie-off" the Personal Identification Number (Pin), i.e., Carrier links the unique thermostat pin number with the customer account information.

Among other data, the Itron REM database houses the thermostat pin numbers and customer account information. With the thermostat pins linked to utility account numbers, SCE is able to track customer activity in the E$T program through REM. Without this link, there would be no way to know where the thermostat was installed.

This overall program management system is potentially detrimental to the E$T program because it hinders the program manager's ability to accurately assess the progress that is being made. The current arrangement requires the project manager to wait for updates from the installer and from Carrier, and under normal circumstances this might be acceptable. However, this process is problematic when timing is crucial, as was the case in 2004 when SCE was under pressure to get the installations completed in time for summer testing. At times like these, the program manager needs to have instant access to the current status of all applications and work orders.

*Summary Recommendation: Create **one database** that incorporates all the information that is currently housed in the separate databases. This database could be SQL Server based and be web-accessible so that multiple users could access the information at any time. The database should be password-protected so that only authorized users would be allowed to view and modify the information. In addition, the database should be "smart" and open up just the pertinent tables, forms, or screens assigned to the user. For example, the E$T program manager would have access to all areas, whereas the installation contractor's password would open up just those areas pertaining to installation activities.*

This database should also integrate customer billing records in order to better enable payment of the incentive and to understand if the incentive needs to be prorated based upon signup date.

---

[30] The CPUC required monthly reporting for the Summer Initiative expansion of the Energy$mart Thermostat[SM] Program. In addition, SCE uses the information on a weekly basis to monitor their progress and develop forecasts for completion.

Installation

Figure 11 depicts the installation model for the E$T program. The main goal of the installation effort is to replace the existing thermostats with Smart Thermostats in small businesses. SCE is not directly involved in the installation process. Carrier's main duty here is to take the customer leads (provided by SCE) and generate a work order for the installer. From there, the installer screens each customer for eligibility and schedules an appointment, which ultimately results in an installation.

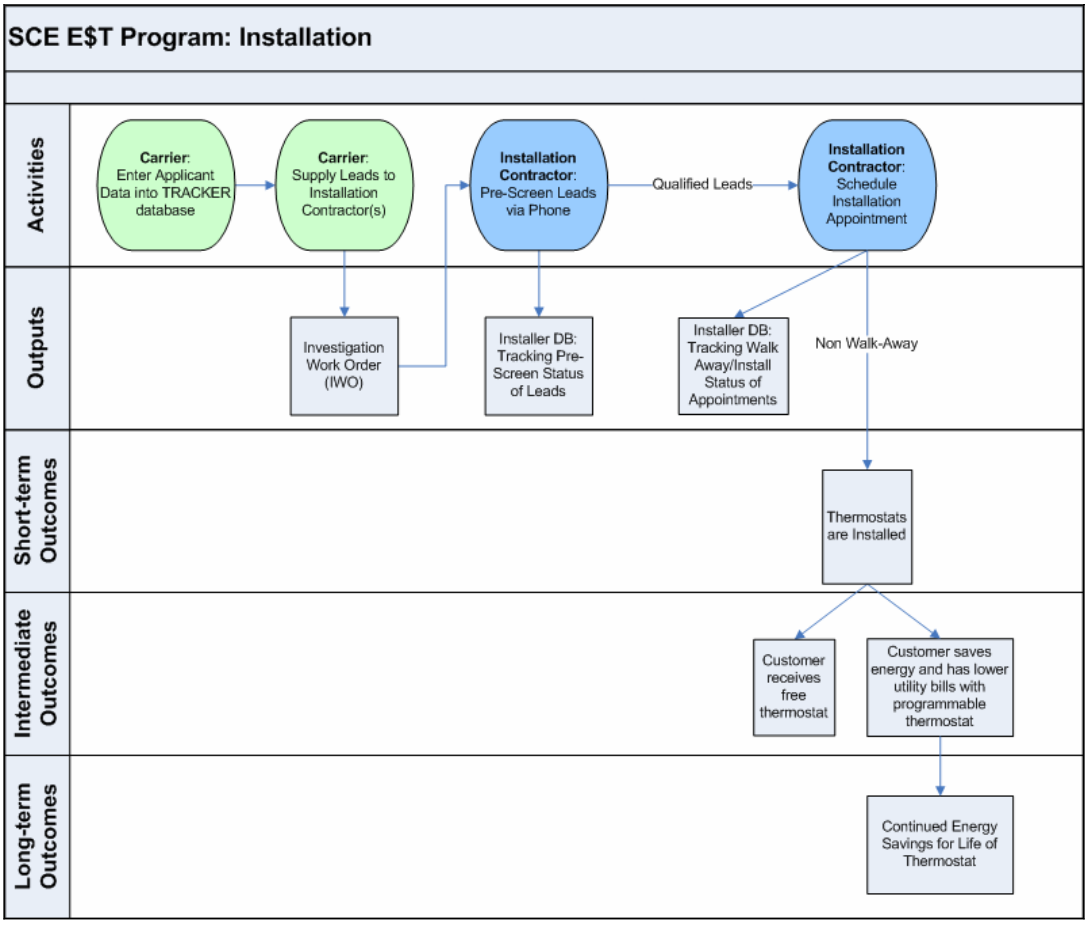


Figure 11: Installation Model for the E$T Program

As mentioned above, Carrier originally used its network of dealers, the Association of California Air Conditioning Dealers (ACACD), to perform the installations for the 2002 SCE E$T program. But in the 2004 summer expansion, the ACACD were not interested in assisting with the project because they were too busy with their normal summer workload. When SCE's proposal to expand the E$T program in 2004 was approved by the CPUC in July, Carrier already had Prime Energy completing installations in the Coachella Valley. Carrier also added Honeywell DMC (Honeywell) to the team. The E$T program manager knew that the 4,000 thermostat expansion would require more technicians, so he also suggested to Carrier that MDI be added to the roster.

The installers are all contracted through Carrier. Carrier pays $140 per thermostat install and $75 per site for a walk-away (i.e., appointments that do not result in an installation). SCE determined the installation prices, and they were integrated into Carrier's total authorized budget for their services. Honeywell and MDI agreed that the installation payment was

adequate. This payment should be more than adequate since the average site has approximately two thermostats, which means that the installers are paid on average $280 per site.

Once Carrier issued the Investigation Work Order, it was the installer's responsibility to schedule the appointment with the customer. The participant survey conducted for this evaluation provides a glimpse of the customer-installer interaction that occurred in the summer of 2004.

Overall, it appears that the installers performed well in the eyes of the business owners. The customers were satisfied with the quality of the installation; on a scale of 1 to 10 (1 indicating 'not at all satisfied' and 10 indicating 'very satisfied'), customers gave the installation quality an average rating of 9. The following summarizes what the participants had to say about the installation:

- **97% report that the scheduler was polite** when they were contacted to schedule an appointment (only 1% say they were not, 2% do not remember)
- **97% say that the schedule was just flexible enough** (3% say it was too flexible, less than 1% say it was not flexible enough)
- **98% say that installer arrived on the date and time promised** (2% say they did not)
- **85% of the participants claim that the installation took about as much time as expected** (8% say it took less time, 7% say it took more time than expected)
- **98% say that the installer had a professional demeanor** (1% say that the installer did not, 1% do not know)
- **95% report that the installer was both polite and accommodating to their questions and concerns** (4% said the installer was not, 2% do not know)

Table 7 indicates that, in most cases, the installers did spend time explaining the thermostat operations to the customer. In fact, only 7% say that the installer spent no time explaining the thermostat to them. Only 38% of those who got no instruction said that this was adequate. About half of all the surveyed participants estimate that the installer spent between 6 and 10 minutes with them. Nearly all of the participants who got this amount of attention from the installer say that 6-10 minutes is adequate.

	Percent	
	Amount of time spent explaining thermostat	**Amount of time WAS adequate**
No time at all	7%	38%
1-5 minutes	22%	88%
6-10 minutes	48%	99%
11-15 minutes	13%	100%
16+ minutes	10%	95%

Table 7: Amount of Time the Installer Spent Explaining the Thermostat Operations

Those customers who say that the amount of time was not adequate also provided the following feedback:

> *"I would have liked more reference materials to understand how to program the thermostat."*

"I would have liked programming and reference materials."

"I need more information on how to program the thermostat."

"I would have appreciated more training from the installer, and a more explicit manual."

During the summer expansion, the installers were under pressure by SCE to get the installations completed. The E$T program manager was not primarily concerned with the installer spending time with the customers, since the belief was that there was already a staff of about 10 customer service representatives at the call center equipped to handle typical programming questions. This was, *in part,* due to the fact that there was a short install period to reach the program goals. However, when we asked the customers how they learned to program their new thermostats, only 1% state that they called SCE for help (Table 8).

Method	Percent of Respondents
Installer	70%
Manual/Card	10%
Manual & Installer	8%
Figured it out myself	7%
Spoke to an SCE representative	1%
Internet	1%
I still don't know	4%

Table 8: How Did You Learn to Program Your Energy$mart Thermostat?

Recommendation: The installers are already instructing the customers on how to program their thermostats in order to maintain good customer relations. The installers should be ***required and trained*** *to program the thermostats at the site since the task is already occurring without it being required. To satisfy most customers, the customer training should take approximately 6-10 minutes. The installers are satisfied with the current amount of funding that they are receiving to install and program the thermostats so no additional funding should be necessary; in addition, the value of the initial rapport that the installer makes with the customer, and the ability to simultaneously perform and tell the customer what to do provides a value-added level of comfort and simplicity to the customer.*

In the past three years of the program, which included over 9,000 installed thermostats, the only program reference material that Carrier provided to the installers to leave with the customers was a small card with programming instructions. They did not provide a thermostat manual, no program introduction letter, no welcome package, not even a program brochure. In fact, Carrier did not provide any formal training to the new installation teams.

Recommendation: The Carrier thermostat handout was inadequate in the eyes of the customers. Carrier should at a minimum provide a thermostat manual, similar to a more detailed manual that comes with any store bought thermostat. SCE should develop a welcome package for the installers to hand out once the installation is complete. The materials could include a welcome letter, the programming instructions, and the phone numbers of departments where the customer can get assistance.

Recommendation: Carrier should be required to give a thorough training on the installation protocol to ensure that all thermostats are installed properly and are delivering the expected load reduction. This will also ensure that the contractors are very familiar with the protocols, ultimately reducing time in the field and shortening SCE's installation period.

The E$T program manager provided the phone call summary for the 2004 program year. As Table 9 shows, only a small percentage of the incoming calls were customers calling with programming issues. There was an increase in calls in October and November, presumably because the participants were having trouble reprogramming their thermostats for the cooler fall season.

Month	Percentage
August	2%
September	6%
October	15%
November	22%
December	14%

Table 9: Percentage of 'Programming Question' Calls to SCE by Month

Recommendation: Since SCE spends time to train its customer service representatives on programming the thermostat, more effort should be made to inform customers that they can call the E$T hotline for programming help if they need it. This information could be included in the welcome package.

Figure 12 shows the monthly and cumulative count of installations for both the Coachella Valley and Summer Expansion efforts. The dotted lines plot the number of installations by month; both the Expansion and Coachella Valley efforts had the highest number of installs in the month of October, with roughly 1,450 and 350 installed devices, respectively. The solid lines show the cumulative installation counts, and as the graph indicates, by October, the program had met nearly 86% of its goal to install 4,000 devices with 3,431 new installations (total cumulative, Expansion + Coachella).

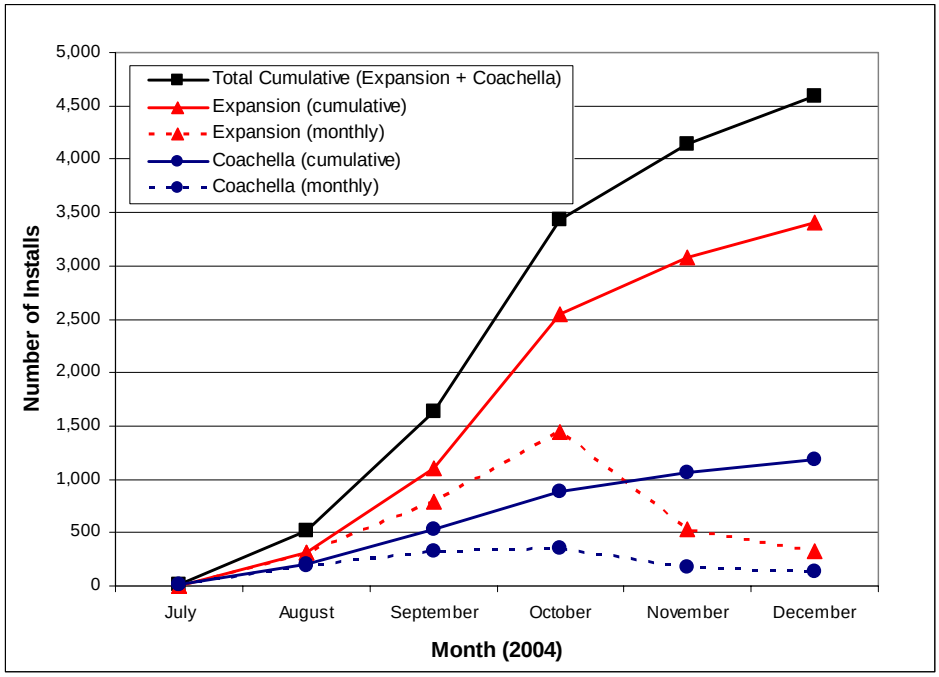


Figure 12: Monthly and Cumulative Installations, 2004

The summer expansion provided a unique opportunity to examine what factors can lead to greater success for installation contractors. Three contractors were installing thermostats in the

summer of 2004. Figure 13 compares the number of installs by contractor. Honeywell was able to install more thermostats than either MDI or Prime Energy during the months of August, September, and October.

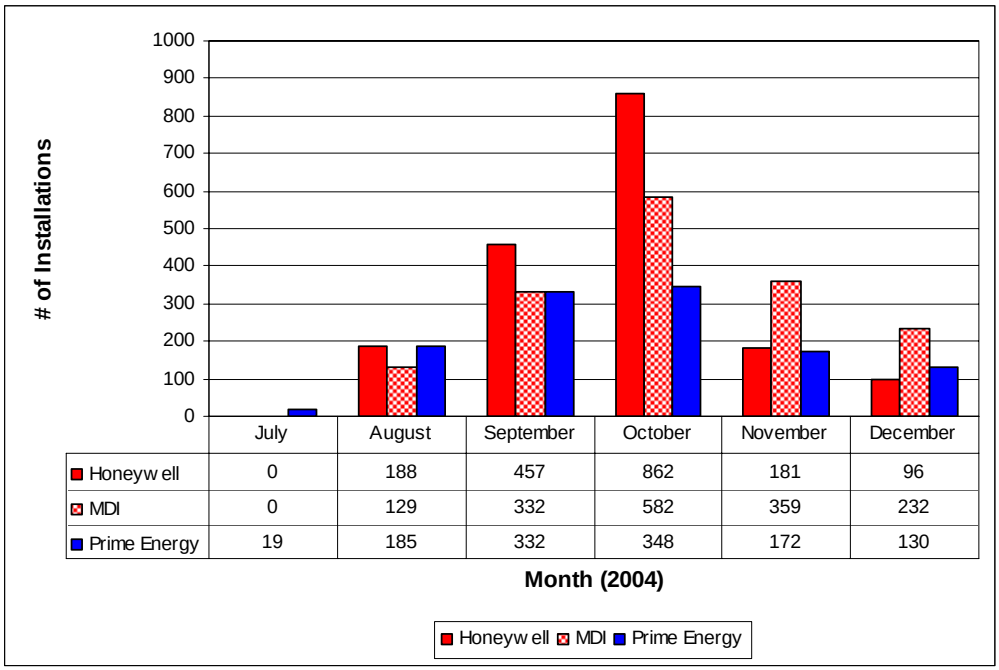


Figure 13: Installs by Contractor

By late September, MDI had 12 full-time installers dedicated to the project. Honeywell had 8, while Prime Energy had only 3 installers. When comparing against the completions, it appears that the *number* of available technicians is not a constraining issue.

In our interviews, we asked the installation contractors how they located qualified technicians. Honeywell makes it a common business practice to borrow talent from temporary staffing agencies and to hire floating staff members from its other offices around the country. In 2004, Honeywell brought in four technicians from Utah which they added to the current staff of four.

MDI, on the other hand, attempted to search for local techs with HVAC experience. They went to community colleges with HVAC programs and performed internet searches for qualified technicians, but found that local competition for these skilled technicians is high, and their search became challenging. They underestimated the labor market for HVAC contractors when initially bidding the project. MDI was finally able to acquire installers from technical trade schools like ITT Tech and DeVry.[31]

Recommendation: Finding qualified technicians is not easy. Nation-wide installation contractors have the ability to supplement their staffing needs with floating staff. Smaller companies can deliver the same staffing needs, as long as they are familiar with where to obtain skilled personnel and can be given time to ramp up. SCE should require that the hired contractors

[31] In addition to lacking staff, MDI did not have the local infrastructure to support the amount of work that had to be completed by the end of summer. They made a request to SCE for an amount totaling $65,000 for administrative startup costs, which the E$T program manager approved as an additional subsidy to MDI.

either have staffing available or know where to find the talent at least two months prior to the first planned installation.

When the installation contractor calls the prospective participant to schedule an appointment, a fair amount of screening takes place. Both MDI and Honeywell were successful in "weeding out" some of the applicants who would have not been qualified for the installation. This process is known as "Pre-Screening". Table 10 is a summary of the pre-screen data provided by Honeywell. Over half of the customers pre-screened by Honeywell changed their minds and decided not to participate in the E$T program.

Prescreen Characteristics	
A/C Not Compatible	34
Called 3 times	6
Cancelled by Edison	2
Does not want to participate	110
Return to utility for further processing	19
Unable to contact	30
Total	**201**

Table 10: Reasons for Pre-Screen (Honeywell)

Sometimes applicants who pass the initial pre-screening end up not being qualified for various other reasons (e.g., no signal, bad AC, etc.). These instances are deemed "walk-away"; installers are paid a flat rate of $75 for walk-away sites. Table 11 shows the count and percentage of pre-screens and walk-aways determined by each of the installation contractors. Both companies did about equally well in pre-screening. Both companies stated that they independently developed a line of pre-screen questioning.

Company	Pre-Screen	% Pre-Screen	Walk Away	% Walk Away	Total Non-Installed Leads
Honeywell	201	29%	486	71%	687
MDI	125	33%	249	67%	374
Combined	326	31%	735	69%	1061

Table 11: Pre-Screen and Walk Away Appointments by Company

Recommendation: SCE should develop a consistent list of pre-screen questions before the program begins. The pre-screening should be performed by SCE to the extent possible when they receive the applications.

Once the installers pre-screened their work orders, they proceeded to schedule an appointment. Honeywell scheduled out of their Los Angeles office and MDI scheduled out of their Illinois office. There was an informal arrangement between Carrier and Honeywell on how the work orders were to be batched. At first, Honeywell performed installations at businesses within a one-hour radius of their office in El Segundo, CA, which was based on an agreement between them and Carrier; MDI picked up the rest. This arrangement became problematic for MDI, and they attempted to schedule the appointments by proximity. As the program progressed, SCE began directing the company to prioritize site visits by age of request, which became an added strain on MDI. Eventually, Honeywell began taking installation requests outside of the initial radius because they were running low on work.

Recommendation: Wasted travel time can be cut down if the installer can visit sites by geographic location. If SCE is concerned about aging work orders, a simple solution is to send an acknowledgement to the customer that their application has been received. In addition, such

a notification could also tell the customer what to expect next – e.g., they will be contacted by an installation contractor, hired by SCE, to conduct a pre-screening of their AC equipment.

Recommendation: SCE could also send out the marketing material in waves, based on location. This way the returned applications will also follow in waves, by location, allowing the installer to ***cluster the installs****.*

Recommendation: Maintain the current procedure in which the installers are responsible for their own scheduling, preferably in a web-based application that is accessible to SCE. As a quality assurance measure, follow up with customers to make sure that the installation is completed to their satisfaction (possibly a post card survey in a welcome packet).

Recommendation: Schedulers should be available for contact during SCE business hours. This could be resolved by either shifting the schedulers' hours they are located in a different time zone, or by scheduling from the SCE area. SCE should also be able to contact the individual installers since occasionally they will not be able to reach the schedulers. The schedulers should also be familiar with the SCE area, specifically the traffic patterns, which will save time on the part of the installers.

In addition to performing Smart Thermostat installations for SCE, Honeywell had been providing ongoing service and maintenance work for another pilot program (the Statewide Pricing Pilot) under a separate contract in 2003. SCE paid the company $120[32] for every service/maintenance call. Service calls range from assisting the customer in person with programming to removal of the device. Honeywell's project manager pointed out that for every service call they pursued, it meant that there was one less Smart Thermostat installation that was deferred in order to complete that call.

Recommendation: Contractors should not be taken away from performing installations, especially when time is an issue. SCE should ensure that there are enough servicing personnel to handle the maintenance requests. This will assure that the already limited pool of installation technicians does not become any smaller.

Service calls are initiated when SCE receives a call from their customers or when the customer contacts Carrier at 1-800-CARRIER. The formal program protocol agreed upon by all parties was that SCE is supposed to forward the information to Carrier, who in turn issues a work order to Honeywell. However, staff at the local Honeywell office recognized the need to not always follow protocol; sometimes SCE customers insist that the service call be attended to the same day or the next day (what both SCE and Honeywell refer to as an "escalated" call). To make this process manageable, SCE and Honeywell opened up direct lines of communication out of necessity. Carrier continues to stay within this process mainly to produce a work order, but these are sometimes just a formality, and in fact are issued after the call has already been completed.

Recommendation: SCE should issue its own work orders for service calls and send them directly to the installers. The delay that occurs from having to funnel the paperwork through Carrier is undesirable to SCE whose main concern is providing good customer service to the E$T participants. These calls are more urgent.

Recommendation: While on-site fixing the thermostats, the contractors should be trained to program all of the thermostats at the site to ensure that the kWh savings from the programmable thermostats are being sustained.

[32] Maintenance costs did not come out of the total authorized budget for E$T summer expansion.

Inventory Management

Inventory management has a unique role with the program structure. Since the program first began in 2001, the thermostat inventory is created as a purchase by SCE through Carrier. This inventory remains SCE property throughout the duration of the pilot program, even after it is installed at the customer site.

Originally, inventory was shipped by Carrier to selected Southern California dealers through the Southern California Air Conditioning Distributors (SCACD), as part of its initial implementation design of using dealers as installers. By the 2004 Summer Initiative, inventory was shipped directly to the installation contractors. As an ongoing program function, Carrier maintains a master list of all inventory shipped, which is shared with SCE. In 2004 the SCE Program Operations Manager also independently tracked the scheduled inventory drop shipments.

Recommendation: Inventory should go directly from the manufacturer to the installers instead of going to SCE. Installer should track inventory and send weekly updates to SCE. SCE should receive a separate inventory list against which the installers list will be checked.

Installation contractors were responsible for tracking and recording the disposition of all inventory assigned to them. During the Summer Initiative, some thermostat inventory was moved from one installer to another to prevent shortfalls, and this created some temporary gaps in the overall tracking. Improvements in the TRACKER database and the subsequent opportunity to "clean up" data during the slow winter months has allowed Carrier to reconcile inventory within 1% of actuals by March 1, 2005.

Calling Curtailments

This section of the report discusses the 2004 curtailments and the triggering of curtailments for the program. Below is a flow chart of the curtailment process.

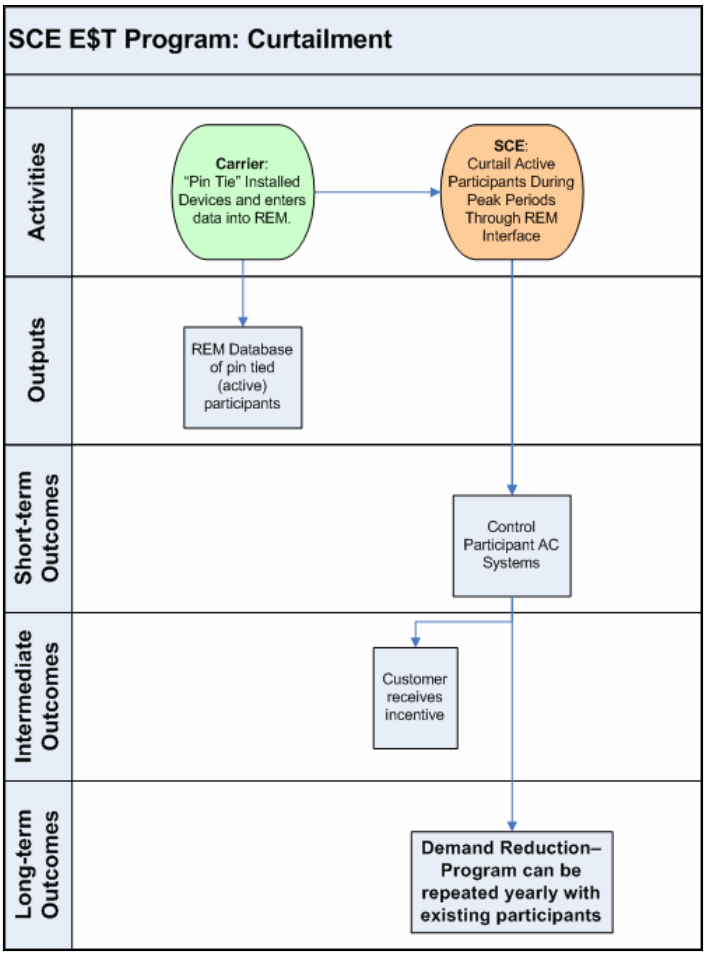


Figure 14: Flowchart of Curtailment Process

During the summer of 2004, SCE issued 12 test curtailments. Curtailments were called at a variety of times and weather conditions. SCE attempted to call curtailments in the middle of a heat period at a variety of times in order to simulate the same conditions that would be experienced during an ISO event. SCE also tried to match the timing of the curtailments concurrent to the ISO peak load.

The selection of the dates of curtailment during the summer of 2004 by SCE was based upon weather forecasts for Los Angeles and Ontario and the CAL ISO web site[33]. The SCE program manager considered the type of day and week, such as holiday weekends, periods of warming trends, the peak temperature of the predicted peak day, pre-heating trends, day of the peak, and the potential for peak energy usage. The manager also tried to include an assortment of business day types so that business operation trends could be assessed. The CAL ISO web site was used to establish the timing of the event by obtaining data on peak day usage for the system.

The E$T program tracking system provides detailed information about each curtailment event called in the summer of 2004. Figure 15 summarizes the curtailment events. The first column

[33] *http://www.wunderground.com/US/CA/Ontario.html* and *http://www.caiso.com/EIS/weatherbank.html*

lists 13 events[34]. The table shows the ID assigned to the event by Carrier, the date of the event, and the start and end times. All curtailments in 2004 were 4 degree offsets.

There were two events that occurred on 10/14 (events 193 and 194). Event 193 was a 2-hour, 4-degree curtailment from 2 to 4 PM. At 4 PM the SCE Program Manager called another 4-degree setback for 2 hours. The manager wanted to understand what the load impact would be like if two curtailments were called continuously.

Event ID	*Month*	*Date*	*Start time*	*End time*
157	July	7/15/2004	2:00 PM	4:00 PM
160	July	7/22/2004	1:00 PM	6:00 PM
164	July	7/26/2004	3:00 PM	5:00 PM
166	July	7/27/2004	3:00 PM	5:00 PM
171	August	8/9/2004	3:00 PM	5:00 PM
174	August	8/10/2004	2:00 PM	4:00 PM
181	September	9/1/2004	2:00 PM	4:00 PM
183	September	9/7/2004	2:00 PM	4:00 PM
187	September	9/8/2004	4:10 PM	6:10 PM
191	September	9/23/2004	2:00 PM	4:00 PM
192	October	10/7/2004	2:00 PM	4:00 PM
193	October	10/14/2004	2:00 PM	4:00 PM
194	October	10/14/2004	4:00 PM	6:00 PM

Figure 15: Dates and Times of Curtailment

RLW previously provided a memo to SCE that suggests some guidelines for scheduling curtailments. This memo summarizes research that was conducted to better understand how the impact of the program varies by the time and temperature of the day. Although this program or a similar program may one day be reassigned from a pilot to a tariff, our recommendations in this memo were directed toward a pilot operation of the program. Some excerpts of the memo are included below as recommendations. The memo in its entirety is included in Appendix SRO.

Recommendation: If the program is converted into a tariff, the curtailments should be triggered based upon SCE peak load or ISO peak load, depending on the goals of the program.

Recommendation: The program manager should call curtailments when the temperature is forecast to be 93-94 degrees or greater in the San Bernardino/Riverside area for some curtailment days.

Curtailment Hours

The Program Manager must select the hours to be curtailed. We analyzed the weather data from 2003 and found that about two-thirds of the time, the high temperature most frequently occurred during the hour ending at 3 pm, and about one-third of the time one hour earlier.

Recommendation: The most promising period for a curtailment can be expected to be the two-hour period from 2 pm through 4 pm. The hours of coincidence with peak price or system peak may be later in the afternoon, from 4 pm to 6 pm, and should also be considered for curtailment.

[34] The event on October 14th counts as one event for customer overrides, as it was a continuous reduction over 4 hours.

Duration of curtailment

One of the key measures of the impact is the duration for each site. Prior analyses suggest that most of the impact has been obtained in the first two hours of the curtailment. In past surveys conducted by RLW for SCE, over a quarter of participants complain that the number of hours that their AC was controlled was too many[35].

Recommendation: Most curtailments should be called for 2 hours to maximize program impacts and minimize customer impact.

Advanced Notification or Instantaneous Call

A related issue is whether the curtailments should be called in advance or instantaneously. If the curtailment is scheduled in REM the day ahead of the planned event, then the communications link has many hours to transmit the signal to each thermostat. For various reasons, such as weather conditions, the signal can be periodically interrupted and the curtailment programming signal can not be transmitted during certain times. The software will continually try to establish communication with all of the devices in the system. The negative aspect of advance programming is that some of the units have problems with their time settings. With advanced notification, an incorrect time setting will cause the curtailment to occur at the incorrect time.

Conversely with an instantaneous curtailment, the curtailment will occur at the time of the call, regardless of the time setting of the thermostat. The advantage of this is that the demand impact is occurring at the exact time of the call, presumably coinciding with a system emergency. The down side of this method is that some thermostats that will typically respond after a short period of time will not immediately receive the signal. More research needs to be spent on this issue before we can recommend either method.

Repeat Calls

An instantaneous call that extends the curtailment well into a scheduled curtailment can restore a substantial portion of the diminished savings of the first call due to overrides.

Temperature Offset

In prior impact evaluation it has been demonstrated that 2-degree offsets have a much smaller effect than 4-degree offsets.

Recommendation: Four-degree offsets should be used for all curtailments.

Technology

The SCE E$T Summer Initiative expansion utilized the same Carrier technology that the AB970 program has utilized for the past 3 years. Each customer receives a free Carrier EMi ComfortChoice Thermostat for their participation. The ComfortChoice package is a combination of Carrier's EMi (Energy Management Interface) programmable thermostat, Motorola's I/O board to communicate radio signal, Silicon Energy's web-based Load Curtailment software, and SkyTel's two-way data communication network. A thorough discussion of the technology capabilities was included in the 2002 process evaluation[36]. This report summarizes the key features of the technology and provides some recommendations.

[35] AB970 SCE Small Commercial Demand-Responsiveness Pilot Program - Process Evaluation Report, December 6, 2002

[36] Ibid

The Carrier EMi programmable digital thermostat is illustrated in Figure 16. Using this battery-free thermostat, the customer can program a seven-day heating and cooling schedule with four periods per day and any desired heating and cooling temperature set points. The thermostat contains a controller board that provides the utility with 2-way, wireless communication. Using a central server, the utility can send a signal to the thermostat instructing it to increase the schedule cooling temperature by a set number of degrees (typically 2^{o} F or 4^{o} F), called the temperature offset, during a specific time period, called the curtailment period.

At any time during the curtailment period, the participant can override the curtailment and restore the scheduled set points by pushing a button at the thermostat itself. The Carrier technology does not require the customer to have Internet access to exercise control. Using the integrated two-way paging technology, the thermostat verifies having received the utility's curtailment signal, along with any override that may take place during the curtailment event.

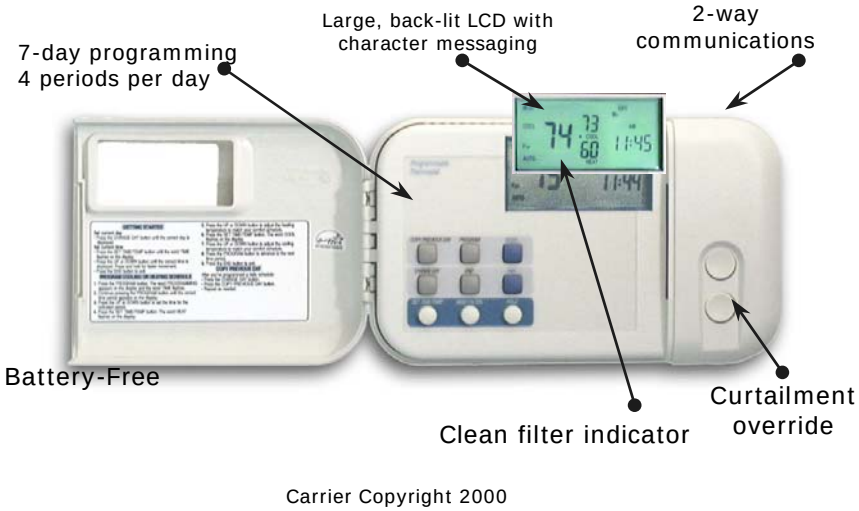


Figure 16: Carrier Thermostat

The Carrier thermostat has changed versions a few times since SCE initially installed them in their territory. The more recent versions have the capability to have their time clocks remotely set by Carrier. This feature is a very important improvement for the thermostats because when the time clocks are incorrectly set, the thermostats do not respond to the curtailment notice at the correct time.

Recommendation: Carrier should track the version of thermostat that is installed at each site since different versions have different capabilities. The ability to send a global signal to all thermostats to change the time is critical. If the times on the thermostats are incorrectly set, then the thermostats respond at the wrong time to the curtailment signal.

Interactive Information

The Carrier thermostat looks and feels like other Carrier programmable thermostats and, accordingly, has limited capability for displaying information over an above the normal thermostat functions. Figure 17 shows all of the icons that are currently available on the thermostat's display panel. Each of these icons is turned on or off by the software contained within the thermostat. Most of these icons are used for the ordinary thermostat control

functions, e.g., displaying the current temperature, the cooling and heating set points, and the mode of the system and fan.

A few icons have been added for use in the SCE demand responsiveness program, such as the Curtailment and Time Left icons shown in Figure 18. These provide a simple visual indicator when a curtailment is in effect and how much longer it will remain in effect. However, the display is small and may not be sufficiently visible for a customer to notice. Therefore these indicators may do little to change customer behavior in terms of reducing other loads when.

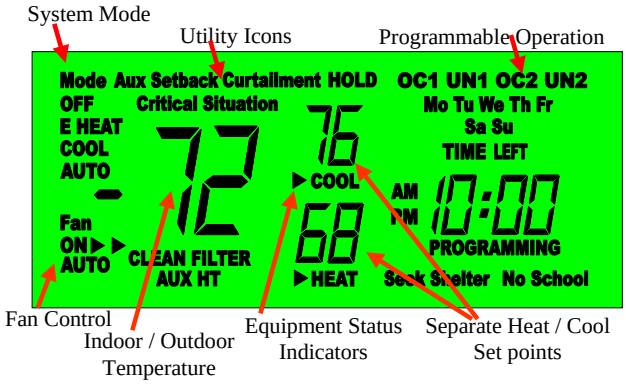


Figure 17: Thermostat LCD Icons

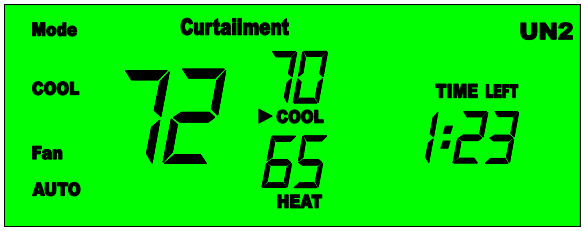


Figure 18: Curtailment Notification and Time Left Information Displays

To test the hypothesis that the curtailment notification is not effective at alerting the customer of the temperature setback, we asked the participants if they thought they had overridden their thermostat in the summer of 2004. Most of the summer initiative participants (86%) say that they do not believe that their business had overridden a curtailment in 2004. Another 12% say that they are not sure, and only 2% say that they thought their business had committed an override.

However, the participant data taken from the REM database tells another story, see Table 12. Only half of the people who think they overrode actually did. Additionally, we found override data for over one-third of those who say they did not override!

Did you override?	# of Respondents	# With Override Data	Percent Agreement
Yes	4	2	50%
No	171	62	36%
Don't Know	25	13	52%

Table 12: Overriding: Respondent Claims Vs. Participant Data

This pattern of results is not surprising; in 2004, RLW found that people were generally unable to distinguish a hot day from a curtailment day. In addition, participants usually underestimated the number of curtailments called by SCE.[37] If customers are unaware that they are being curtailed, then it logically follows that they are equally unaware when they are overriding.

One way to prevent non-intentional overriding is to lock the thermostat. Only a quarter of the participants say that they lock their thermostats, see Table 13. Seventeen percent say they physically lock the device, while 6% opt for an electronic lock (password) to prevent tampering. Two percent lock the thermostat both physically and electronically.

Do you lock your thermostats?	Percent
Yes, physically	17%
Yes, electronically	6%
Both physically and electronically	2%
No	58%
Don't Know	19%

Table 13: Locked Thermostats

Recommendation: In the past, program participants have indicated that they would like a more visible indicator to alert them that a curtailment is taking place. The current indicator is a small line of text reading 'Curtailment' in the thermostat's LCD window. Customers would prefer a small red light or another more visible indicator so they do not accidentally override their thermostat during a curtailment. The tradeoff is that a more conspicuous indicator, however, might alert customers unnecessarily to curtailments and increase the rate of overrides.

The Carrier thermostat could provide an auxiliary output that could be used to display a more conspicuous indication that a curtailment is in effect or to directly turn off other auxiliary loads during a curtailment. Future versions of the Carrier thermostat might offer an on/off switch for audio and or light curtailment indicators, allowing the customer to select the indicator that they prefer.

Recommendation: In subsequent programs the utility might spot test two different types of indicators (a control group and a test group within some type of homogeneous population), and then in the later evaluation look to see what kinds of behavioral trends occurred.

Internet Programming

The Carrier technology also provides the capability for a participant to program and obtain information about the operation of the thermostat interactively via the Internet. While some customers have found this to be an important feature, Carrier has found that only 20% of customers actually access the website. There is reason to believe that the incidence of internet programming is even less frequent than what Carrier reports. Table 14 shows the breakdown of participants who say that they (1) have internet access, (2) have visited the SCE website, and (3) have used the internet programming feature. Of the 87% who have access to the internet, only 22% say that they have visited the utility website, and only 24% of *those* people say that they have utilized the remote programming feature offered by the E$T program. These results mean that only 5%[38] of all customers are using the internet programming feature!

[37] AB970 Small Commercial Demand-Responsiveness Pilot Program, Overrider Survey Final Report, November 23, 2004.

[38] 87% x .22% x 24% = 5%.

Participants with Internet Access	Yes			No
	87%			13%
Participants who have visited SCE.com	Yes		No	
	22%		78%	
Participants who have used internet programming feature	Yes	No		
	24%	76%		

Table 14: Internet Programming

Furthermore, when we asked the participants to tell us the primary reason they decided to sign up for the program, only 1% say that the internet programming feature was the impetus that convinced them to participate. Over a quarter of participants do not even recall that the thermostat can be programmed through the internet.

Recommendation: Provide all customers with a card that contains the website address and their username that will allow them access to their thermostats online. Track the number of hits to the programming interface. If traffic does not increase significantly after customers are provided with the website address, SCE should consider abandoning the internet programming feature to save program money.

The program manager found in the past that implementing internet access was more complex than anticipated due to the installation process. Many program participants had more than one thermostat at a given building, and the unique communication ID code numbers and locations were not recorded accurately by the installation contractors. Therefore when Internet programming was enabled, customers might not know which thermostat in their building they were programming. SCE rectified this situation by requiring Carrier dealers to write the thermostat communication ID number on the inside of the actual thermostat cover.

Recommendation: Stress the importance of accurately recording the thermostat pin IDs and device locations at the time of the install to the installation contractor. This will decrease the amount of research (and possible service visits) that would be required to locate the correct pins and locations at a later time.

The website through which customers can access their thermostat is illustrated in Figure 19 (https://www.mytstat.com/sce.html). The first screen requires the customer's username and password. Then can they edit or program their thermostat schedule.

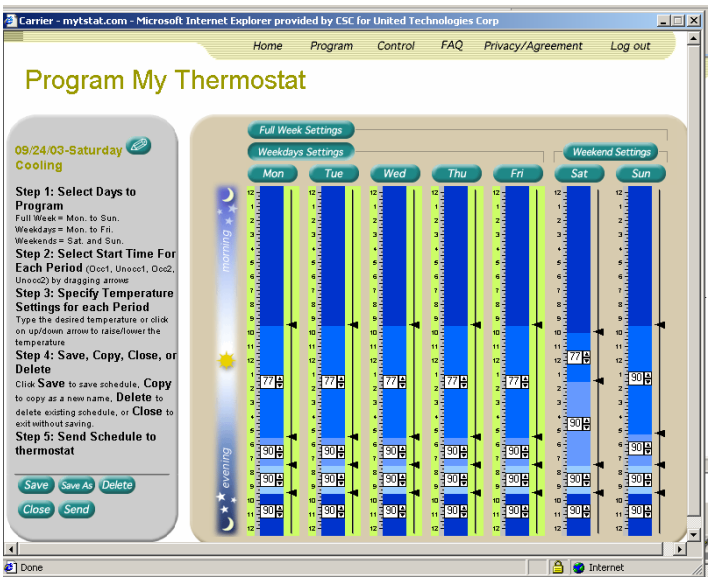


Figure 19: Internet Thermostat Control Screen

Communication

The two-way communication between the customer and the utility works as illustrated in Figure 20. The thermostat is connected to a control module that accesses the Internet via the Skytel Pager network. When the utility elects to initiate a call for curtailment, it sends a page to the thermostat using a distinct code that downloads new settings to the thermostat. Silicon Energy hosts a web site through which the utility dispatcher can view and manage the status of the program by customer or in aggregate.

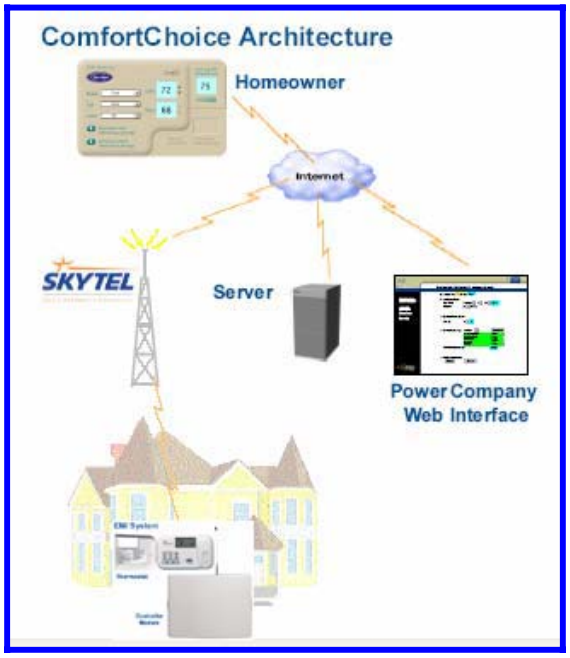


Figure 20: The Carrier Communication System

Tracking

The Carrier system also offers the ability to track the operation of the AC on an hourly basis, store up to a week of data, and upload the data to the Silicon Energy server. This is called the run-time data feature. Each Carrier thermostat continuously logs the run-time data and writes it to non-volatile memory once an hour. The following data are logged:

- Number of minutes during the hour the equipment has run.
- The number of times the equipment was started during the hour (1,2,3,4)
- The average indoor temperature during the hour.
- The offset between the average indoor temperature and the actual temperature at the end of the hour.

These data are the information that SCE needs to monitor overrides and apply the appropriate penalty to the incentive. It also provides a way for Carrier to run preventative diagnostics. The run time data are also a key element of the impact analysis plan. Carrier has described the run-time data collected by these thermostats as follows:

- What it does:
    - Each hour, the thermostat monitors the equipment run time cycles and minutes and average room temperature and set points.
    - The thermostat can store the data for 24 hours for 7 days.
    - It can transmit the data on request to a server maintained by Silicon Energy.
    - The Silicon Energy software stores the data for future analysis.
- What it means:
    - Allows a comparison for estimating load savings instead of sub-metering.
    - Allows preventive diagnostics.

Figure 21 illustrates the data that might be collected throughout a curtailment. The figure shows that just prior to the curtailment, the set point was 72° F, but this was raised to 76° F for four hours. The current temperature shows the average temperature at the thermostat during each hour during the curtailment. At the start of the curtailment, the temperature was 72 degrees. By hour 3 it had risen to 76 degrees.

	Start	Hour 1	Hour 2	Hour 3	Hour 4	End
Current Temp	72	74	75	76	76	76
Cool Setpoint	72	76	76	76	76	72
Mode	Cool	Cool	Cool	Cool	Cool	Cool
Fan	Auto	Auto	Auto	Auto	Auto	Auto
Hold	Off	Off	Off	Off	Off	Off
Run Time	-	0	0	17	45	-
Number of Starts	-	0	0	1	2	-

Figure 21: Sample Snapshot Data

The run time shows that in this example the air conditioner was idle during the first two hours and ran only 17 minutes during the third hour. In the third hour the AC was started once. We can infer from this that the effective duration of the curtailment was at least 2 hours, and probably about 2 hours and 43 minutes. In the fourth hour, the AC had two starts and a total run time of 45 minutes. By this time we can infer that the AC was cycling normally at the higher set point. These data points provide a rather complete picture of the curtailment event for this particular air conditioner.

Carrier claims that the run-time data provides an effective alternative to end use metering of the AC load. If the run-time data are coupled with estimates of the operating kW of each HVAC unit, these data can be used to estimate the hourly kWh load of each installed unit. These data can also be used to estimate the *hourly* load reduction during each curtailment; however they can not be used to estimate impacts on more responsive loads (5 to 15-minute) that would be used to estimate spinning reserve. Sub-metering must still be used to compute instantaneous demand impacts.

Recommendation: Set up the Itron system to collect thermostat data either automatically for the entire summer, or manually collect the run time and verify that data have been collected, on a weekly basis. This will ensure that the run time analysis for an impact evaluation can be completed.

Contracts

In preparing its Request for Proposals (RFP) for a contractor to implement the program in 2001, SCE stated the technical requirements almost verbatim from the Decision. Specifically, the RFP stated:

The preferred technologies eligible to be included in this program should be programmable HVAC (connected) thermostats with two-way Internet connectivity. Technologies that simply allow third parties to interrupt load on a one-way basis will not be considered. At a minimum, the technology selected must have all of the following characteristics:

- *Operate in accordance with all local, state, or federal codes for use with small commercial packaged HVAC systems in the geographic areas selected*
- *Allow the customer some level of control over its own HVAC equipment (override, etc.)*

- *Provide interactive information for customers to make consumption decisions (e.g. via the thermostat or a computer Internet connection), and*
- *Allow the remote administrator to verify actual operation of the individual device at the customer site, including duration and level of kW demand reduction.*

The thermostats must be compatible in both form and function with existing HVAC systems for small businesses, and must be equivalent to traditional HVAC control when the demand responsiveness function is not activated or operational. The pilot program requires that only the thermostat itself is capable of Internet interface, an option that does not require the customer to own or operate a personal computer in order to participate in the program.

The RFP asked bidders to provide the best solution that they could to comply with the technical requirements stated in the Decision. Carrier's proposal summarized its technology as follows:

> *With Carrier's Internet-communicating thermostat, Silicon Energy's EEM software, and wireless two-way communications, SCE can temporarily adjust small business temperature setpoints during peak demand times to reduce energy usage and demand. SCE's small commercial customers maintain full flexibility to override a temperature setback directly from their thermostat or remotely over the Web.*
>
> *ComfortChoice brings new features to demand management solutions such as verifiable load control and customer choice in the curtailment event, along with value added features stemming from Internet access to the energy management devices.*

Carrier went on to describe the proposed system as

> *Enabling two-way communications between each small business installation and SCE, with Internet connectivity between the Carrier EMi (Energy Management Interface), and Silicon Energy's Enterprise Energy Management software. The Silicon Energy software will collect and store event information for later retrieval by Southern California Edison Company for program settlement, planning and fine-tuning.*
>
> *The proposed load control system will be configured to allow SCE to customize data gathering and display the customers' event participation patterns. SCE will have the ability to control the customer's thermostat, yet the customer retains full flexibility to override the temperature setback directly from their thermostat or remotely over the Web at any time. Customer override events are stored in the system, thereby allowing SCE to settle any program non-compliance concerns with the customer in an efficient and documented manner. All information is logged and can be presented in a variety of formats to SCE and the customer.*

An SCE evaluation team determined that the Carrier proposal had the most comprehensive solution and was the most cost effective of all ten bids that were submitted. In fact, only the Carrier system was a true "two-way" communicating system that included the Internet, as described by the CPUC Decision. SCE subsequently awarded Carrier the contract. Their contract has been extended for the past 3 years.

5. Operations Guide

This section of the report was written to serve as an operations manual for future program managers interested in understanding the scope of implementing similar small commercial demand-response programs.

The steps in the program process are:

1. Determine program management and administration structure
2. Identify target customers
3. Set incentive level
4. Select the technology to use
5. Sign contracts (manufacturers, installers)
6. Develop marketing materials
7. Design signup procedure
8. Develop tracking database
9. Distribute marketing materials
10. Enter applications
11. Send leads to installers
12. Track installs and walk-aways from installers
13. Develop maintenance protocols
14. Call curtailments
15. Evaluate program impacts and process

Management

Based on the specific operations at SCE, the principal management of the program will require, at a minimum, the equivalent of one and a half full time employees. One additional FT Customer Service Representative (CSR) is needed to assist the program manager(s) with day to day operations. Additional employees will be needed to assist with marketing, customer service, tracking, database management, installation, and evaluation. Below are the following types of employees that are needed for the program, the role that they will play, and the estimated hours per week that the position(s) will entail at the beginning of each program year and during maintenance mode.

Position	Responsibilities	Hours per Week	Duration	Contracting
Program Director	All major decisions and responsibilities program design, budgeting and staffing	0.5 FTE employee (20 hours)	Entire project	SCE Employee
Program Manager (Operations)	All major responsibilities for daily tracking of leads, inventory, operations,	1 FTE employee (40 hours)	Entire project	SCE Employee

	budget, direction to CSRs, subcontractors, and reporting.			
Customer Service Representative Supervisor	Supervises and manages customer service staff and inbound/outbound calls. Coordinates with PM. Trains CSRs on program operations and any ongoing surveys.	(a) 1 FTE employee	(a) Entire project	SCE Employee
Customer Service Representative	Assists with customer service, processing applications, resolving customer questions about the program, daily reports, and other administrative functions.	(a) *New installation period*: 4 FTE employees (b) *Program maintenance*: 1 FTE employee	(a) Duration of period (b) Entire project	SCE Employee(s)
Marketing	Takes lead role in developing marketing materials with significant input from PM. Delivers marketing campaign.	0.5 FTE employee (20 hours)	Begins approx. 4 months before installation start date, duration of 2 months	SCE Employee(s) or Subcontractor
Data Management	Develops and maintains tracking database used to input leads, installs, and all non-qualified. Also develops tracking queries that are used for reporting.	(a) 0.5 FTE employee (20 hours) (b) 1 FTE	(a) Entire project in maintenance (b) If a new database is developed, a FTE employee is required.	SCE Employee(s) or Subcontractor
Installation Manager	Tracks thermostat inventory, ensures that the installers have adequate supply, issues work orders, resolves installation issues.	1 FTE	Throughout installation period (use for maintenance during non-install periods)	SCE Employee(s) or Subcontractor
Installation Dispatcher	Schedules and forwards appointments to installers.	Depends on number of devices to install	Installation period, see installation section	Subcontractor
Installers	Installs technology at eligible sites.	Depends on number of devices to install	Installation period, see installation section	Subcontractor
Manufacturer	Provides technology and software to control thermostats. Tracks inventory, ensures that thermostats are responding, provides list of unresponsive thermostats to subcontractor to fix.	0.5 FTE employee	Duration of project	Subcontractor
Audits	Audits sites to ensure that program is working as designed. Fixes non-	On demand	Occasional need	Subcontractor

	responsive thermostats.			
Evaluation	Conducts annual process and impact evaluations.	Depends on scope	End of Summer	Subcontractor

Eligible Participants

Targeted Mailing List

The group of eligible participants is largely determined by the goals of the program. In the case of the E$T program, qualified customers are defined as small C&I customers in small cities and rural areas, having high average monthly consumption in the summer, located in areas with high electricity consumption due to climate. The quantity of AC load largely varies by climate zone; coastal areas tend to have mild summers and low AC use), therefore regional climate considerations are a good screen for eligible participants. Screening at this level will promote effective use of the marketing budget and decrease the cost of participant acquisition by eliminating as many non-eligible customers from the target population as possible. Additionally, mapping software can be used to target specific feeders that require load relief.

SCE can derive a targeted mailing list from their billing data by excluding:

- Non-GS tariffs (non-commercial and industrial)
- APS tariffs (Air Conditioner Cycling Program Participants)
- Accounts with more than 200 kW demand
- Accounts with less than 1,000 KWh usage/month during the summer
- CEC Zone 6 service zip codes (coastal areas)
- Customers participating in other load control programs or already enrolled in E$T
- Areas without two-way paging capabilities[39]
- Duplicate mailing addresses

Required Equipment

In addition, customers who wish to participate in the program must have at least one functional, existing package or split-system air-conditioning system. The system must be between three and twenty tons nominal cooling capacity. The system must have a single zone thermostat for each unit, and be controlled by the customer. This information is determined most commonly when the installation contractor visits the site.

Determining How Many Mailers Should Go Out

In the past, mass mailing efforts have produced far fewer responses than anticipated. In 2002, the direct mailing campaign yielded a 1% return rate, and in 2004, the mailer produced a slightly better customer response of about 2.5%. The SCE team (or marketing team) should realize that it may take many more mailers to produce the needed response since many customers will not qualify because they do not have the necessary equipment. Past experience shows that the team can expect between 1-2.5% return rates on mass mailings. Bar coding should be used on postcards to shorten data entry time upon receipt.

Incentives

The incentive level must be determined before the program is implemented and should be considered for adjustment at the beginning of each summer. In the past three years of the

[39] SCE calls this the Skytel Exclusion List. Skytel, the radio provider, provides a zip code list of all areas that are not covered by its two-way paging system. As of 2004, approximately 15% of SCE's territory is out of Skytel's range.

program, the incentive level has changed each year depending on the projected energy shortages for each summer. An important fact to consider when setting the incentive level is that a higher number of curtailments correlate with a higher number of customers that are unwilling to be subjected to the loss of their AC. A balance between obtaining the optimal load resource and actually being able to sustain it with high participation levels is a challenge in designing the incentive structure.

Consider whether the customer should receive a net gain from participating in the program. If a program goal is to reward the customer for participating, regardless of whether they participate in any events, then a net gain should be offered to participants. However as the program moves toward becoming a tariff, the customer incentives should be reduced. A customer really should only make money if they save SCE money by participating in the load reductions. If the customer overrides every curtailment, they are not achieving much load reduction for SCE and therefore should not be rewarded for participating in the program.

A positive reinforcement program is preferable to a punishment per override incentive structure. SCE should determine the maximum amount that they can spend on overrides for the summer. As Table 15 shows, if SCE decides to call a maximum of 12 events and the price per event is set at $12, the cost of paying a customer who participated in every event would be $144. This price is less expensive than the last set-up which guaranteed $150 if a customer never overrode. The cost would become increasingly cheaper if SCE set the price at $10, $8 or $5 per event.

The PM should also estimate the cost in incentives that they would have to pay for each event based upon the selected incentive level. For example, if there were 5,000 installed thermostats and each non-override cost the utility $10, the maximum incentive cost would be $50,000 for the event. With an approximate 20% override rate, the actual cost would be around $40,000.

	Incentive Price Per Event			
# of Events	**$5**	**$8**	**$10**	**$12**
10	$50	$80	$100	$120
11	$55	$88	$110	$132
12	$60	$96	$120	$144
13	$65	$104	$130	$156
14	$70	$112	$140	$168
15	$75	$120	$150	$180
16	$80	$128	$160	$192
17	$85	$136	$170	$204
18	$90	$144	$180	$216
19	$95	$152	$190	$228
20	$100	$160	$200	$240

Table 15: Price Per Event Reward Matrix[40]

Customers should be informed how much they are earning every month. This will reinforce the desired behavior by demonstrating that their credit is accruing if they do not override. Incentives are paid on an annual basis in the form of a bill credit that has been reduced by the amount of overrides that the customer has enacted and prorated for those customers that have cancelled their participation part way through the summer. All credits go out at the end of the year. The advantage of providing bill credits is that they avert the need to send out tax forms for incentive

[40] The shaded area indicates configurations that are more expensive than the 2004 incentive payment structure which guaranteed $150 to customers who never overrode their thermostats.

payments that exceed the IRS maximum reportable income for annual cash rebates and incentives. Participation is required through October 31 in order to qualify for financial incentives.

In marketing the incentive, one idea is to emphasize the *potential* incentive if curtailments were called throughout the program period. For example, in the text (not bulleted) the material could say:

> *You could receive up to $240 this summer if your participation is requested once per week! (This is based on a $10 incentive payment per event and a May through October program offering)*

SCE would not be committed to call all 24 of these curtailments, yet the economic potential message will have captured the customer's attention.

Marketing

Marketing materials should be developed for the program in conjunction with a team of marketing professionals at least two months prior to the planned first installation. These individuals have the background and the tools to make your campaign effective. They will also have experience with postal processing requirements. The marketing campaign should start about one month prior to the first planned installation. This will ensure the first applications do not sit for too long before they are contacted for installation.

The objective of an effective marketing campaign is to create interest and awareness in the program you are trying to promote. Communicate to the marketing professionals that the materials should be developed with the following goals:

- Build participation in the program
- Develop a similar look and feel to all messages about the program
- Leverage other marketing resources that are targeting small commercial businesses
- Provide only pertinent information about the program
- Emphasize the incentive (or potential economic gain) if one will be granted at the end of the program
- Explain in easy-to-understand language what to expect if you become a participant
    - Conduct a Reading Ease test to see if the language is appropriate for your target audience
- Utilize bullets to summarize information where possible

The marketing team should saturate all available media outlets with information about the program in order to reach the program's targeted audience. The materials that should be developed include:

- Collateral materials: brochures, tabletop displays (tents) at outreach events, letters to prospective participants, letters to community groups, generic presentation on program operations that can be given to community groups
- Materials translated into other languages to reach non-English speaking and ethnic multi-cultural markets
- Press release for general media

- Articles and ads to use in trade and business journals and in other publications
- Link to program information on SCE.com (fact sheet and application form)
- Bill inserts
- Radio and television spots

In addition, the marketing team should consider other tactics for increasing interest in the program. Other creative marketing strategies may include:

- Developing an SCE Energy$mart Thermostat[SM] logo to be included on every printed piece of marketing material. Over time, this may increase program recognition by both current and potential participants.
- Creating a network of influential sources that will publicly endorse the program. Influential sources can include community organizations, local business chambers, and local governments.
- Providing public recognition of customers who participate in the program. For example, SCE could take out a one-page newspaper advertisement that lists the sponsors as well as all the names of the participating businesses. This will not only act as a marketing tool for the program, but it will also serve as good public relations (and free advertising) for the listed businesses. This recognition may also increase awareness about the program among patrons.
- Holding meet and greet sessions at participating businesses. A participating business could host the informal session with SCE representatives. The goal would be to promote business-to-business dialogue about the program and the technology, and garner new participants by encouraging participating customers to "spread the word".
- Query high schools to see if students are looking for volunteer opportunities. They could walk door to door if properly trained and incentivized. Maybe a scholarship would be given to the student with the most signups.

Message

In addition, the marketing material can include the following messages to help persuade the customer:

- Assists the community with its energy needs,
- Helps keep the power on
- Free thermostat, which may also produce lower electric consumption or when used properly
- Annual incentive
- Allowed to override (empower the customer)
- Green/conservation messages and cues (recycled paper, print double sided)

The total cost for marketing using mass mailers for the summer expansion was $300,000, which resulted in 5,100 responses. This cost could be trimmed by using more focused face-to-face marketing.

Program Signup

An enrollment card should be attached to the program brochure. A signature from each customer is required in order to certify that they are interested in participating in the program and that they are SCE customers. Additional options for signup should be offered to customers to ensure that the program is accessible to all interested parties. Internet data entry forms and phone signup procedures should be in place before recruitment begins. The internet enrollment form should be a link that is accessible through the small business rebates and savings link on the SCE website *(www.sce.com/rebatesandsavings/smallbusiness/energysmarthermostat default.htm).*

The customer signature could be obtained electronically or during the installation process (If required before installation, offer a downloadable application). The basic information that should be captured on the application includes:

Customer name	Service address	Number of thermostats	Email address
Service account number	Business type	Square footage	Signature from property owner or manager
Business Name			

Make sure that the marketing team merges all account numbers and service addresses onto the mailed applications or at least onto the letters. This will eliminate time once the applications are received since the CSRs will be required look up the customer by name in the database. A merged account number is much easier to match than a name or a street address. The account number merge assures that fewer applications will be unable to be processed. The marketing source should also be merged onto the application in order to track response by approach. Be sure to include the program manager or other program team members in the mailing (i.e., "seed" the mailing) to ensure that the items made it through the post office and to the targeted individuals.

The installation contractors should visit the most aged applicants first, so that customers aren't kept waiting too long between the date that they sent in their applications to the time of the install. The marketing team can assist with this installation goal by geographically stratifying the mailings and sending them out in waves by general locations. By using this strategy, the responses should come back by location, allowing the installation team to cluster their visits by geographic location.

It is critical that the tracking system is kept up-to-date so that the marketing team immediately knows how successful their marketing effort is and if they need to alter it in any way. Notify the mail room and provide a billing code to ensure that the postcards are delivered to the designated department as soon as they are received. Another option is to assign a PO Box number to which all returned applications are sent. Ensure that the appropriate department code is included on the postcard.

Track the date that each enrollment card is received by keeping stacks of cards labeled with each date in a filing system and ensure that the cards are entered into the tracking system immediately. Even a one day lag in the entry process can hold up the entire operation since installers are counting on the data being entered.

If internet and phone applications are utilized, then ensure that these data are being transferred into the main program database. Ideally, all phone reps would be provided with blank application forms that they can fill out over the phone with the customer and send to the data entry team. The internet application data should be directly transferred into the database. Queries should be built that allow the assigned staff person to generate lists of ineligible

customers. A letter should be sent to each customer who is deemed ineligible for the program. Appendix SRO contains a draft version of such letter.

Call Center

During high volume call times such as the installation period, SCE should have at least 4 staff on hand to answer customer questions. Carrier has a large call center that receives many general calls regarding its products, and can handle E$T calls after hours, as the SCE call center is only operable 8am to 5pm during the day.

Tracking

SCE should create a tracking database that combines data from SCE's billing, account, and marketing databases. Although aggregating these databases will create duplicate copies of the data, it will save much time for the CSR's when they are validating each application since they will not have to search multiple databases for the qualifying information. The Skytel eligible zip codes should be linked into the tracking database as a lookup table as well as their rate class, SIC code, billing history, and climate zone.

To verify a customer's verification status a CSR will simply enter a customer's service account number and the eligibility should be displayed on screen. The integrated database will house all the information necessary to decide whether an applicant is qualified or not.

It is important to track all non-qualified customers and the marketing source for all leads, including the outreach method, subcontractors, and method of awareness. The following data should also be included in the database to ensure that additional criteria are met:

Static Fields:

1. Primary key
2. Account holder's name
3. Business Name
4. Service Address
5. Service Phone
6. Status Code
7. Total Usage (monthly >1000 kWh)
8. Total kW (<200 kW)
9. Total Billed (bills <$10K)

Entered Fields:

1. STATUS of application (coded)
2. Date application received
3. Contact First and Last name
4. Phone number
5. Business Type Code
6. Square Footage
7. Number of AC units (same as # thermostats)

8. Marketing code
9. Type of application received (mail, internet, phone)
10. Signature received
11. Customer Comments
12. Date letter sent

Sharing of Data with Installation Teams

This step in the process is very important for tracking inventory and completions. One web-accessible database is the best option for tracking leads and the status of their installation. The database could be hosted by a subcontractor, and SCE and all interested parties could have access to it, or a portion of it, with passwords.

All of the applications entered by SCE will automatically be uploaded into the database. The installation manager should check the new applications daily and assign them to an installer by geographic region. The installer can download work orders and check the scheduled installs online. After the installer visits a site, they should enter the outcome for each work order in the database. Ensure that every lead is completed. The installation contractors should be instructed to enter outcomes from all of the sites that they visited in each week by the following Monday at noon PST.

Regular checks and verification of data to ensure accuracy are necessary. Checks that should be done include:

- Ensure that all leads entered in last 3 weeks have been visited
- Ensure that the installation contractors send weekly lists back to SCE with the list of thermostats that they completed. This list can be checked against the list in the database and can be used to generate installation payments.
- Ensure that Carrier loads all of the installed thermostat information into REM.
- The installers should record the inventory that they receive in the database. Also, all shipment invoices should be accepted and signed by installers. SCE should also receive a list of the inventory on hand and check that against the list of thermostats that the installation manager has received. Any discrepancies should be resolved.
- Monthly work orders must be included with invoices and approved by SCE.
- SCE should receive the Carrier call center data on a weekly basis to ensure that all customer issues are resolved in a timely manner.

Weekly reports (or even daily) should be produced by the PM to summarize the number of sites and thermostats installed (completes and incompletes) and applications received by:

City	Application status
Geographical area	Installation team
Marketing code	

Installation

The installation process is one of the most critical components of the program. If the installation is not properly completed and recorded, SCE can lose a lot of information on the units that they are controlling. Establishing a **common procedure and policy** for installation contractors is

critical to a successful program. The installation process should consist of the following tasks for the PM:

1. Determine the length of time that the installation project will take
2. Ensure that there are enough thermostats to install
3. Identify contractors
4. Design all forms (work orders)
5. Design leave behinds
6. Train contractors
7. Track installations
8. Verify a sample of installations

Installation Timeline

The first issue to consider when planning an installation project is the date that all the thermostats must be installed by. That will dictate how many resources must be allocated to the project. This section contains some estimates that can be used to determine approximately how long the installation process will take using a variable numbers of installers and assuming that the thermostats are readily available.

An installer should be able to complete a site visit in 1.5 hours on average, or 5.33 sites per day, assuming that the installation manager has allocated sites in geographic clusters to each installer. Since the not-qualified rate is currently around 21%, we can estimate that 4.21 sites (5.33*0.79) can reasonably be installed in a day. The average length of time per thermostat install is around 0.75 hour once an installer is experienced at installing the thermostats.

This following table presents some estimates that are used to generate the approximate installation schedule. There are approximately 2.1 thermostats per site, 4.21 completed sites per day, 8 working hours per day, and 20 working days per month.

Description	Value	Units
Stats / Site	2.1	stats
Sites / Day	4.21	sites
Hours / Day	8	hours
Hours / Site	1.899	hours
Days / Site	0.237	days
Days / Month	20	days

Table 16: Assumptions for Setting Installation Timeline

Table 17 shows the estimated time an installation project will take depending on the number of thermostats that are being installed and the number of dedicated installers that are allocated to the project. For example, if the project required 5,000 installed thermostats, with one installer it would take 565 total days, or 28.3 working months! By allocating one additional installer to the project, the time would be cut in half to 14.1 working months. By allocating five installers to the project, working full time on the project they could have all 5,000 thermostats installed within six months. Ten installers could have the job done in just under 3 months.

The best time to complete the installations is in the winter and early spring, which is a slower period, in terms of work requests, for most HVAC contractors.

Sites	Thermostats	Days	Months with # of Installers					
			1	2	4	5	7	10
1	2	0.24	0.01	-	-	-	-	-
500	1,050	119	5.9	3.0	1.5	1.2	0.8	0.6
1,000	2,100	237	11.9	5.9	3.0	2.4	1.7	1.2
1,500	3,150	356	17.8	8.9	4.5	3.6	2.5	1.8
2,000	4,200	475	23.7	11.9	5.9	4.7	3.4	2.4
2,381	*5,000*	*565*	*28.3*	*14.1*	*7.1*	*5.7*	*4.0*	*2.8*
3,000	6,300	712	35.6	17.8	8.9	7.1	5.1	3.6
3,500	7,350	831	41.5	20.8	10.4	8.3	5.9	4.2
4,000	8,400	949	47.5	23.7	11.9	9.5	6.8	4.7
4,500	9,450	1,068	53.4	26.7	13.4	10.7	7.6	5.3
5,000	10,500	1,187	59.3	29.7	14.8	11.9	8.5	5.9

Table 17: Estimated Time for Installation Project

Thermostat Inventory

Constant communication with the manufacturer is necessary when beginning an installation project since manufacturers often do not have surplus inventory. If the thermostats need to be installed by a particular date, then it is important to emphasize the project timeline with the manufacturer and follow up on a regular basis to ensure that the product is delivered in accordance with the project schedule. A delivery bonus should be considered if the manufacturer is able to deliver all of the units on time and on budget without impacting the installation schedule.

Installer Selection

If a fast ramp up time is required, the use of dedicated installers is the fastest installation method. If this is the case then the fastest method would be to subcontract with a firm to manage the installation process. This firm can in turn subcontract to other smaller and/or local firms to perform the installations. Be sure that the installation manager has adequate resources of installers in mind and has experience working on a large scale site visit project before giving them the contract. Again, try to schedule the installation period during the winter when HVAC contractors are slower.

Another idea is to identify contractors that are currently administering other energy efficiency programs that target small commercial businesses. Some of these programs also include HVAC tune ups and the installation of programmable thermostats. The program outreach could leverage the installation and travel resources allocated to programs that target similar customers.

Installation Considerations

Check units for proper performance. HVAC tune-ups are becoming more common in program offerings. Some studies show that a tune up can reduce the energy consumption of a unit by up to 30%. Consider integrating tune-ups into the program offering. Participants will be easier to recruit, since this is a valuable non-monetary incentive mechanism. It's analogous to offering someone a free tune-up on their car for driving fewer miles on "save the air" days.

Provide field report. Provide paperwork or electronic forms for installers to record information on existing equipment and deficiencies. Good record keeping will reduce the likelihood of SCE being held responsible for future failures. If deficiencies are discovered at the site, the installer should disclose the findings to the customer and possibly get a signature that verifies that the information was discussed at the time of the installation.

Programming setpoints. Programming should be done by the installers for each customer. Although this is a time consuming process, it is very important from the customer's perspective as well as for the program's reputation. All of the thermostats serving the same spaces should be programmed at the same setpoints. This ensures that the thermostats all have the same cooling setpoint before and after the curtailments are called.

All AC units at site must receive E$Ts. Participating customers must have thermostats installed on **all** working AC units at their site. This ensures that the reduced load of a curtailed unit is not being supplanted with the increased load of a nearby unit.

Before starting *any* installation, the installer should inspect the site to:

- Verify that they have access to all units
- Verify that all AC units are working

If the installer does not have access to even one unit, the entire installation must be terminated. Likewise, if even one AC unit is not working on-site, the entire site will not qualify for the installation. The exception is if the business does not ever plan to fix the broken unit.

If the site is deemed appropriate (all AC units are working and are accessible to the installer), the installer should install one thermostat and check for a signal. If the site does not receive a signal, the site will be dropped from the program.

Following these steps ensures that the installer does not waste time and inventory by beginning an installation on one AC unit only to find that another unit is either not working or inaccessible. Testing the first installation for signal also saves resources since the installer finds out with the first install whether the customer will be able to participate in the program.

Thermostat and communications device (I/O board) must be clearly marked with the pin ID. Each thermostat must be clearly marked with its individual identification number (pin) in order for the unit to be identified in the future. The utility should specify where the ID will be marked so that it can be located easily by either the customer or a service technician. The ID should be clearly shown on both the thermostat and the I/O board.

Provide clear responsibilities list: The installers should be responsible for the following tasks:

1. Attend training session
2. Coordinate site visits with installation team
3. Enter installed sites into database every day
4. Verify accessibility and AC unit operation
5. Install thermostats as per manufacturer's recommendations
6. Test thermostat communications
7. Program thermostats
8. Complete work orders and forward them to the manager
9. Repair any non-responsive thermostats (maybe subcontracted to a different "maintenance" firm)

Installer protocol. The installer needs to understand that the customer perceives them as utility representatives. Therefore a short list of standard protocols should be given to each installer during training that covers topics such as:

- Introductions

- Professional dress
- Carry an ID
- Have an SCE contact available to call in an emergency
- Bring a letter on SCE letterhead that introduces the study and verifies that you are a representative
- Welcome package (leave behind)

Installation Forms

There are at a minimum four pieces of information that should be made available to the installer. A letter of introduction should be produced if prompted by the customer. The welcome package should be left at each site. A work order should be issued for each thermostat. The customers who applied by internet and phone should be required to sign an agreement form at the time of installation. A sample of each of these forms is included in the appendix.

1. Letter of introduction – This should provide verification to the customers that the installer is an authorized representative of SCE
2. Welcome package – This should include the following items:
    a. A **welcome letter** that again outlines the program operation and provides phone numbers for the customer to call if they have any problems,
    b. A **program brochure**,
    c. A **postcard survey** that inquires about their satisfaction with program signup and the thermostat installation procedure – This survey should improve installation procedures and ensure that protocols are being followed,
    d. A **thermostat manual** (including programming instructions), and
    e. A **sticker** to place on the thermostat notifying occupants that it is a special load control thermostat and should be modified only with consideration
    f. (Optional) A **tent** for the participants to place on a counter or reception desk that alerts their customers/clients that their business is participating in a load control program (which may explain the higher than normal interior temperature)
3. Customer agreement form - Customer signature form
4. Work order / data collection sheet containing the following data entry slots:
    1. Installation Outcome (Completed, Refusal, Reschedule, or Walk Away)
    2. Square footage
    3. Business type
    4. Tonnage (critical)
    5. Number of units
    6. ID number for each unit (pin)
    7. Description of thermostat locations
    8. Type of thermostat replaced
    9. Type of system

10. Equipment manufacturer
11. Model number
12. Date of installation or walk-away
13. Installation company and name of installer
14. Status of equipment
15. Any problems or special situations
16. Place for the customer to sign or initial if problems are found onsite

Installation Costs

The current cost for each thermostat installation is $140, and $75 per "walk away" (site visited where no thermostat could be installed). The contractor should receive a lower payment, maybe $50, if the customer refuses the installation when the contractor arrives for the appointment since they have only invested travel time in those situations. The table below summarizes the installation outcomes and the payments associated with each.

Installation Outcome	Payment to Installer
Reschedule	$0
Refusal	$50/site
Walk Away: AC Not Accessible	$75/site
Walk Away: Equipment Not Compatible	$75/site
Walk Away: No Signal	$75/site
Completed	$140/thermostat

Table 18: Installation Outcomes and Associated Payments

Installation Validation

A team of auditors should validate that a sample of thermostats were installed appropriately. The purpose of program verification is to ensure that the technologies installed at small commercial sites through the program are installed and operating properly, and have the potential to deliver energy and peak demand savings. Approximately 10% of the population of thermostats should be verified. This is also a good opportunity to administer a short survey to the customers to understand their satisfaction with the program and the thermostat functions.

The inspection should include the following steps:

1. Check that the time displayed on the thermostat is accurate. Correct if necessary.
2. Record the thermostat and fan modes and space temperature, taking the information directly from the display of the thermostat.
3. Check the current schedule displayed on the thermostat.
4. Press the End button and record the cooling and heating setpoints
5. If multiple units exist, make sure cooling schedules agree
6. Test and record the results of the communication test
7. Record the location of the thermostat, the Pin number displayed on the thermostat.

All of the information required for the inspection form is displayed in the thermostat window, making for a short visit. In order to perform the communications test, the surveyor needs to manipulate some functions of the thermostat. The buttons that need to be pressed in order to perform the test are shown in the sample inspection form shown in Appendix SRO.

Maintenance

An annual dropout rate of between 2- 4% of sites occurs due to businesses moving, thermostats failing, or customers wanting removal from the program. In order to retain as many customers as possible, customers should receive participation status reports for every month that the program is operating. The report will identify all curtailment dates and any override dates that the customer has requested so that they know how much their incentive is on an ongoing basis.

Any discrepancies can be dealt with on a more current basis rather than waiting until the end of the summer to inform the customers about their participation. The monthly customer reports are also a good way to give participants friendly reminders about the operation of the program. The override penalty will be more relevant if they can see how their incentive is affected by the action of overriding. A sample override report can be viewed in Appendix SRO.

A letter should be sent to all existing customers at the beginning of each summer thanking them for participating in the program and informing them about any program changes for the upcoming year.

Deadbeat maintenance is the repair of non-respondent thermostats in the program. To assess the communications status of the system, the thermostats are programmed to send a "heartbeat" radio message back to the control system once a week during off-peak hours in response to a "query." All heartbeat messages are recorded in a server database operated by Silicon Energy, under control to SCE. Reports show the number of heartbeat messages missed for each thermostat, as well as alarms for heartbeat messages that have not been received for extended periods of time. The number of missed heartbeats along with the alarms can be used to indicate sites with failed or failing thermostat reception.

On average, 7% of the units fail to call in as expected after the request for curtailment. According to Carrier, these thermostats can be broken down into two functional categories:

1. Those that receive signals, but are too weak to send responses (Non-Respondents), and
2. Those that do not receive signals or send a heartbeat (Deadbeats).

Carrier asserts that Non-Respondents receive the weekly signals and curtailment requests, and act accordingly, but do not respond back to the server. Deadbeats, on the other hand, fail to receive any signals and do not respond to curtailment events. Some explanations for deadbeats are that the radio or antennae are defective, the unit is out of range intermittently, or the power has been turned off. Contract language with the program contractor should include fixing non-respondent and deadbeat units on an ongoing basis. SCE currently pays a contractor on an hourly basis to fix the deadbeats.

Calling Curtailments

The triggering of events depends upon the goal of the program. If the goal is to reduce peak load when SCE is peaking and thus avoid paying peak prices, then the events should be called to coincide with SCE's peak periods. If the goal is to reduce load when the ISO is experiencing a peak and there is a threat of rolling blackouts, then the trigger should be the ISO peak. Both SCE and ISO peaks should be considered if the program can afford the incentive payments for all of these events.

If the curtailments are called on days that do not coincide with the system peaks (such as for tests), the following guidelines should be used to schedule the curtailments:

- Use predicted high temperatures to guide curtailment calls. A temperature predicted in the 93-94 degree range is a high temperature day in SCE territory.

- The 2pm – 4pm period most often contains the high temperature in SCE territory, however the hours of 4pm to 6pm should also be considered since they may contain the system peak.
- A curtailment should be called for a minimum of 2 hours since the greatest impact is achieved in the first 2 hours of a curtailment
- Consider calling another curtailment directly after the first 2 hour curtailment period. This will restore some of the lost impact due to overrides.
- Call 4-degree offsets for a greater impact (as opposed to 2-degree offsets).

Technology

There are many features that should be considered when selecting an appropriate technology. At the time of the E$T program's inception, the main feature that was required was two-way communication. Carrier was selected to provide the technology in 2001 since they were the only firm with this feature integrated into their thermostat technology[41]. The 2-way communication enables SCE to validate that the thermostats are responding to the curtailment request and understand which customers are overriding the curtailments. Some other important features to consider when selecting a technology are:

- Internet programming
- Broadcast signal to change time clocks
- Software program to manage curtailments
- Compliance with commercial codes (number of periods)
- Ease of installation (number of wires)
- Signal coverage
- Flexibility of curtailment calls (degrees, advance scheduling, grouping of thermostats)
- Participant overrides allowed
- Customer display (How advanced is the display? Does it show usage?)
- Curtailment indicator (visual, audio, or both?)
- Capacity for auxiliary load control
- Run time and temperature data collection
- Communications protocol (Paging, telephone, BPL, IP Address, satellite/radio signal; 1 or 2-way)
- Cost of thermostat, communications, data collection, control software, tracking, and installation

The cost of the Carrier thermostats has stayed stable from 2001 to 2004. This price should decrease some as time passes and more competitors enter the market.

[41] Carrier was the only two-way paging technology based on radio communications, but there were other "hard line" applications based on powerline communications and broadband

Evaluation

The thoroughness of the contracted evaluation will be determined by the CPUC filing requirements. If an impact analysis is required, the primary objective of the impact evaluation is to assess the potential kW demand reduction of the program. The evaluation should also develop information about signal reception, frequency of participant overrides and other factors affecting the impact of the program

A general approach to the evaluation that has been used in the past is to first develop information on AC sizes from the program tracking data. A sampling plan must be developed for selecting the sites to be monitored with whole building and end-use meters. The SCE E$T program currently has 145 whole premise meters and 100 end use meters in place. These data along with the thermostat run time data can be used to estimate the following statistics for each curtailment:

- Maximum demand reduction (MW) (coincident with peak)
- First and second hour energy savings (MWh)
- Snapback (energy increase in hour after curtailment period)
- Duration

The full 2004 SCE Energy$mart Thermostat[SM] Impact Evaluation Report, including the entire analysis methodology, can be found on the CALMAC website at:

(http://www.calmac.org/publications/Final_2004_SCE_E$T_Program_Impact_Eval_Report_g.pdf).

Budgeting

All budgets for any program expansions that will have to be evaluated separately should be kept separate from the day-to-day operations. This will enable the program manager to track the funds expended on the fixed and variable costs and to forecast the future cost of the program much easier than if the budget were tracked together. Along the same lines, the line items in each program year should be named the same for similar activities so that the PM can track the per-unit cost of the product, installation, administration, and evaluation. Contractor fees should be clearly delineated.

Specific budget costs depend on the scope of program expansions and the level of customer service provided to the existing customer participation base. Customer incentives play a large part of the annual costs, and have been reduced for three years in a row (from $300 per year to $100 a year). Tracking program costs and incentives separately is critical for both cost effectiveness and tax code purposes.

In 2005, SCE filed expected program costs of $1,779,000, with $900,000 of incentives, and $879,000 of program operations, including all subcontractor and in-house incremental expenses associated with the program, and carryover costs associated with the 2004 Summer Initiative. This works out to an average maintenance cost of over $200 per thermostat, based on an installed based of over 8,000 thermostats. Further cost effectiveness calculations for reduced costs and program maintenance and expansion are detailed in Chapter 9.

6. Survey Methodology

Data Sources

The participant and non-participant sampling frames were derived from the Summer Initiative marketing list and E$T installation tracking list. First, we merged the two lists. Non-participants were those accounts in the marketing list, but not in the install tracking list. Participants were those accounts in both the marketing list and the tracking list. The Venn diagram below illustrates the logic behind selecting the two sampling frames.

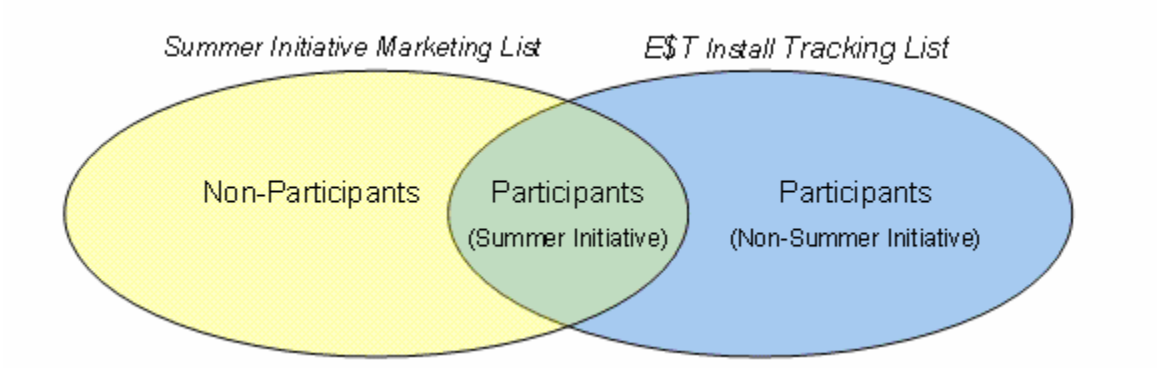


Figure 22: Venn Diagram of Participant and Non-Participant Sampling Frames

We conducted three filters on the participant data extract. First, in order to capture only those participants who actually installed new devices because of the summer marketing campaign, we excluded every device with an application date on or before July 8, 2004, the day that SCE began marketing the expansion. Second, we filtered by installer, and included only those thermostats installed by MDI or Honeywell. Lastly, since questions regarding curtailment were integrated into the survey, we included devices only if they were installed by September 30, 2004, assuming that these thermostats were curtailed during the two October events. These three filters resulted in a list of 528[42] participants, representing 1,061 devices.

Sample Design

We stratified the participant sample proportionally by climate zone. Below is the calculation for stratum sample size. For example, Orange County has 317 customers in the population. We desired a total sample of 200; therefore, 317/528=0.60 and 0.60 x 200 = 120. We sampled 120 customers from Orange County.

$$\text{Stratum Sample Size} = \frac{\text{Stratum Population}}{\text{Total Population}} \times \text{Desired Sample Size}$$

We selected a stratified random sample of 200 participants for the telephone survey effort. All climate zones are proportionally represented, see Table 19.

[42] We excluded duplicate phone numbers to prevent the possibility that a customer would be selected twice for the phone survey. We found that 10 customers had signed up for the program at more than one location. In these cases, we allowed only one of the sites to be selected for the survey. Duplicate phone numbers were ejected from the list at random. The contact population included 518 unique customers.

Climate Zone	Population	Sample
Coastal	2	1
Orange County	317	120
Riverside/ San Bernardino	84	32
San Gabriel Valley	125	47
Total	528	200

Table 19: 2004 E$T Participant Survey Sample Design

The non-participant sample was selected using a simple random sample from the non-participant population.

Telephone Survey Instrument Design

We developed two instruments for the customer surveys. We developed a participant questionnaire to gather a variety of qualitative and quantitative information including:

- Occupant and building characteristics
- Reasons for participation
- Program knowledge
- Customer satisfaction
- Opinions about the installation
- Awareness and response to curtailment
- Suggestions for improving the E$T Program

We also developed a non-participant survey with the intention of measuring:

- Reasons for not participating
- Reactions to the marketing material
- Occupant and building characteristics

RLW submitted the survey instruments to the SCE project manager for a final review and ultimately approval. We also conducted pilots to determine the final length and content. The surveys appear at the end of this report in Appendix SRO.

Telephone Survey Data Collection

Using the survey instruments described above, the participant telephone surveys were conducted by Geltz Communications in Pasadena, CA and the non-participant telephone surveys were conducted by RLW Analytics in Sonoma, CA. All telephone surveyors were provided instruction on program operation, proper etiquette for contacting participants, and how to record participant responses. To ensure the integrity of the sample design and prevent bias, the telephone recruiters attempted to contact each customer a minimum of seven times before moving on to a backup customer. If no contact could be established after the seventh call, the recruiters designated the customer as 'Unable to Contact' and pursued a backup.

Survey Analysis

The quantitative data survey analysis was carried out using SAS, a commonly used statistical software package. Customers' verbatim responses are provided throughout to clarify the quantitative findings.

7. Participant Survey Results

This is a summary of additional participant survey results that do not appear in the text of the process evaluation.

The telephone surveyors tracked all calls and recorded the outcome of each call; Table 31 summarizes the actual outcome types, and the corresponding collapsed outcome we used to characterize the telephone survey dispositions. Upon completing each interview, the telephone surveyor reviewed the survey for accuracy and completeness and then entered the data into an electronic database designed specifically for this survey by the project analyst. Prior to analysis, the project analyst thoroughly performed a quality control check on the data, identifying and correcting any illogical or unreasonable responses.

Collapsed Outcome	Actual Outcomes
Contacted and Completed	Completed
Contacted, but Not Complete	Customer Claims No Participation
	Language Barrier
	Refusal
	Termination
Unable to Contact	Disconnected
	Unable to Contact (7+ calls)
	Vacant
	Wrong Number

Table 20: Collapsed Outcomes

Table 21 presents the dispositions of the telephone survey data collection effort. We attempted to contact a total of 283 participants. Of these 283 participants, we were able to contact 275 and complete a telephone survey with 200 of them, corresponding to conversion rate of 73%. The conversion rate is defined as the ratio of Contacted and Completed (200) to all Contacted Participants (200+75). The average calls made per completed survey was 2.29.

Collapsed Outcome	# of Calls	% of all Calls Made
Contacted and Completed	200	71%
Contacted, but Not Complete	75	27%
Unable to Contact	8	3%
Total	283	100%
Conversion Rate		73%
Average Calls Made Per Customer		2.33
Average Calls Made Per Complete		2.29

Table 21: Participant Survey Dispositions

Occupant and Building Characteristics

Table 22 shows the types of businesses that were contacted for the participant survey. Retail stores made up over one quarter of all businesses. Retail, manufacturing businesses, medical offices and labs, and restaurants account for 70% of all businesses.

Business Type	Percent
Retail Store	27%
C&I Work (manufacturing)	20%
Medical/ Lab	11%
Restaurant (non-fast food)	11%
Office Building	9%
Automotive Service	5%
Church	4%
Restaurant (fast food)	4%
Refused	3%
C&I Storage (warehouse)	2%
Beauty Salon	2%
Other	2%
Convenience Store/ Gas Station	1%
Convenience Store (no gas station)	<1%
Fitness Club/ Gymnasium	<1%
Grocery Store	<1%
Non-profit	<1%
School	<1%

Table 22: Business Type (Participants)

Only 2% of the businesses were classified as 'Other' and included:

- A fraternal organization,
- A vineyard,
- And a public law library

About half of the respondents know or can estimate the age of the building they occupy. The age of the buildings ranges from 1 to 50 years. The mean building age is 23 years. The participants have occupied their current place of business for an average of 10 years. On average, they intend to stay at that location for another 10 years.

Table 23 shows that 97% of the businesses have employees. The number of employees ranges from 1 to 200; the average number of employees at a location is 12. Three-quarters of the respondents say that their employees never complained about the temperature inside the building during the summer of 2004.

Do you have employees?	Percent
Yes	97%
No	3%

Table 23: Percentage of Participating Businesses With and Without Employees

Table 24 shows that 88% of the businesses have customers. Nearly all of these respondents (97%) say that customer comfort is important to their business. Over three-quarters of the respondents say that their customers never complained about the temperature inside the building during the summer of 2004.

Do you have customers?	Percent
Yes	88%
No	12%

Table 24: Percentage of Participating Businesses With and Without Customers

Motivations for Participation

We asked the participants to tell us what primary and secondary reasons led to their participation in the E$T Program in 2004. Table 25 shows that 49% of the respondents claim that they decided to participate because the program helps them save money on their electric bill. Twenty-six percent say that they joined to conserve energy. Less than 10% say that they signed up to be in the program in order to receive the incentive.

Primary Reason	Percent
Save money	49%
Conserve energy	26%
Incentive	8%
Programmable thermostat	5%
It was free	4%
Replace old thermostat(s)	4%
Seemed like a good idea	2%
Climate control	1%
Internet programming	1%
Don't Know	2%
Total	100%

Table 25: Primary Reasons for Participation

Table 26 indicates that nearly two-thirds of the respondents do not have a secondary reason for participating in the E$T Program. Again, conserving energy and saving money are important secondary factors for participation.

Secondary Reason	Percent
No other reason	63%
Conserve energy	13%
Save money	11%
Incentive	6%
It was free	4%
Replace old thermostat(s)	2%
Climate control	1%
To promote and support the technology	1%
Don't Know	1%
Total	100%

Table 26: Secondary Reasons for Participation

Program Knowledge

We gave the respondents the opportunity to tell us, in their own words, what they currently know about the E$T Program. We categorized responses based on what the informant did or did not say:

- *Spontaneous Recall:* Any accurate response

- *Prompted Recall:* Points that the participant claimed to know after prompting
- *Did Not Recall:* Points that the participant missed and did not claim to know after prompting

Table 27 shows that nearly one quarter of the participants spontaneously recall that the thermostat and installation was free. Most of the participants also remember that SCE will pay a $150 participation bonus. However, only 4% remembered that their thermostat could be programmed through the internet. Almost none of the customers spontaneously recall that there is a $10 payment reduction for overriding and that SCE could call up to 12 curtailments in the summer of 2004.

Item	Recall	Prompted	No Recall
Each thermostat and installation was free.	25%	72%	4%
There was a $150 participation bonus per thermostat.	12%	82%	6%
The thermostat could be programmed through the internet.	4%	70%	27%
You could save up to 30% on your heating and cooling bills.	4%	85%	12%
SCE could control your thermostat by up to 4 degrees during an energy curtailment.	7%	86%	8%
You could override the curtailment, but it would cost you $10 per override.	2%	81%	17%
SCE could call up to 12 energy curtailments in the Summer of 2004.	1%	82%	18%

Table 27: Respondent Recall of Key Program Features

Customer Satisfaction

Most summer initiative participants (91%) say that they don't intend to remove or change out their new thermostats. The small percentage who say they *will* replace the device, foresee that eventually, the thermostat will break, and then they will replace it. A few say that they will take the thermostat with them when they move. One person reports that the thermostat has already been removed due to faulty wiring.

When asked how long they will continue to participate in the E$T program, the participants say:

"As long as it continues to save us money."

"For the foreseeable future. I'd like to continue as long as possible."

"I will participate as long as the program is cost-effective."

"As long as it is available."

"I'd like to continue, but I'd like more information on how to control it."

"As long as the thermostat works."

In Table 28, we see that participants are satisfied with most aspects of the E$T program. They are most satisfied with the ease in contacting SCE when they had questions about the thermostat (mean rating = 8.92). Overall, the program was given an average satisfaction rating of 8.45.

How satisfied are you with…	Mean Satisfaction Rating
The way the Energy$mart Thermostat notifies you of a curtailment.	8.36
The ease in which the thermostat can be programmed or reprogrammed.	7.91
The effect of the $mart Thermostat on your electricity bills.	7.09
The ease in contacting SCE when you had questions about your $mart Thermostat.	8.92
SCE's ability to provide prompt and helpful answers to your questions.	8.09
Overall, how satisfied were you with the Energy$mart Thermostat program so far?	8.45

Table 28: Customer Satisfaction

The participants surveyed are not as satisfied with the effect of the thermostat on their electric bills (mean rating = 7.09). The customers who are not satisfied with the effect of the thermostat on their bills (and rate their satisfaction a 5 or less) cite various reasons, including 'my bill is higher', 'my bill has stayed the same', and 'my bill is lower, but not as low as I expected'. Table 29 summarizes these results.

My energy bill is…	Percent
Higher	17%
The Same	80%
Not as Low as I Expected	3%

Table 29: Reasons Why E$T Participants are Not Satisfied with the Effect of the Thermostat on their Bills

As Table 30 indicates, most of the E$T participants (95%) report that they would recommend the program to others. The participants who *would* recommend the program provided these additional comments:

"Because I save money and it is free."

"It's a good program. I've already referred others to it."

"It's easy to use and a smart way to control the AC."

"It's reliable, less time-consuming and saves money."

"[I would recommend this program because of] the savings, convenience, and conservation."

The respondents who said they would *not* recommend the E$T Program to others stated:

"Employees get too hot in the summer when required to do manual labor."

"I had it for 6 months and it does not work. I wasn't given a pin number; I have no control."

"I am not happy with the thermostat and how it is hard to program."

Would you recommend this program?	Percent
Yes	95%
No	4%
Don't Know	2%

Table 30: Customers Who Would Recommend the E$T Program to Others

Customer Recommendations

We asked the participants to provide recommendations that would help SCE improve the E$T program for future customers. While some individuals recommended things that SCE already does (indicating a lack of knowledge about the program), a few provided insightful suggestions:

"I'd like more information about internet programming."

"There should be an audio alarm to notify the customer of curtailment."

"During the first six months, SCE should provide a bill comparison to show where we are saving because of the program."

"SCE needs to follow up in 2-3 months to see how the customer is doing."

"Give more explicit information on how to control the thermostat."

"Installers need to be more knowledgeable. The website needs to be more user-friendly."

"It would be helpful to leave behind documentation on how to access the website and program the thermostat through the internet."

"Keep people up-to-date and informed – possibly by email."

"The installer needs to spend more time explaining the thermostat."

"Send a more explicit and user-friendly manual on how to program the thermostat."

8. Non-Participant Survey Results

This is a summary of additional non-participant survey results that do not appear in the text of the process evaluation.

The telephone surveyors tracked all calls and recorded the outcome of each call; Table 31 summarizes the actual outcome types, and the corresponding collapsed outcome we used to characterize the telephone survey dispositions. Upon completing each interview, the telephone surveyor reviewed the survey for accuracy and completeness and then entered the data into an electronic database designed specifically for this survey by the project analyst. Prior to analysis, the project analyst thoroughly performed a quality control check on the data, identifying and correcting any illogical or unreasonable responses.

Collapsed Outcome	Actual Outcomes
Contacted and Completed	Completed
Contacted, but Not Complete	Call Back
	Contact Not Knowledgeable
	Left Message
	Refusal
	Termination
Unable to Contact	Disconnected
	No Answer
	Unable to Contact (7+ calls)
	Wrong Number

Table 31: Collapsed Outcomes

Table 32 presents the dispositions of the telephone survey data collection effort. We attempted to contact a total of 292 non-participants. Of these 292 non-participants, we were able to contact 217 and complete a telephone survey with 164 of them, corresponding to conversion rate of 76%. The conversion rate is defined as the ratio of Contacted and Completed (164) to all Contacted Participants (164+53).

Collapsed Outcome	# of Calls	% of all Calls Made
Contacted and Completed	164	56%
Contacted, but Not Complete	53	18%
Unable to Contact	75	26%
Total	292	100%
Conversion Rate		76%

Table 32: Non-Participant Survey Dispositions

Occupant and Building Characteristics

Table 33 shows the types of businesses that were contacted for the participant survey. Office buildings make up one-third of all businesses. Warehouses, retail stores, and medical labs combined account for another one-third of all non-participating business types. Five respondents say that they are apartment managers working out of their own apartments, so they were classified as 'Other'.

Business Type	Percent
Office Building	33%
C&I Storage (warehouse)	13%
Retail Store	11%
Medical/ Lab	10%
C&I Work (manufacturing)	8%
Beauty Salon	7%
Automotive Service	5%
Other	5%
Restaurant (non-fast food)	3%
Convenience Store (no gas station)	1%
Convenience Store/ Gas Station	1%
Grocery Store	1%
Hotel/ Motel	1%
Restaurant (fast food)	1%

Table 33: Business Types (Non-Participants)

About half of the respondents know or can estimate the age of the building that they occupy. The age of the buildings ranges from 2 to 65 years. The mean building age is 24 years.

Table 34 shows that 79% of the non-participating businesses have employees. The number of employees ranges from 1 to 100; the average number of employees at a location is 10.

Do you have employees?	Percent
Yes	79%
No	9%
Refused	12%

Table 34: Percentage of Non-Participating Businesses With and Without Employees

9. Program Cost-Effectiveness

Overview

This chapter presents an analysis of program cost-effectiveness. The first section contains a discussion of the benefit/cost methodology and a description of the baseline program characteristics used in the analysis. In the next section, several different scenarios for operating the program going forward are modeled, ranging from a base case where the program closes in 2005 to scenarios that incorporate effects of program expansion, cost reductions, and improved targeting. The scenarios are grouped into three broad categories in order to differentiate the impact of legacy units from the cost-effectiveness of future program maintenance and expansion. Within each of these categories, the results of varying several design assumptions are tested, including variations on implementation costs, targeting, and energy savings. Sensitivity analyses are conducted to identify the main factors that affect the cost-effectiveness of the program. A brief discussion of the technical potential for implementing the program in SCE's service territory follows.

Results of the analysis suggest that the E$T pilot's initial start-up costs outweigh the benefits of the existing legacy units. However, the cost-effectiveness of the program improves dramatically in scenarios that incorporate a few reasonable design assumptions, especially by tailoring the offering to customers with relatively high cooling loads, ensuring it is cost-effective to retain individual participants in the program, and operating the program at least five years, long enough to recover initial investments and capture achievable demand reduction benefits over time. The forward-outlook of the program without including the original units is much more favorable. Results of these analyses suggest that with a few realistic modifications to the 2004 program design, keeping current participants as a demand response resource and recruiting additional participants to the program are both cost-effective.

Benefit-Cost Evaluation Methodology

Application of the California Standard Practice Manual Framework

The economic analysis of the E$T program was performed using the framework prescribed in the *California Standard Practice Manual*.[43] Costs for program initiation and operation are captured and compared against benefits that accrue over time. The results are presented from three different perspectives, as provided for in the *Standard Practice Manual*. Treatment of different costs and benefits for each perspective is shown in Table 35 on the next page.

The Total Resource Cost (TRC) test is used as the primary screen for cost-effectiveness throughout the analysis, although the Participant and Utility/Program Administrator perspective provide additional insight. The TRC test helps assess whether the program is likely to improve economic efficiency overall. The programs, however, also have distributional impacts that may affect stakeholders in different ways. The other two tests, the Participant Test and the Program Administrator Test, are useful in ascertaining the distributional impacts.

[43] California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects, October 2001. Downloadable at: http://www.energy.ca.gov/greenbuilding/documents/background/07-J_CPUC_STANDARD_PRACTICE_MANUAL.PDF

Perspective	Benefits	Costs
Participant	1. Incentive Payment 2. Bill savings due to energy efficiency enabled by the Energy$mart thermostats during curtailments (and year-round in some scenarios)	1. Over-ride penalties 2. Investments by participant to accommodate load control (assumed negligible) 3. Value of service loss, including lost business or increased operating costs during load control. The true value of the loss is unknown. It is assumed to be negligible, or at least lower than the benefits, because participants self-select into the program.
Total Resource Cost	1. Avoided generation capacity costs 2. Avoided congestions costs 3 Avoided fuel costs 2. Avoided energy costs derived from use of the programmable thermostat during curtailments. 3. Peak period energy savings accrued during load control	1. All recurring and non-recurring program costs 2. Any participant costs (assumed negligible)
Utility or Program Administrator	1. Avoided supply costs a. Avoided energy costs derived from use of the programmable thermostat during curtailments, including transmission and distribution b. Avoided generation capacity costs	1. Incentive costs less over-ride penalties 2. All other recurring and non-recurring program costs 3. Participants' bill reductions (less avoided energy costs) due to participant thermostat use

Table 35: CA Standard Practice Manual Framework

The Participant Test is the measure of quantifiable benefits and costs to the customer due to participation in a program. It provides some insight into the desirability of the program to current and potential customers. Some of the costs incurred by Participants, such as the value of the service loss, are not transparent or easily quantifiable. This is of minor concern because the participants self-select into the program and in the process weigh the benefits they derive against the costs they incur from participating in the program.

The Program Administrator Test weighs the benefits accrued by SCE, primarily avoided supply costs, against the costs of program administration and lost utility margin.

Benefit (Avoided Cost) Framework

In order to conduct this analysis it was necessary to determine the proper benefit measure to use for demand reductions resulting from E$T program. There is ongoing discussion in CA regarding the proper valuation of capacity. The proper choice of an avoided costing framework is scheduled to be taken up in ongoing CPUC proceeding R. 04-04-025, which is examining the need for consistency in methods and inputs used in setting pricing levels for Qualifying Facilities (QFs) and evaluating a range of programs, including energy efficiency, demand response and distributed generation.[44] The issue of demand response valuation will not be taken up until Phase 3 of this proceeding, which will not begin until 2006 or later.

[44] R. 04-04-025, Order Instituting Rulemaking to Promote Consistency in Methodology and Input Assumptions in Commission Applications of Short-Run and Long-run Avoided Costs, Including Pricing for Qualifying Facilities. Issued April 24, 2004.

Failing a ready-made approach from R. 04-04-025, we adopted the following interim approach, which is consistent with the CPUC directives and the positions of SCE as formally set out in R. 04-04-025 thus far and in the recently-filed testimony on advanced metering.

The primary sources of benefits for demand response programs are from the avoided generation capacity costs plus any ancillary avoided energy costs during the period when the program is operated. The CPUC ordered utilities to apply avoided generation capacity, congestion, and fuel costs for the 2004-05 programs based on the expenses of maintaining and operating a combustion turbine, as determined by the California Energy Commission (CEC).

Consistent with the CPUC directive, the cost-effectiveness analysis for the 2002-2005 period employs values of $85/kW-year for generating capacity, $63 per MWh for displaced energy, and $7 per MWh for congestion avoidance[45]. The 2002-2005 analysis employs the same adjustment factors as SCE in their March 30, 2005 AMI business case[46]. The program runs twenty-four hours a year, requires no advance notice to participants, and is designed to target days when SCE's loss of load probability (LOLP) is among the highest of the year. It is generally activated in days when peak demand is high and/or supply is short. Given the nature of the program, the full annualized generation capacity cost is prorated using a cumulative LOLP allocation factor of 0.90.

The actual capacity value attributable to a demand response (or any other demand-side management program) must be adjusted according to its deliverability and the degree of resource adequacy or inadequacy. In addition, for every MW of expected load reduction due to demand-side management, 1.15 MW of capacity procurement is avoided, assuming a 15% planning reserve margin.

Although the benefits applicable to the 2002-2005 are clear, when it comes to applying benefit values for forecasting – 2006 and beyond – the analysis takes a conservative approach and uses values lower than those applied to the 2002-05 period. Program benefits used in the cost-effectiveness analysis are presented in Table 36. Additional documentation is presented in the Appendix.

Table 36: Benefit (Avoided Cost) Assumptions for Economic Analysis

Program Benefits			
	2002-2005	**Forecasting**	
Proposed Generation Capacity Cost	$85.00	$69.7	$US 2005/kW-year
Critical Peak Demand Energy Adder	$63.00	$63.00	$US 2005/MWh
Congestion Value Energy Adder	$7.00	$7.00	$US 2005/MWh
Average Marginal Energy Cost	$60.00	$60.00	$US 2005/MWh
Planning Reserve Margin (PRM)	0.15	0.15	Per unit of energy
Cumulative LOLP Allocation	0.90	0.90	Assumes 12 2-hr curtailments

[45] R.02-06-001. July 21, 2005, Appendix B.

[46] Testimony Supporting Application for Approval of Advanced Metering Infrastructure Deployment Strategy and Cost Recovery Mechanism, A. 05-03- , March 31, 2005

E$T Program Costs

All the retrospective calculations of costs are conducted using actual historical expenditures for the 2002-2004 E$T program. The 2005 costs are based on that year's budget. Future program costs are based on the anticipated program, equipment, and installation costs for the 2006 year. The figures from the 2002 to 2004 period are high for forecasting future program costs because they include start-up expenses that decrease once the program has been designed and is running smoothly. The baseline program cost assumptions employed for forecasting purposes are detailed together with the all of the forecasting assumptions in Table 38.

Load and Energy Impacts

The load impacts used in both the retrospective and forward analysis are drawn from RLW's impact evaluation of the 2004 E$T program evaluation and the actual end-use metering data.[47] The load impact is large during the first hour of curtailment events but slowly decreases as temperatures inside participant facilities increase, and air-conditioners restart. Load and energy impact assumptions employed in the benefit-cost analysis are summarized in Table 37. The total energy impacts vary depending on the number of thermostats installed and enrolled in the program, but per ton and per thermostat values remain the same. The totals in the below table apply to the units installed by 2005.

Impact Estimation for End Use Metered Data			
	Per Sample Ton	**Per Thermostat**	**2005 Total**
Maximum kW Reduction	0.49	1.95	8,977
First Hour kWh	0.33	1.31	6,046
Second Hour kWh	0.21	0.84	3,847
Average peak load reduction over 2-hr curtailment (kW)	0.27	1.08	4,947
Energy "snapback" (kWh)	-0.02	-0.09	-421
Net Critical peak energy savings (kWh)	6.20	25.55	113,650
Average Annual Cooling Energy use (kWh)	1,452	6,216	28,583,600
Thermostats per customer			1.8
Energy efficiency impact Assumption (Included in some scenarios)			
1% energy efficiency impact (kWh)	14.5	62.1	285,836

Table 37: Summary of Load and Energy Impacts for SCE's 2004 E$T Program

Variable Program Characteristics and Forecasting Assumptions

This section summarizes the variations of program and participant characteristics used in the forecasting scenarios. Although the assumptions are adjusted for individual scenarios, the variations are rooted in underlying baselines. The baseline assumptions and characteristics were assembled from a variety of sources including RLW's impact evaluation of the 2004 E$T program, program records provided by SCE, and from recent regulatory documents. In the case of analysis components that lack a natural baseline – such as program life – the baseline was selected to represent informative conditions that could reasonably be depicted in alternative

[47] Program Impact Evaluation of the 2004 SCE Energy$mart ThermostatSM Program. Final Report, January 17, 2005. Prepared for SCE by RLW Analytics.

scenarios. Individual scenarios generally adjust the baseline assumptions through either a cost reduction of 10 percent, changes in targeting, the inclusion of energy-efficiency savings, or a combination of three. The baseline program characteristics and forecasting assumptions employed in the benefit-cost analysis are presented in Table 38.

	Expansion Assumptions	Value	Units
1	Annual Expansion (New Units)	4,500	installations/year
2	Years of Expansion (Starting '05)	2	years
3	Equipment Cost (per new unit)	$220	$US 2005/thermostat
4	Installation Costs	$100	$US 2005/thermostat
5	Expansion Costs	$25	$US 2005/thermostat
6	Non-Install Rate	15%	Per unit installed
7	Non-Install Costs	$50	$US 2005/non-installation
	Assumptions regarding Characteristics		
8	Discount Rate	8.2%	
9	Program Life	10	Years
10	# of program events per year (2005-2024)	12	per year
11	Average Electricity Rate	$110	$US 2005/MWH
12	Annual Drop-out Rate (2005-2024)	2.0%	per year
13	Average Tonnage/Unit	5.2	Tons/thermostat
14	Average Annual Electricity Use per thermostat	39.49	MWh/thermostat
15	Percent Cooling Load	19%	
15	Assumed Energy Efficiency Effect	0.0%	Estimate
	Maintenance Cost Assumptions		
16	Incentive Payment	$75.	$US 2005
17	Per Unit Program Management Costs	$55.	$US 2005/thermostat

Table 38: Baseline Forecasting Assumptions and Program Characteristics

The future characteristics of the program and the participants both affect the benefit-cost ratio for the TRC, the participants, and the program administrator. The program characteristics can be divided into two categories, those under the control of the administrator and those that are not. To complicate matters, several program characteristics and expenses, such as thermostat costs, fluctuate over time and present the administrator with different levels of managerial flexibility.

One item of particular interest is the annual energy efficiency savings. Although the results are somewhat mixed, most research on setback thermostats indicate that they yield positive year-round energy savings. Even so, whether or how benefits from energy efficiency should be incorporated into cost-effectiveness analysis for a demand-response program is a matter the CPUC is considering, but has not yet resolved. Therefore, the cost-effectiveness analysis includes both scenarios with and without the value of energy savings from energy efficiency. Based on a review of current literature, a conservative value (1% of annual cooling load) was used in some of the scenarios.[48]

[48] King, C., Delurey, D. Efficiency and Demand Response: Twins, Siblings or Cousins? *Public Utilities Fortnightly*. March 2005. www.fortnightly.com

Results of the Economic Analysis

Overview

The economic analysis features program scenarios are presented in three sections. The first section analyzes the adjustments required to make the program – including past, present, and future – cost-effective. This analysis includes the legacy units from the program start-up including all their costs and benefits. The second section provides a forward outlook and analyzes the cost-effectiveness of keeping thermostat units already installed in maintenance mode. It treats past expenditures as sunk cost and excludes them for the cost-effectiveness analysis of future actions. The third section analyzes the cost-effectiveness of adding new participants to the program given a few program modifications. Like the second section, it is forward looking and excludes the start-up expenditures. The scenarios are grouped into three sections in order to differentiate the impact of legacy units from the cost-effectiveness of future program maintenance and expansion. Finally, the sensitivities of program characteristics and costs are examined to identify their relative impact on the cost-effectiveness of the program.

One common thread throughout all the scenarios is that the Participant Test results are high, indicating the program is financially attractive for customers, which is a positive attribute affecting recruitment. Some preliminary estimates of the technical potential for cooling loads that could potentially participate in the program are discussed later in this chapter.

In general, despite the legacy units and the start-up expenditures, the program has the potential to provide cost-effective demand response resources, but the program will require a few modifications. Given the areas for program improvement and cost-savings identified in earlier chapters of this report, a cost-effective E$T program is not only feasible; results of the cost-effectiveness analyses indicate that such an outcome is within reach.

Scenario Analysis

Cost-Effectiveness – Current Program

This section analyses whether the program as whole is cost-effective given its past history of expenditures and scenarios about future expansions and/or maintenance. It combines the high expenses of the initial pilot years with future years that are anticipated to be cost-effective. This section does not examine whether, in the future, it is cost-effective to maintain installed units or install additional units. The range of modifications and ability to improve the cost-effectiveness is limited by the expenditures in the initial years. The program can opt to keep all or some of the currently installed E$T thermostats in maintenance mode, attempt to push down program management costs, or install additional thermostats in more cost-effective cooling units thereby increasing the cost-effectiveness of the entire program. The cost-effectiveness of the program is slightly enhanced through including a conservative estimate of year-round energy efficiency savings (1%) for the cooling load.

In general, given prior start-up expenditures and history it is difficult to make the existing pilot program cost-effective as whole except through adding new, better targeted, cost-effective installations (discussed in Scenario 3), and shedding participants with smaller air-conditioning units that are not cost-effective to maintain. The results in Table 39 make this clear. The TRC increases with a longer program life and with additional cost-effective installations. Shutting down the program limits the ability of the program recover benefits in future years and encumbers the program and the rate-payers with the expense of existing legacy units before their full benefits are captured.

	Base Scenario Prorgram Shuts Down After 2005	Maintenance Only 10 More Years	Maintenance Only 10 More Years Efficiency Assumption	9000 Unit Expansion Targeting Lower Costs	9000 Unit Expansion Targeting, Lower Costs Efficiency Assumption
Variable Inputs					
Program Life	0.0	10.0	10.0	10.0	10.0
Annual Incentive		$75.0	$75.0	$75.0	$75.0
Program Management per unit		$55.0	$55.0	$55.0	$49.5
Average Tons per Unit		5.2	5.2	7.0	7.0
Avg. Annual Electricity Use (MWh/thermostat)		39.5	39.5	53.2	53.2
Average Percent Cooling Load		-	19.1%	19.1%	19.1%
Energy Efficiency Assumption		-	1.0%	-	1.0%
Expansion per year		-	-	4,500.0	4,500.0
Years of Expansion		-	-	2.00	2.00
Thermostat Costs		-	-	$198.0	$198.0
Installation Costs		-	-	$90.0	$90.0
Expansion Cost		-		$25.0	$25.0
Extra Incentives		-	-	$0.0	$0.0
Non Install Rate		-	-	15.0%	15.0%
Non-Install Costs		-	-	$50.0	$50.0
Benefit/Cost Ratios					
Total Resource Cost	0.44	0.58	0.60	0.91	1.06
Participant	6.52	5.64	6.03	4.61	5.14
Program Administrator	0.27	0.37	0.38	0.58	0.64

Table 39: E$T Cost-Effectiveness – Expansive Outlook (Includes Legacy Units)

Cost-Effectiveness – Forward Outlook, Maintenance Only

One of many important decisions faced by the program administrator is whether or not to continue paying current participants incentives in order to have their load available as demand response. The cost of the installed thermostats already has been incurred and those thermostats can provide future benefits. The following analysis investigates the cost-effectiveness of continuing the program in maintenance mode.

These results suggest that reducing overall costs can bring the program within range. One way to do this is by streamlining implementation as discussed in earlier chapters of this report. Additionally, costs can be reduced by targeting the program to customers with larger air conditioning units, and, hence, larger cooling loads. This analysis suggests that some of the customers included in the current program have air conditioning units too small to warrant their participation in the program. Given the baseline costs, the break-even point for keeping a cooling unit with a thermostat in maintenance mode for ten years is, 3.45 tons. This result is only slightly affected by including energy efficiency savings. Assuming 1% annual energy efficiency savings on cooling load, the break-even point is a 3.06 ton cooling unit. These estimates assume that all other factors remain constant. As program management costs are reduced, keeping smaller and smaller units in the program becomes cost-effective. Regardless, the program cost-effectiveness improves significantly by dropping units that are not cost-effective.

Since the program in its current state provide several opportunities to improve cost effectiveness, it is quite plausible to lower per unit program management costs substantially, enabling the program to reap benefits from thermostat units already installed. Given the current participant characteristics, lowering program management costs ten percent from the baseline makes it cost-effective to keep units attached to air-conditioners bigger than 3.15 tons in maintenance mode.

The most favorable course is to combine the two, seeking to divest the program of the most inefficient units and to lower program management costs. These results are presented in Table 40.

Forward Outlook - Maintenance Scenarios	5 Additonal Years	10 More Years	10 More Years Lower Costs	10 More Years Lower Costs Efficiency Assumption
Variable Inputs				
Program life	5.0	10.0	10.0	10.0
Yearly Incentive	$75.0	$75.0	$75.0	$75.0
Program Management Costs	$55.0	$55.0	$49.5	$49.5
Avg. Tons per cooling unit	5.2	5.2	5.2	5.2
Avg. Annual Electricity Use (MWh/thermostat)	39.5	39.5	39.5	39.5
Average Percent Cooling Load	-	-	-	19.1%
Energy Efficiency Assumption	-	-	-	1.0%
Benefit/Cost Ratios				
TRC	1.45	1.51	1.65	1.73
Participant	1.65	3.38	3.38	3.77
Program Administrator	0.99	0.81	0.85	0.87

Table 40: E$T Cost-Effectiveness – Forward Outlook Maintenance Only

Cost-Effectiveness – Forward Outlook, New Installations

New installations provide a blank slate and promising opportunities. If targeted and managed properly they have the potential of delivering cost-effective load reductions. Analysis presented here are based on a scenario that includes a two-year, 9,000 unit expansion (4,500 thermostats per year), and assumes the program continues up to ten years after the last installation.

The results make it clear that new installations are not cost-effective if the current targeting and overhead costs continue into the future. This is reflected in the baseline scenario, with a TRC Benefit/Cost Ratio of 0.84. The results are most sensitive to better targeting of larger air-conditioning units and it is possible to make new installations cost-effective solely through targeting. In order for new installations to be cost-effective solely through targeting, the program would have to target participants with air conditioners units larger than 6.17 tons. Given the baseline costs, participants with cooling units smaller than 6.17 tons are not cost-effective to recruit into the program.

An attractive approach is to combine better targeting with cost reductions as in the fourth scenario, enabling participants with smaller units to become cost-effective. With a ten percent reduction in installation, equipment, and program management costs, it is cost-effective to recruit participants with units larger than 5.5 tons, enlarging the pool of eligible participants.

Forward Outlook - New Installations	Base Scenario Current Costs & Characteristics	Energy Efficiency Current Costs & Characteristics	Targeting Current Costs Different Characteristics	Targeting & Modifications Lower Costs Different Characteristics	Modifications & Energy Efficiency Lower Costs Different Characteristics
Variable Inputs					
Program Life	10.0	10.0	10.0	10.0	5.0
Annual Incentive	$75.0	$75.0	$75.0	$75.0	$75.0
Program Management per unit	$55.0	$55.0	$55.0	$49.5	$49.5
Average Tons per Unit	5.2	5.2	8.0	8.0	8.0
Avg. Annual Electricity Use (MWh/thermostat)	39.5	39.5	60.8	60.8	60.8
Average % Cooling Load per thermostat	-	19.1%	-	-	19.1%
Energy Efficiency Assumption	0.0%	1.0%	0.0%	0.0%	1.0%
Units Installed Per Expansion Year	4500.0	4500.0	4500.0	4,500.00	4,500.00
Years of Expansion	2.0	2.0	2.0	2.0	2.0
Thermostat Costs	$220.0	$220.0	$220.0	$198.0	$198.0
Installation Costs	$100.0	$100.0	$100.0	$90.0	$90.0
Expansion Cost	$25.0	$25.0	$25.0	$25.0	$25.0
Extra Incentives	$0.0	$0.0	$0.0	$0.0	$0.0
Non Install Rate	15.0%	15.0%	15.0%	15.0%	15.0%
Non-Install Costs	$50.0	$50.0	$50.0	$50.0	$50.0
Benefit/Cost Ratios					
Total Resource Cost	0.84	0.88	1.33	1.46	1.53
Participant	3.60	3.99	1.96	1.96	2.26
Program Administrator	0.27	0.29	0.41	0.44	0.47

Table 41: E$T Cost-Effectiveness – Forward Outlook, New Installations

Factors Affecting Program Cost-Effectiveness

This analysis points to several key opportunities for improving cost-effectiveness. Because not all the adjustments have the same impact on the cost-effectiveness of the program, it is important to identify the dimensions that yield the largest improvement and extent to which it is possible to change those parameters. In order to measure the impact of the modifications, we conducted a sensitivity analysis that varied each component by a specific percentage while holding all other inputs constant. Displaying changes to program characteristics and costs in percentage terms allows us to compare program features under the same metric. Figure 23 – a Spider Plot – demonstrates the impact of altering each of the major features on the TRC Benefit/Cost Ratio *altering one dimension at a time and holding all other dimensions constant*. (Spider charts do *not* show the impact of altering more than one component at the same time).

The slope of each line indicates the relative impact of altering the program feature or assumption. A steeper line indicates a larger impact. The direction of each line indicates whether an increase in the feature leads to a higher or lower TRC Benefit/Cost Ratio. For example, increasing the average size or participant air-conditioners (tonnage per unit) leads to an increase in the kWh per thermostat unit which in turn translates to increase in the TRC Benefit/Cost Ratio.

The average size of the participant's air-conditioners has the largest impact on the cost-effectiveness of the program, followed reductions in operations and maintenance cost per unit (program management costs). It is important to note that the variable cost per unit has an exponential impact on the benefit/cost ratio. Both of these program features are within the control of program administrator. Another key feature is the impact of program life – the number of years after the last installation that units are kept in maintenance mode. Although its impact on the benefit/cost ratio is small in comparison to reductions in costs, if the cost of maintaining a participant in the program is positive, a longer program life increases the cost-effectiveness ratio. That decision lies clearly within the control of program administrator and the CPUC.

Moreover, it is important to note that the impact of program life increases when lower discount rates are employed.

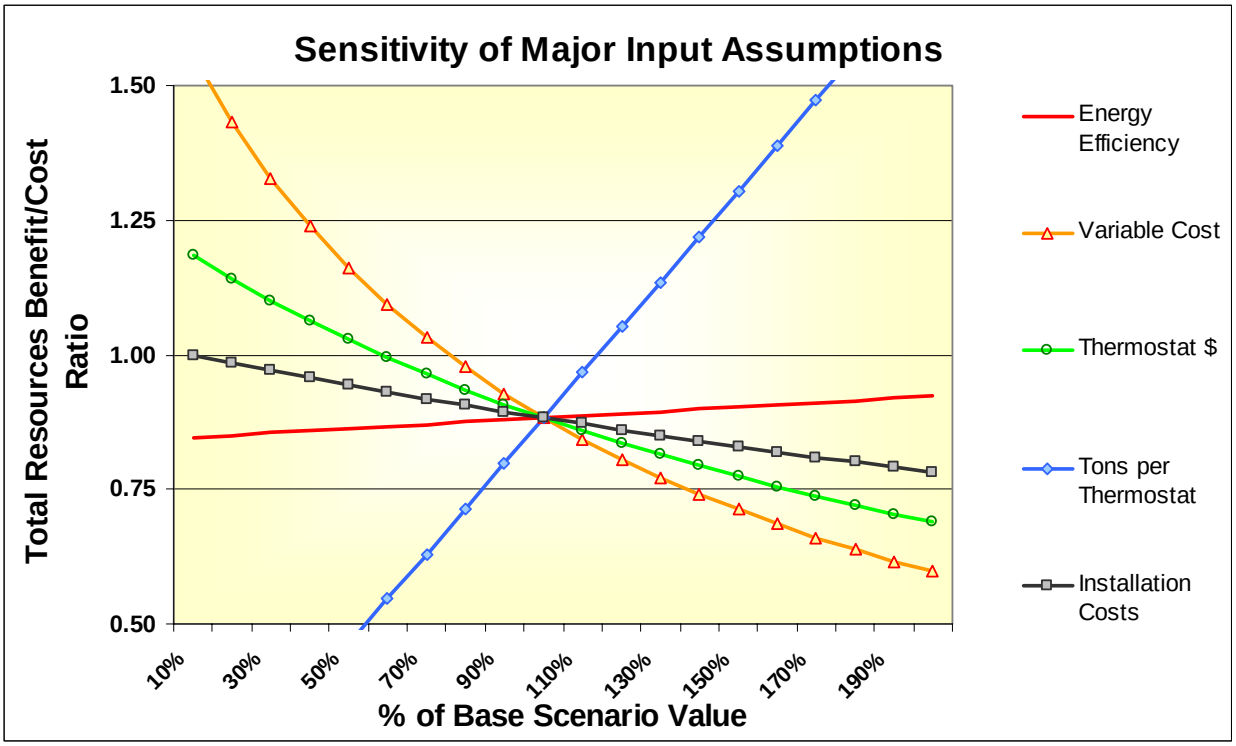


Figure 23: Spider Plot

In the case of program expansion, there are more ways in which it is possible to improve cost-effectiveness. New installations provide more leeway in targeting the program. Moreover, the technology costs are likely to decrease further. They already have decreased over 30 percent, from $300 to $220, since the initiation of the program in 2002.

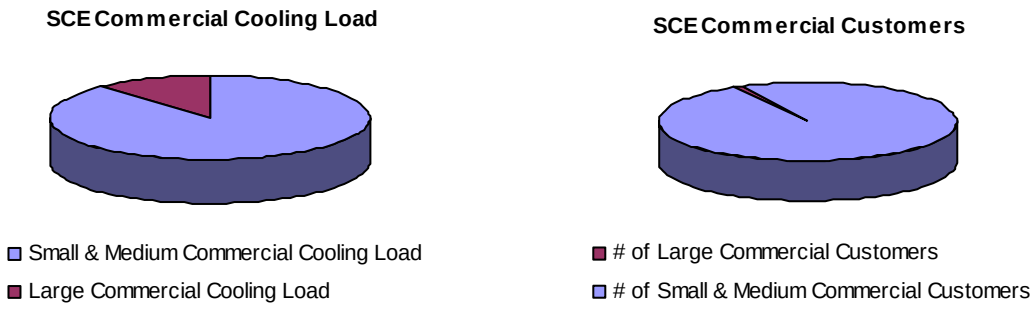
Figure 23 above omits several program features and assumptions with smaller effects in order for the chart to remain readable. Two features, however, deserve mention in order to caution against alterations that do not make the program more cost-effective from the TRC perspective. First, changing the incentives does not have any impact on the TRC Benefit/Cost Ratio because it is essentially a transfer from the program administrator to the participant. Benefit-cost analysis does not include transfer because they represent neither a gain nor a loss to society, or in this instance the total resource costs. Second, the size of the participant's cooling has a large impact on the cost-effectiveness of the program precisely because larger cooling units use more energy, and curtailing them leads a higher capacity benefits.

The sensitivity analysis provides a roadmap to different program alteration that can improve the cost-effectiveness of the program. Despite the legacy units and start-up expenses, with modification, the E$T program can deliver cost-effective demand response.

Technical Potential

Technical potential refers to the level of market penetration for a given measure technically feasible from an engineering perspective. This assessment does not account for the cost-effectiveness of the program. The information presented next provides some preliminary estimates regarding the small and medium commercial and industrial customers that can technically install E$T Thermostats in their facilities.

The basis of the analysis is the total commercial customers in the SCE area, 494,000[49]. Of these customers the vast share of them are small or medium business. Although the large commercial customers account for 12% of the total yearly commercial electricity consumption, they constitute about 1% of commercial customers[50].



Knowing the number of small and medium commercial customers, however, does not provide information about the size of the air-conditioning units. This is important, since the program effects are reported in term of the size of the air-conditioners unit (kWh/ton). The information about the overall energy, however, allowed us to estimate the average yearly cooling load for small and medium commercial customers and compare it to the average load for the sample in the E$T 2004 program evaluation. The *average cooling load* of the average small and medium customer is approximately 60 MWh while the *total average load* of the program participants is approximately 59 MWh. This indicates that, on average, the potential participants likely have larger air-conditioning units than the participants. Therefore, using the average size of air-conditioners of program participants provides a conservative estimate of the market potential. Using these calculations, the program has the potential of providing up to 924 MW of capacity per year. Preparing a more detailed estimate of technical potential, estimate of the cost-effective economic potential and market potential would require additional analysis. Information regarding the Technical Potential estimate is presented in Table 42.

---

[49] SCE 2006 General Rate Case, California Energy Commission, 2003 Demand Forecast

[50] SCE Website, 2005.

Market Assessment	Value	Units
Commercial Electricity Consumption for SCE Area	34,468	GWh
Share of SCE small & medium commercial	88.00%	Percent
Share of SCE Large Commercial	12.00%	Percent
Small & Medium Commercial Cooling Load	30,332	GWh
Large Commercial Cooling Load	4,136	GWh
# of Commercial Customers	494,000	Customers
# of Large Commercial Customers	5000	Customers
# of Small & Medium Commercial Customers	489,000	Customers
Average yearly Cooling Load - S/M Commercial	62.03	MWh
Average Yearly Cooling Load - Large Commercial	827.23	MWh
Tons Per Cooling Unit	4.28	Tons/unit
Load Reduction per unit	1.89	kWh
Total Potential Capacity	924.21	MW-yr

Table 42: Technical Potential for Energy$mart Thermostats

Conclusions

Analyses presented in this chapter suggest it would be difficult to make the existing program cost-effective based on legacy-installations alone without new, more cost-effective thermostat installations. However, the cost-effectiveness of the program improves dramatically in scenarios that incorporate a few reasonable design assumptions, especially by expanding the program, tailoring the offering to customers with relatively high cooling loads, and by operating the program at least five years – long enough to recover initial investments and capture achievable demand reduction benefits over time. With a few realistic modifications, continuing the program with (most) existing participants and recruiting additional participants to the program would yield a cost-effective result. The required modifications are reasonable in light of discussions the strategies for improving future program designs presented in earlier chapters.

Appendix 1. Non-Participant Survey

RLW_ID:_____

Hello, my name is _____, and I am calling on behalf of Southern California Edison. May I please speak to <<**CONTACT NAME**>>?

Ask for the contact name provided – this is who should have received the reminder brochure.

Q1. I would like to get your feedback about the SCE Energy$mart Thermostat program mailer that you received last summer. We recently sent you a copy of that same brochure with a letter explaining that we would be contacting you. The survey will only take 3 minutes to complete. Do you have time today to take this short survey?

1= YES, continue

2= NO, **ASK: "May I get an alternative time when it would be better to reach you**?" **GET CALLBACK INFO (ENTER IN CONTACT LOG) & COMPLETE LATER IF NECESSARY. CIRCLE FINAL OUTCOME – ONLY FINAL OUTCOMES ARE ENTERED INTO DATABASE.**

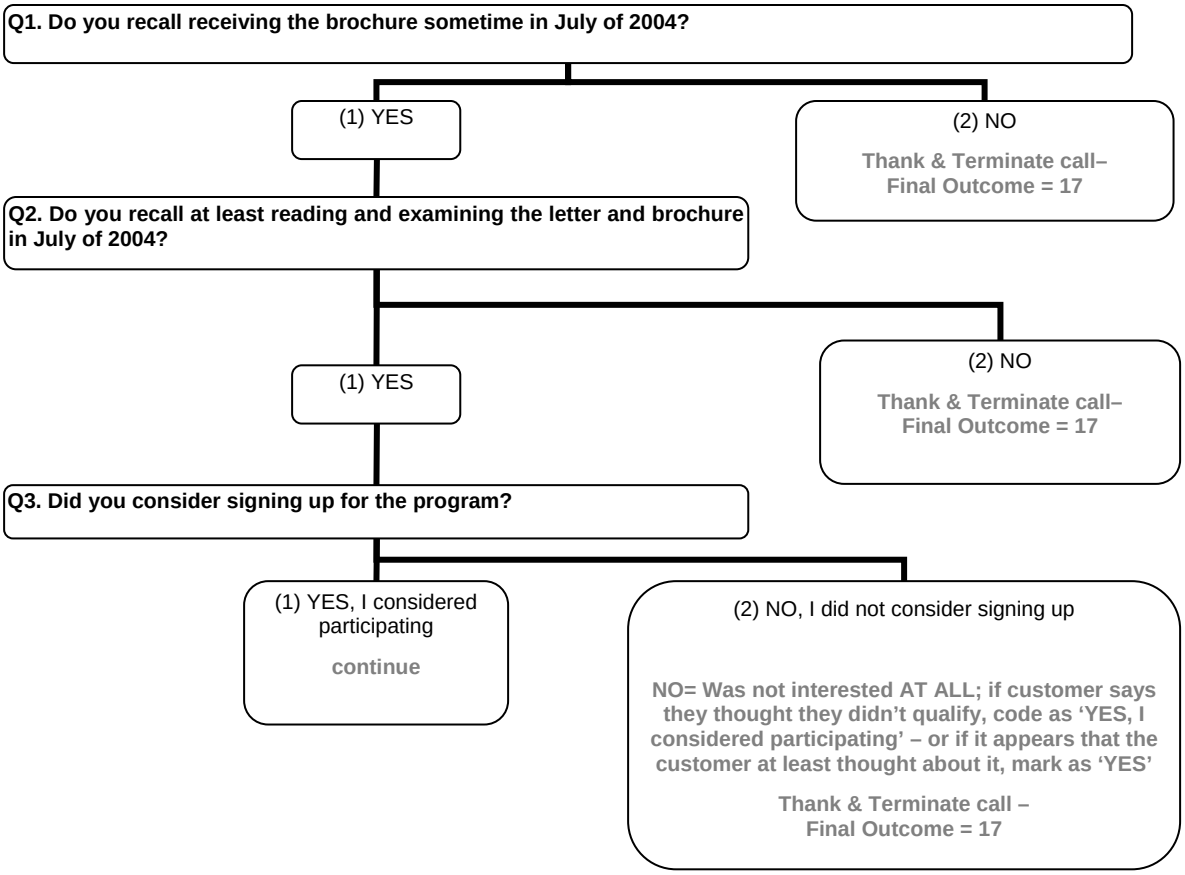
Contact Log

	Date	Time	Caller Initials	Contact Name & Title	Outcome Code	Comments
1						
2						
3						
4						
5						
6						
7						

Outcome Codes:

Code	Text
0	Partially Complete -- Need follow up
1	Completed
2	Call Back
3	Left Message
4	Busy
5	No Answer
6	Refusal
7	Termination
8	Wrong Number
9	Disconnected
10	Language Barrier
11	No Phone #/Cannot Locate #
12	Customer Recently Passed Away
13	Duplicate Record
14	Stratum Filled
15	Vacant
16	Unable to Contact
17	Customer Claims No Participation
18	Contact Not Knowledgeable

Section 1: Screener

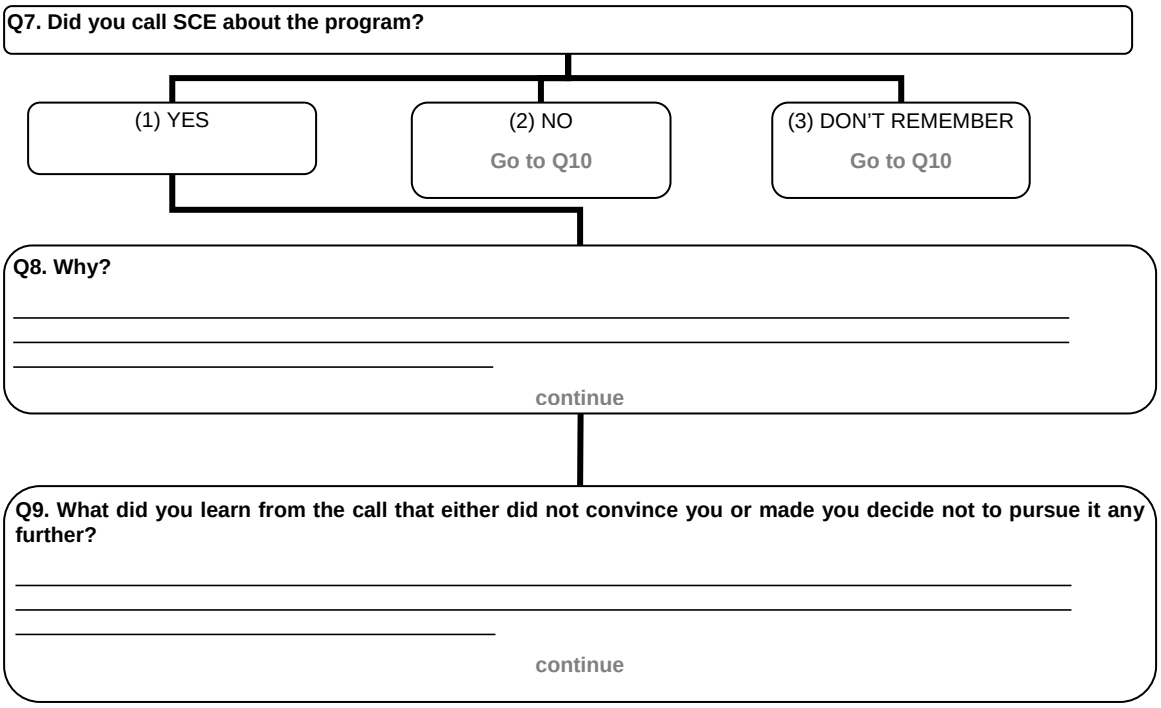


Section 2: Non-Part Perceptions about the Program

Q4. In your own words, what did you think SCE was offering you?

Q5. Do you recall finding anything particularly <u>interesting</u> about the program?

Q6. Do you recall finding anything particularly <u>confusing</u> about the program?



Q10. Did you feel there were any <u>risks</u> involved with the program? Please explain.

Q11. On the other hand, did you feel there were <u>benefits</u> to be gained by participating? What were they?

Q12. Can you tell me why you decided not to send the application and join the program?

Q13. What would have convinced you to send in the application?

Just to review, the offer you received last summer paid a $150 bonus for every thermostat installed. In addition, SCE told participants that their thermostats would be controlled up to 12 times last summer.

Q14. If you receive a new offer this summer to participate in a thermostat program that pays *$100* a year with curtailment events *only during an electrical emergency*, would you consider it now?

(1) YES: Why?

(2) NO: Why Not?_____

_____

Section 3: Non-Part Demographics

Thank you for your opinions. Before I let you go, I just need to capture some information about your company.

Q15. What type of business is this?

(01) Automotive Service
(02) Beauty salon
(03) C&I Storage (warehouses)
(04) C&I Work (manufacturing)
(05) Church
(06) Convenience store (no gas station)
(07) Convenience store/ Gas Station
(08) Fitness Club/ Gymnasium
(09) Grocery store
(10) Hotel/Motel
(11) Medical/Lab
(12) Non-profit
(13) Office building
(14) Restaurant (Non-fast food)
(15) Restaurant (Fast Food)
(16) Retail store
(17) School
(98) Other (please describe):_____

Q16. How old is the building you occupy?

(1) Age in years _____ OR (2) Year Built _____
(3) DK

Q17. How many employees do you have at this location?

(1) Exact #_____
(2) Don't Know
(3) No Employees

Thank you for participating in this confidential survey. Your input will help improve the SCE Energy$mart Thermostat program for this summer. Do you have any questions about this survey that I may be able to answer?

IF THE CUSTOMER WANTS TO CONTACT SOMEONE AT THE UTILITY TO VERIFY THIS STUDY, THEY MAY CONTACT SCE AT 877-823-8716.

Appendix 2. Participant Survey

RLW_ID:

Hello, my name is _____, and I am calling on behalf of Southern California Edison and RLW Analytics.

Q1. I would like to get your feedback about the Energy$mart Thermostat program in terms of installation, programming, & satisfaction. The survey will only take a few minutes to complete. Are you the person I should speak to?

1= YES, continue

2= NO, **ASK:** "Is there someone else that I can talk to who will be able to answer a few questions about the Energy$mart Thermostat program?" **GET CALLBACK INFO (ENTER IN CONTACT LOG) & COMPLETE LATER IF NECESSARY. CIRCLE FINAL OUTCOME – ONLY FINAL OUTCOMES ARE ENTERED INTO DATABASE.**

Contact Log

	Date	Time	Caller Initials	Contact Name & Title	Outcome Code	Comments
1						
2						
3						
4						
5						
6						
7						

Outcome Codes:

Code	Text
0	Partially Complete -- Need follow up
1	Completed
2	Call Back
3	Left Message
4	Busy
5	No Answer
6	Refusal
7	Termination
8	Wrong Number
9	Disconnected
10	Language Barrier
11	No Phone #/Cannot Locate #
12	Customer Recently Passed Away
13	Duplicate Record
14	Stratum Filled
15	Vacant
16	Unable to Contact
17	Customer Claims No Participation
18	Contact Not Knowledgeable

Section 1: General Information (Program Knowledge and Motivations for Participation)

Before we begin, I would like to tell you that your answers will be confidential, and will be used only to inform and make improvements to the program.

Q2. Can you please briefly explain your understanding of the Energy$mart Thermostat Program?

DO NOT PROMPT– IF THEY GET STUCK, REPHRASE: "WHAT DID YOU KNOW ABOUT THE PROGRAM PRIOR TO SIGNING UP?"

- **LET THE CUSTOMER RESPOND COMPLETELY WITHOUT INTERRUPTION, AND CIRCLE "RECALL" FOR ANY POINT THEY MENTION**
  - **RECALL = SPONTANEOUS RECALL**
- **FOR POINTS THEY MISSED, SAY: "DO YOU RECALL THAT [POINT THEY MISSED]", AND CIRCLE**
  - **PROMPTED = RECALLED ONLY AFTER YOU MENTIONED IT**
  - **NO RECALL = DID NOT RECALL AND DID NOT SAY THEY REMEMBERED AFTER YOU MENTIONED IT**

FYI: "CURTAILMENT" = A curtailment happens when SCE changes the cooling-setpoint of the thermostat so that the AC turns off. This saves energy for the customer, and helps to save energy for California during the hot summer months.

1	Each thermostat and installation was free.	Recall	Prompted	No Recall
2	There was a $150 participation bonus per thermostat.	Recall	Prompted	No Recall
3	The thermostat could be programmed through the internet.	Recall	Prompted	No Recall
4	You could save up to 30% on your heating and cooling bills.	Recall	Prompted	No Recall
5	SCE could control your thermostat by up to 4 degrees during an energy curtailment.	Recall	Prompted	No Recall
6	You could override the curtailment, but it would cost you $10 per override.	Recall	Prompted	No Recall
7	SCE could call up to 12 energy curtailments in the Summer of 2004.	Recall	Prompted	No Recall

Q3. What was the <u>main reason</u> that you decided to participate in the Energy$mart Thermostat program?

_____

_____

_____

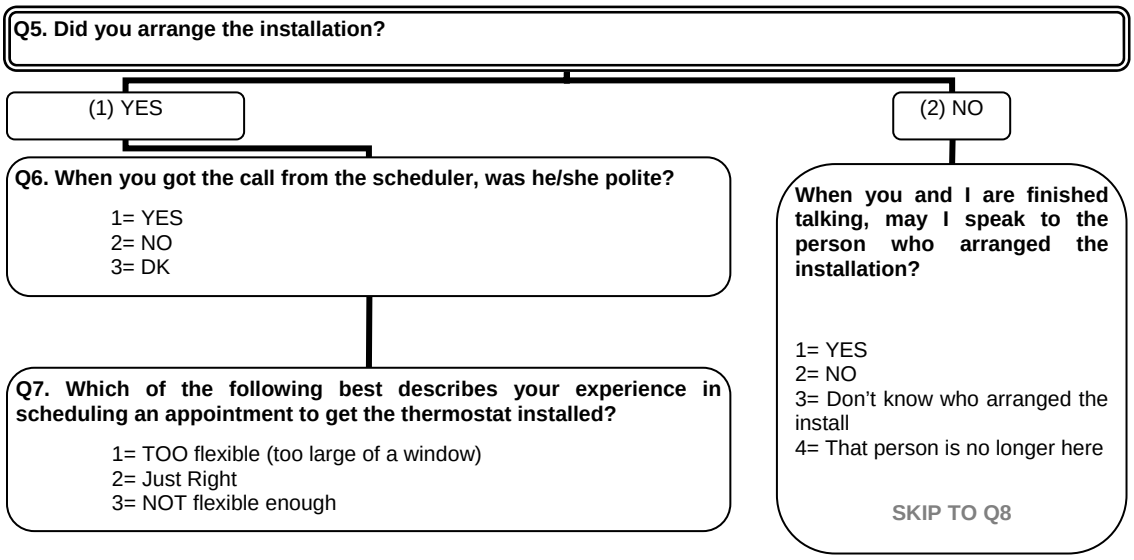
Q4. Was there <u>any other reason</u> you decided to sign up?

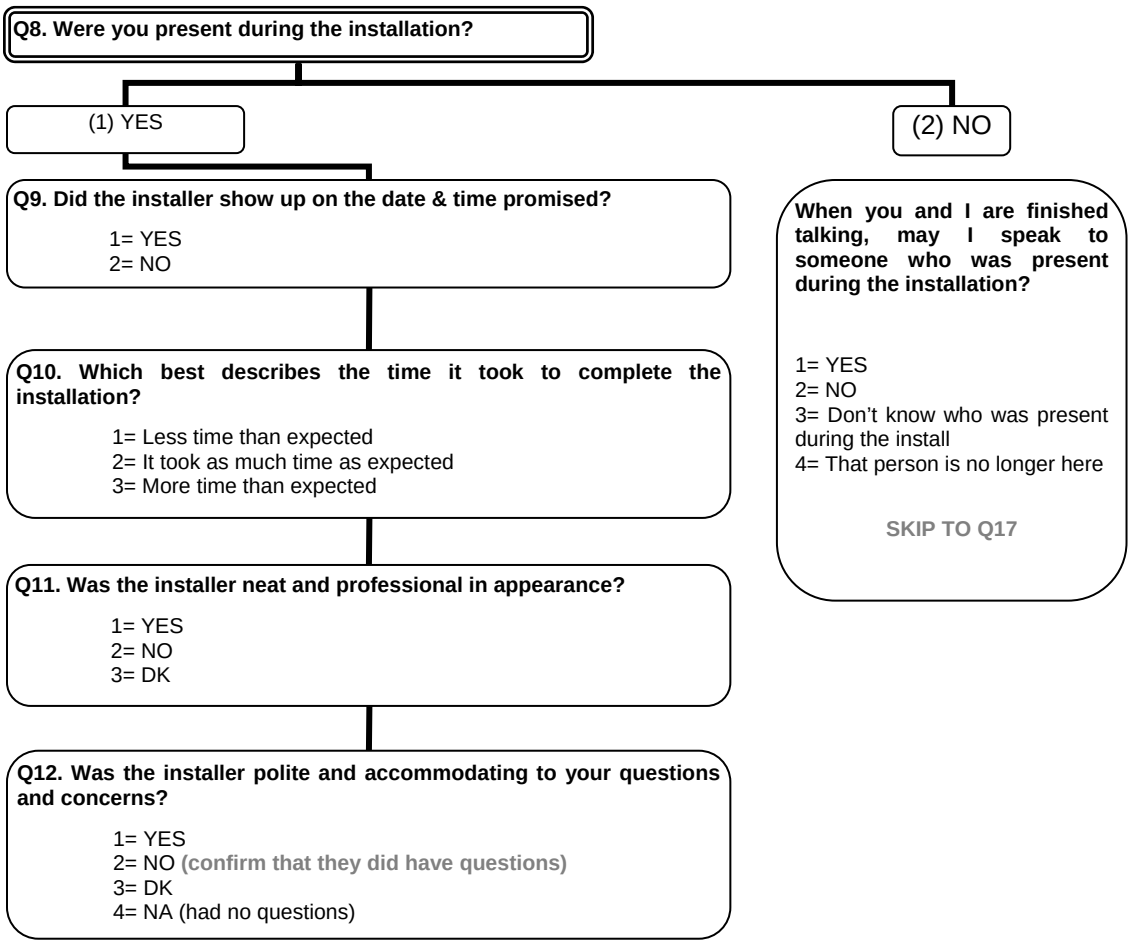
_____

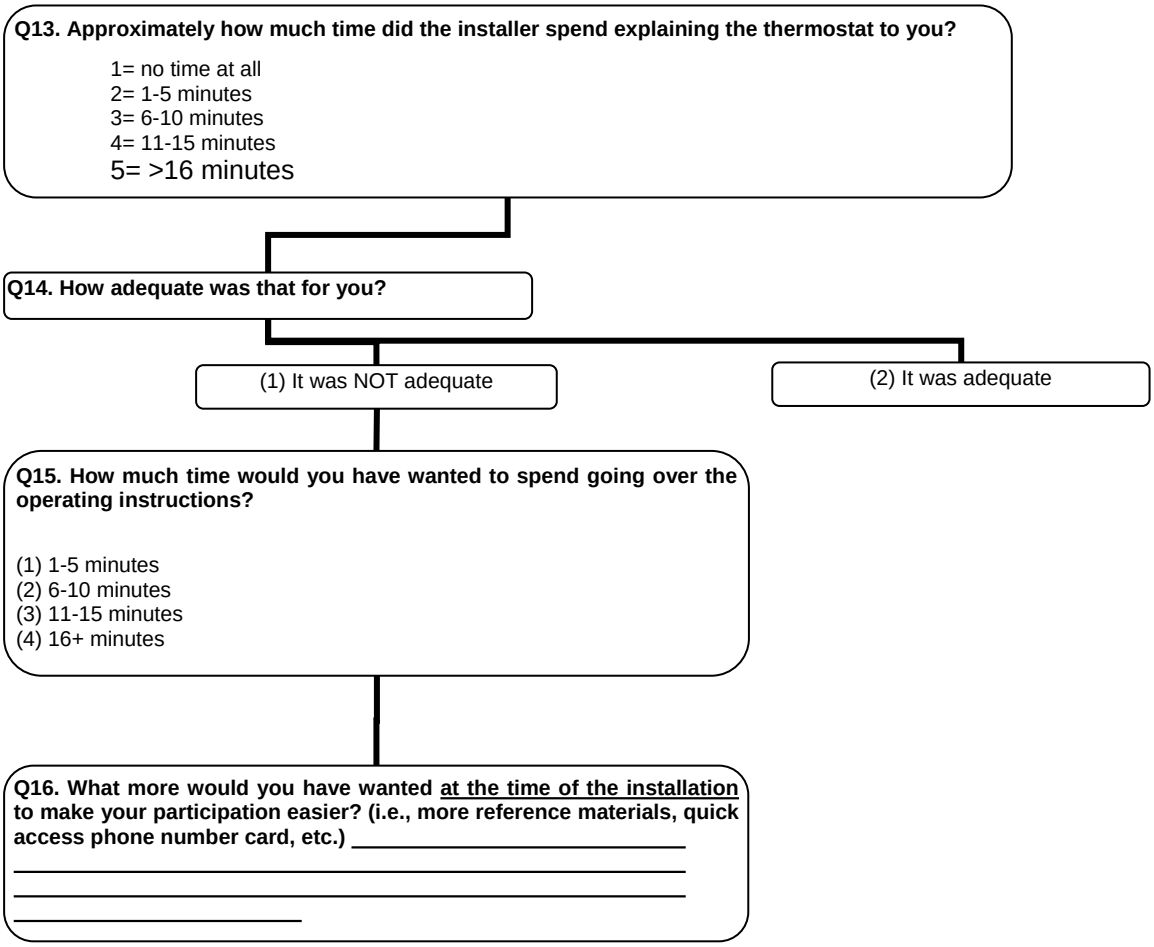
_____

_____

Section 2: Installation


Q5. Did you arrange the installation?
(1) YES
(2) NO
Q6. When you got the call from the scheduler, was he/she polite?
1= YES
2= NO
3= DK
Q7. Which of the following best describes your experience in scheduling an appointment to get the thermostat installed?
1= TOO flexible (too large of a window)
2= Just Right
3= NOT flexible enough
When you and I are finished talking, may I speak to the person who arranged the installation?
1= YES
2= NO
3= Don't know who arranged the install
4= That person is no longer here
SKIP TO Q8


Q8. Were you present during the installation?
(1) YES
(2) NO
Q9. Did the installer show up on the date & time promised?
1= YES
2= NO
Q10. Which best describes the time it took to complete the installation?
1= Less time than expected
2= It took as much time as expected
3= More time than expected
Q11. Was the installer neat and professional in appearance?
1= YES
2= NO
3= DK
Q12. Was the installer polite and accommodating to your questions and concerns?
1= YES
2= NO (confirm that they did have questions)
3= DK
4= NA (had no questions)
When you and I are finished talking, may I speak to someone who was present during the installation?
1= YES
2= NO
3= Don't know who was present during the install
4= That person is no longer here
SKIP TO Q17



SECTION 3: Thermostat Programming

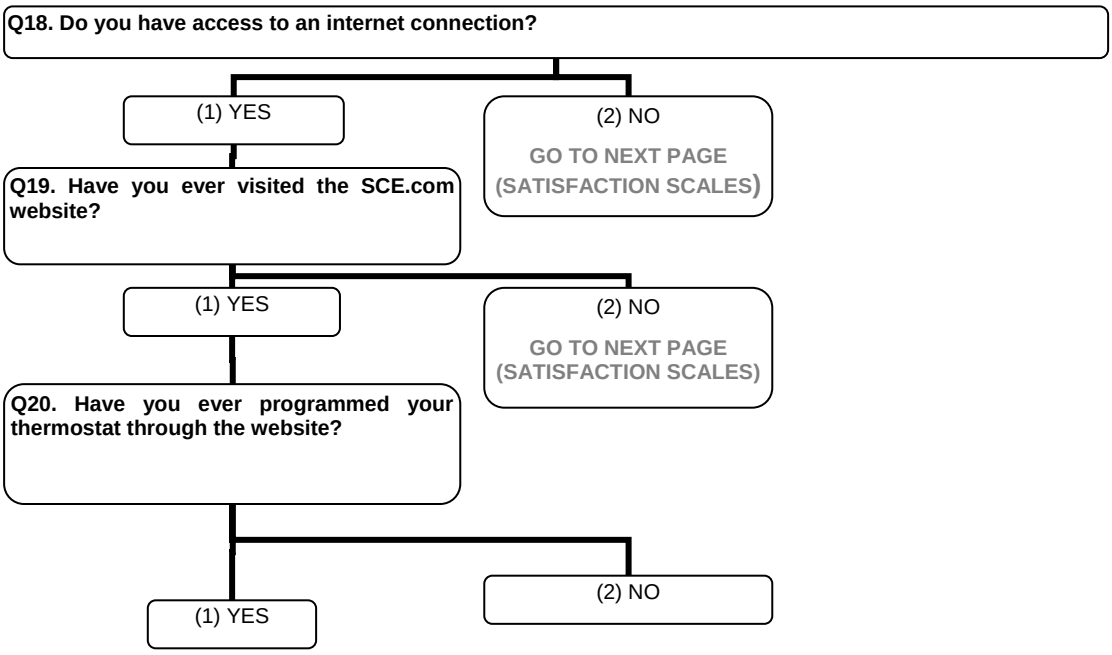
Q17. How did you learn how to program your Energy$mart Thermostat?

_____

_____

_____

_____


Q18. Do you have access to an internet connection?
(1) YES
(2) NO
GO TO NEXT PAGE (SATISFACTION SCALES)
Q19. Have you ever visited the SCE.com website?
(1) YES
(2) NO
GO TO NEXT PAGE (SATISFACTION SCALES)
Q20. Have you ever programmed your thermostat through the website?
(1) YES
(2) NO

SECTION 4: Customer Satisfaction

Now let's talk about your level of satisfaction with the Energy$mart Thermostat Program. How satisfied are you with the following aspects of the program on a 1 to 10 scale, with 1 being 'not at all satisfied' and 10 being 'very satisfied'. **CIRCLE ONE NUMBER FOR EACH ITEM.**

*****ITEMS 7 & 8 ARE RELATED. FOR ITEM 7, MARK '99' IF THE CUSTOMER NEVER SOUGHT ASSISTANCE; IF '99', SKIP ITEM 8*****

	How satisfied are you with…	**Not at all Satisfied**									**Very Satisfied**	**DK**	**NA**	**If 5 or less, Why?**
S1	The quality of the installation **(Has it been securely attached to the wall? Does it look good?)**	1	2	3	4	5	6	7	8	9	10	98	99	
S2	The way the Energy$mart Thermostat notifies you of a curtailment.	1	2	3	4	5	6	7	8	9	10	98	99	
S3	The ease in which the thermostat can be programmed or reprogrammed.	1	2	3	4	5	6	7	8	9	10	98	99	
S4	The effect of the $mart Thermostat on your electricity bills.	1	2	3	4	5	6	7	8	9	10	98	99	
S5	The amount of the incentive. **(FYI $150)**	1	2	3	4	5	6	7	8	9	10	98	99	
S6	The amount of the override penalty. **(FYI $10/override)**	1	2	3	4	5	6	7	8	9	10	98	99	
S7	The ease in contacting SCE when you had questions about your $mart Thermostat.	1	2	3	4	5	6	7	8	9	10	98	99	
S8	SCE's ability to provide prompt and helpful answers to your questions.	1	2	3	4	5	6	7	8	9	10	98	99	
S9	Overall, how satisfied were you with the Energy$mart Thermostat program so far?	1	2	3	4	5	6	7	8	9	10	98	99	

Section 5: Override and Curtailment

Q21. Did you or anyone else at your establishment override a curtailment this summer?

1= YES

If yes, approximately how many curtailments did you override this summer? **PROBE FOR AN ACTUAL #, OR CIRCLE 'NOT SURE'**

#_____ / Not Sure

2= NO
3= DK

Section 6: Participant Characteristics

Q22. What is the nature of this business?

01= Automotive Service
02= Beauty salon
03= C&I Storage (warehouses)
04= C&I Work (manufacturing)
05= Church
06= Convenience store (no gas station)
07= Convenience store/ Gas Station
08= Fitness Club/ Gymnasium
09= Grocery store
10= Hotel/Motel
11= Medical/Lab
12= Non-profit
13= Office building
14= Restaurant (non-fast food)
15= Restaurant (fast food)
16= Retail store
17= School
98= Other (please describe):_____

Q23. How old is this building? **Enter age in years OR year built:**

(1) Age in years _____
(2) Year built _____
(3) Don't Know

Q24. Do you physically or electronically lock your $mart Thermostats?

1= YES, physically
2= YES, electronically
3 = BOTH electronically & physically
4= NO
5= DK

Q25. Do you have employees at this location?

(1) YES

(2) NO

Q26. How many employees do you have at this location?

1= Enter Exact #_____
2= Don't Know
3= Refused

Q27. Did your *employees* ever complain about the temperature inside the building during the summer of 2004?

1= Always
2= Sometimes
3= Never
4= DK

Q28. Do you get customers at this location?

(1) YES

(2) NO

Q29. Is customer comfort important to your business?

(1) YES

(2) NO

(3) DK

Q30. Did your *customers* ever complain about the temperature inside the building during the summer of 2004?

1= Always
2= Sometimes
3= Never
4= DK

Q31. How long have you occupied your current place of business?

(1) #_____ years
(2) DK
(3) Refused

Q32. How long do you intend to stay there?

(1) #_____ years
(2) DK
(3) Refused

Q33. Do you plan on changing out your Smart Thermostat?

(1) YES → When?
  (a) When it breaks
  (b) _____ years
  (c) When I move out, I will take the Smart Thermostat with me
  (d) When I quit the program
(2) NO
(3) DK
(4) Refused
(5) The thermostat has already been removed.

Q34. How long do you plan to continue participating in the E$T Program?

_____
_____
_____

Q35. Do you have recommendations that would help SCE improve the Energy$mart Thermostat program for future customers?

(1) NO RECOMMENDATIONS
(2) YES, WRITE BELOW:

_____
_____
_____

Q36. Would you recommend this program to other establishments like yours?

(1) YES
(2) NO
(3) DK
(4) Refused

Q36a. Why or Why Not?_____
_____
_____

*****Did you need to talk to someone else about the installation (Q5 & Q8) – try to get them on the phone now, or get callback info & complete the survey later.**

Thank you for participating in this confidential survey. Your input will help improve the Energy$mart Thermostat program. Do you have any questions about this survey that I may be able to answer?

IF THE CUSTOMER WANTS TO CONTACT SOMEONE AT THE UTILITY TO VERIFY THIS STUDY, THEY MAY CONTACT SCE AT 877-823-8716.

Appendix 3. Program Operations Samples

Sample Letter to Ineligible Customers

Business Name

Address

City, CA Zip

Account Number, Thermostat Number

SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

Dear <<Customer First Name>>:

Southern California Edison (SCE) would like to thank you for your interest in the SCE Energy$mart Thermostat[SM] Program. After reviewing your application, we discovered that your account is ineligible due to the following reason(s) marked with an **X**:

X A/C is not compatible

Desired location for installation is non-commercial

Incomplete Application

Already enrolled in an SCE demand response program

Other (<< mail merged 'Other' reason>>)

To help you stay cool and save energy in the summertime, we recommend the following 'no-cost' solutions:

Pre-cool your building in the morning before it gets too hot

Shut window blinds to shade rooms from direct sunlight

Turn off the lights when not needed

Permit employees to dress for warm weather

Keep the windows and doors shut to keep hot air out and cool air in

Again, we thank you for your interest and hope you will support future program offerings from SCE. For more tips on how to save energy, visit *www.fypower.org*.

Sincerely,

Southern California Edison

Sample Continuing Participant Letter

2131 Walnut Grove Ave.
B7, 3rd Floor
Rosemead, CA 91770

June 3, 2004

XXX
2656 Hanover Lane
NORCO, CA 92860

Dear SCE Energy$mart Thermostat℠ Customer:

As the weather warms up this summer, we are pleased to announce that the SCE Energy$mart Thermostat℠ program will once again be offered to small business customers this year. For 2005, there are a few changes and reminders:

- The program tests will be limited to only 12 events this year
- The annual financial incentive for participation is up to $100 per thermostat, for each operating thermostat at your site (confirmed by June communication test)
- The annual incentive is reduced by $10 for each event override
- The advanced thermostat is yours to keep at the end of the program

Your participation in the SCE Energy$mart Thermostat℠ program helps the state of California develop future programs that can avoid rolling outages in times of energy crisis. By remotely increasing the temperature of air conditioners instead of interrupting power to the community, SCE can help keep everyone's energy available.

Please feel free to call us toll free at (877) 823-8716, Monday through Friday, 8am to 5pm (voice mail available) for any questions or to receive additional information.

We look forward to your continued participation in this very important program, and encourage you to continue saving energy with your new thermostat. If there is any way we can help you make your operation more successful, let us know!

Sincerely,

Mark S. Martinez, Program Manager

SCE Energy$mart Thermostat℠

Sample Override Letter

Business Name

Address

City, CA Zip

Account Number, Thermostat Number and Location

Dear <<Customer First Name>>:

Southern California Edison (SCE) would like to thank you for your continued participation in the SCE Energy$mart Thermostat[SM] Program. This is your monthly update.

SCE conducted three tests during the month of June 2005, raising your thermostat by four degrees. Our records indicate that your responses to the tests were:

June 1	Override **x**	No Override
June 15	Override **x**	No Override
June 19	Override	No Override **x**

Please remember that for each override, the maximum annual incentive payment of $150 will be reduced by $10.

To help you save energy for the summer, we encourage you to read the enclosed information, and to verify both the time clock setting and the temperature programming on your thermostat. The thermostat is designed to help you save energy while maintaining your maximum comfort. In addition, we recommend the following:

Pre-cool your building in the morning before it gets too hot

Shut window blinds to shade rooms from direct sunlight

Turn off the lights when not needed

Permit employees to dress for warm weather

Keep the windows and doors shut to keep hot air out and cool air in

Shade air-conditioner

If you have any questions regarding the programming of the thermostat or service problems call 1-800-CARRIER.

If you have any questions regarding the program, please contact SCE at (877) 823-8716 or visit *www.sce.com.*

Sincerely,

Southern California Edison

Attachment: SCE Energy$mart ThermostatSM Program - Thermostat Programming Information

Appendix 4. Sample Verification Survey

The instructions below are instructions for carrying out the inspection itself. Forms are provided for recording the results of the test for up to nine thermostats at one site.

Communication Test Instructions

(Press **FAN** Button at least 10 seconds until display reads **2 ^{02}**, press **UP** button until **OF^{20}** is displayed, press **SET TIME/TEMP** once, Press **UP** until SE^{20}, then wait….1-4 minutes until either PAS F1 or F2 is displayed, record reading on form. Press **END** button.

Stat Pin

The stat pin number may be hand written on the inside of the t-stat door, otherwise it will not be available unless the I/O Board is easily accessible. If accessible, the STAT pin number is located inside the I/O Board (remove cover) on the Antenna module.

Unit Tonnage

Record Tonnage only if known by site contact or if you have access to unit model number

Thermostat #1:

Current Time: ____:____ PM / AM **Stat Time**: ____:____ PM / AM

Mode: Heat / Cool / Auto / Off / Hold **Fan**: **Mode** AUTO / ON **Space Temp**.: _____F°

Schedule Mode: □ OC1 □ OC2 □ UN1 □ UN2 (Check One)

Press END Button, Record Setpoint(s) Cool_____ F° **Heat**_____ F°

Communication Test: PAS / F1 / F2 (Circle Only One!)

Stat Location: _____**Stat Pin Number**:_____ **Tonnage:** _____

Thermostat #2:

Current Time: ____:____ PM / AM **Stat Time**: ____:____ PM / AM

Mode: Heat / Cool / Auto / Off / Hold **Fan**: **Mode** AUTO / ON **Space Temp**.: _____F°

Schedule Mode: □ OC1 □ OC2 □ UN1 □ UN2 (Check One)

Press END Button, Record Setpoint(s) Cool_____ F° **Heat**_____ F°

Communication Test: PAS / F1 / F2 (Circle Only One!)

Stat Location: _____**Stat Pin Number**:_____ **Tonnage:** _____

Appendix 5. Installation Contractor Samples

Contractor Introduction Letter

May 16, 2005

To Whom This May Concern:

The bearer of this letter is an authorized contractor for Southern California Edison and is performing the thermostat installations for the SCE Energy$mart Thermostat℠ program. Please help them complete their work by:

- granting them access to each of the thermostats to be replaced
- allow them to collect information about your AC unit
- assist them with programming
- completing and returning the postcard survey

Your cooperation is essential to the future success of the program, and the information you provide will be kept confidential by SCE.

If you have any questions, please contact SCE at (877) 823-8716.

Mark S. Martinez

Manager of Load Control Programs

Southern California Edison

Customer Agreement Form

SOUTHERN CALIFORNIA EDISON
An *EDISON INTERNATIONAL*℠ Company

I verify that <<contractor name>> from <<company>> was at my business on <<date>> to install SCE Energy$mart Thermostats.

_____ Thermostats were requested

_____ Thermostats were installed

_____ Thermostats will be installed at a later date

_____

Signature and Date

Contractor complete:

Business Name

ID:

Pins installed:

Work Order

SCE Energy$mart Thermostat Installation Work Order/Dispatch

Appnt dt:				*Actual Start Time:*	
Appnt Window:				*Actual End Time:*	

Customer Data

Bus. Name:
Bus. Address:
Bus. Address:
Bus City, & Zip:
Called in by:
Cust#

Contact Name:
Primary #:
Secondary #:
Thomas Page:
Notes

Work Order#
Parent ID
Location ID
Assigned to:
Technician:

# of T-stat's at Fac.:
#of T-stat's Installed:
Date Issued:
Required Date:
Work Order ID:

Request Activity Summary

T-stat Account #	Pre-Screen	Install	Walk away
Totals:			

Installation Results:

Thermostat ID:
Signal Test : Pass/Fail
Self Test: Pass/Fail

Manufacturer#	Model#	Serial #	Location	I/O Loc

Fail Reason:

Installed PIN#:

Print Clearly Pin# below:

Area that T-stat cools:

Tonnage: Amps Compressor: Fan:

Where there any failed installation attemps prior to a final result for this request?

If yes, how many failed attmpts? YES/NO If Yes, list PIN#'s related to failed attempts here:

Unit Program schedule below

	Wake/OCI		Day/UN1		Eve/OC2		Sleep/UN2	
	Start time	Heat/Cool	Start time	Heat/Cool	Start time	Heat/Cool	Start time	Heat/Cool
Mon	:	/	:	/	:	/	:	/
Tues	:	/	:	/	:	/	:	/
Wed	:	/	:	/	:	/	:	/
Thur	:	/	:	/	:	/	:	/
Fr	:	/	:	/	:	/	:	/
Sat	:	/	:	/	:	/	:	/
Sun	:	/	:	/	:	/	:	/

Customer Signature: Date:

Pre-installation Checklist

If the E$T program manager considers integrating HVAC tune ups into the program offering, below is a short list of the types of checks that should be performed.

- ✓ Evaporator Fan and Motor
- ✓ Condenser Fan and Motor
- ✓ Compressor
- ✓ Condenser Coils (clean)
- ✓ Evaporator Coils (clean)
- ✓ Refrigerant Charge/ Leak Check
- ✓ Heating System
- ✓ Pilot Assembly
- ✓ Burner Assembly
- ✓ Check Flame Adjustment
- ✓ Check for Gas Leaks
- ✓ Thermostat
- ✓ Filters
- ✓ Condensate Drain
- ✓ Contactor
- ✓ Circuit Breaker
- ✓ Wiring

Appendix 6. Welcome Package Materials

Introduction Letter

This letter should be attached to the pre-paid postcard with SCE mailing address on front.

Welcome!

Welcome to the SCE Energy$mart Thermostat[SM] Program! We value your participation in the program and would like to hear your opinions on the program activities thus far. We want to understand how successful the application and installation procedures are in order for us to determine what types of improvements we should make.

Enclosed are some additional program materials:

- Short postcard survey
- E$T program brochure
- Thermostat manual

Thank you for your time. Please contact a SCE representative if you have any questions about the program. If you experience problems with the operation of your thermostat or have programming questions, please call Carrier at 1-800-CARRIER.

SCE Program Manager

Mark Martinez

302-626-8249

Postcard Survey

This should be postage paid to increase the chances of the customers completing the survey.

Please fill out and return to SCE.

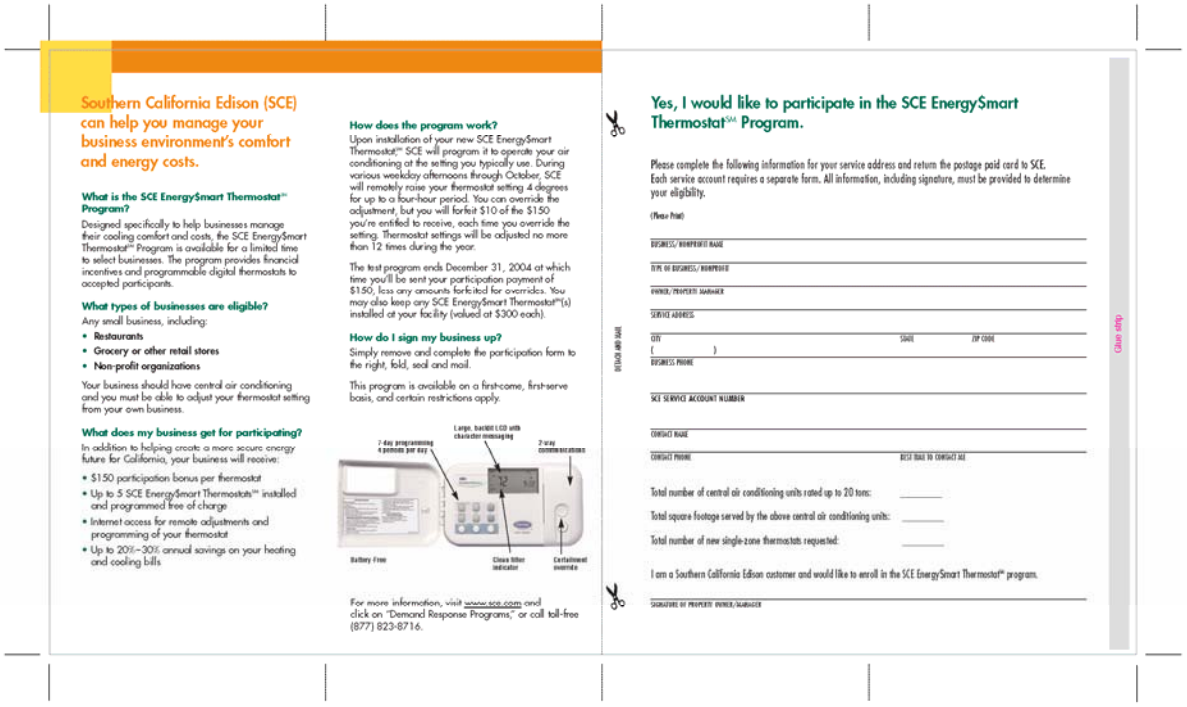
SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL℠ Company

We would like to get your feedback about the Energy$mart Thermostat program. This survey will only take a few minutes to complete.

1. Did you arrange the installation? YES NO
2. Was the scheduler polite? YES NO
3. Was the appointment scheduling flexible enough? YES NO
4. Did the installer show up on the date and time promised? YES NO
5. Did the installer spend enough time explaining the thermostat to you? YES NO
6. What else could SCE have provided to make your participation easier?

Thank you for your time!

Program Brochure



Thermostat Manual

Obtain the most current detailed thermostat manual from Carrier.

E$T Sticker

A sticker could be placed on the thermostat to provide a prompt to reduce overriding. It can be affixed on or near the smart thermostat. Figure 24 depicts a sticker with a simple message in eye-catching colors. A sticker that measures 3 ¼ inches in length and 1 7/8 inches in height would fit on the face of the Carrier thermostat. RLW designed the sticker below in Microsoft Visio. The digital file can be furnished upon request.

Figure 24: Thermostat Sticker

Appendix 7. Curtailment Triggering Memo

August 12, 2004

Mark S. Martinez

Southern California Edison Company

Subject: AB970 Curtailment Scheduling Guidelines

This memo suggests some research guidelines for scheduling curtailments in the AB970 SCE Energy$mart Thermostat (E$T) program that will develop a better understanding of the impact of the program and how the impact varies by the time and temperature of the day.

Background

The motivation for these recommendations is driven by the fundamental difference, from an evaluation point of view, between a temperature offset program such as the E$T program, and a traditional duty cycle program such as SCE's ACCP program. The two programs use fundamentally different control strategies and hardware technologies for controlling central air conditioners to achieve load reduction during curtailment periods.

With a duty cycle program, which limits the operating time (duty cycle) of the AC unit, we can estimate the impact of any given cycling strategy during any given hour by understanding the operating load and normal operating duty cycle of the AC units in the program during the hour. This information can be developed by end use metering a sample of units and analyzing the load of the units on uncurtailed days. This is called the duty-cycle model.

The result of this duty cycle analysis is a matrix or statistical model that predicts the total kW load impact of any given cycling strategy at any given combination of time and temperature. This is sometimes called the time/temperature impact matrix. The time/temperature impact matrix gives system controllers the information that they need to regard a duty-cycle load management program as a load shed reliability resource.

Our goal is to develop a similar time/temperature impact matrix for the SCE Energy$mart Thermostat program. With a temperature-offset program, a curtailment causes the AC unit to temporarily shut off due to the new operating set point. The load of each participating unit then drops to zero at the start of the curtailment as long as the smart thermostat receives and acts on the curtailment signal. Unless the curtailment is overridden, the unit should stay off until the indoor temperature has risen to the new set point. Then the unit should go back into operation at the new set point and start cycling normally to match its output to the required cooling load. Finally, when the set point is set back to its original value after the curtailment, the unit should operate continuously until the indoor temperature drops to the original set point.

Under this operational model, the two key characteristics of the curtailment impact are the magnitude and duration of the impact for each site. The magnitude is defined as the difference between the actual load during the curtailment and what the load would have been in the absence of the curtailment. The duration is defined as the time from the start of the curtailment until the indoor temperature reaches the new set point. If we wish to develop a time/temperature impact matrix we must understand the factors that affect both the magnitude and the duration of the impact for each site.

To estimate the magnitude of the impact we need to understand the normal load of the AC unit at each given time and temperature. For this, we need to observe the AC units on non-curtailment days. Similarly, to measure the duration of the impact we need to observe the AC units on curtailment days. Therefore for each cell in the time/temperature matrix model, we would like to have a balanced sample of curtailment and non-curtailment days. Ideally, if we were allowed an unlimited number of curtailments, we would call a curtailment every other day on all weekdays throughout the range of temperatures occurring in the summer.

But the preceding ignores the following important constraints:

- The program is limited to twelve curtailments during the summer,
- There have already been five curtailments prior to today, as shown in Figure 1, as well as one today, and
- Curtailments are most likely to be needed on hot days and during hot hours rather than during moderate days and hours.

Date	Start	End time
7/15/2004	2:00 PM	4:00 PM
7/22/2004	1:00 PM	6:00 PM
7/26/2004	3:00 PM	5:00 PM
7/27/2004	3:00 PM	5:00 PM
8/9/2004	3:00 PM	5:00 PM

Figure 1: Curtailments to Present Date in 2004

Selecting Curtailment Days

Given the constraints discussed above, our focus will be on a strategy for selecting the remaining six curtailments and a matching set of six baseline days, by profiling expected temperature days during the remaining available curtailment period in 2004. We have based our analysis on the daily high temperatures seen in the San Bernardino / Riverside weather station during the comparable period last summer. We used the hourly temperature data for the period August 16 through October 1. We stopped at October 1 since this will give us more time for the 2004 impact analysis and because the added days in October provide flexibility if added curtailment days are needed.

After dropping weekends, we had 33 days. For each of the 33 days, we calculated the high temperature of each day and the hour of the day in which the high temperature occurred. Figure 2 shows the high temperature of each of the 33 days.

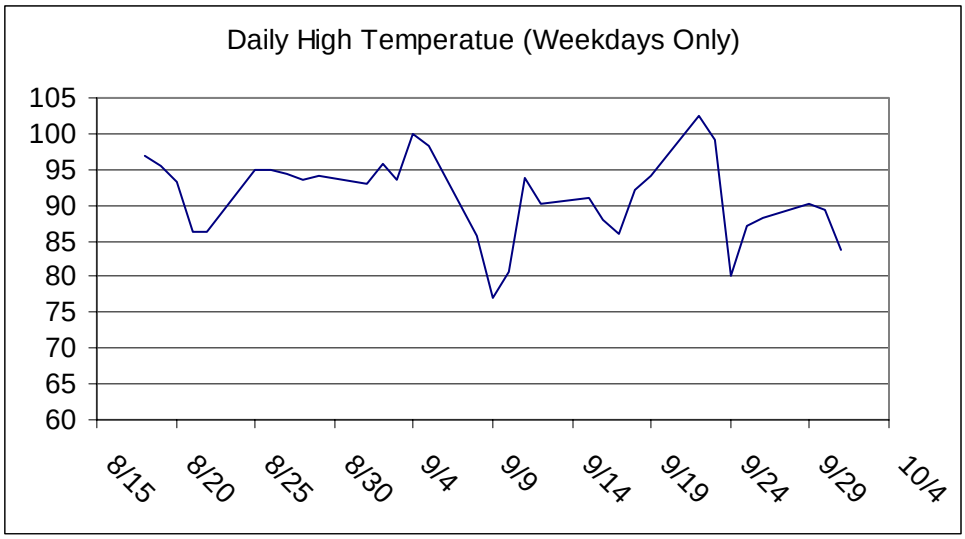


Figure 2: Daily High Temperature of each Weekday in Period

Then we sorted the 33 days in decreasing order by high temperature and selected the hottest 12 days. Table 1 shows the hottest 12 days, while Table 2 shows the remaining 21 days. During this period the 12 hottest weekdays had a high of 94 F or greater. These results suggest that if the remainder of the summer of 2004 is similar to the comparable period in 2003, we can expect about 12 weekdays with a high of 94 or greater. By reviewing the daily weather forecasts for San Bernardino / Riverside and identifying days with an expected high temperature of 94 or greater we can expect to identify about 12 potential curtailment days.

date	temp	dow	rank	hour
9/ 22/ 2003	102.4	2	1	14
9/ 4/ 2003	100.1	5	2	15
9/ 23/ 2003	99.0	3	3	14
9/ 5/ 2003	98.4	6	4	14
8/ 18/ 2003	96.9	2	5	15
9/ 2/ 2003	95.9	3	6	15
8/ 19/ 2003	95.4	3	7	15
8/ 26/ 2003	94.9	3	8	15
8/ 25/ 2003	94.9	2	9	14
8/ 27/ 2003	94.3	4	10	15
9/ 19/ 2003	94.2	6	11	14
8/ 29/ 2003	94.0	6	12	15

Table 1: Hottest 12 Weekdays in Period

date	temp	dow	rank	hour
9/ 11/ 2003	93.7	5	13	15
9/ 3/ 2003	93.6	4	14	15
8/ 28/ 2003	93.5	5	15	14
8/ 20/ 2003	93.4	4	16	14
9/ 1/ 2003	93.1	2	17	15
9/ 18/ 2003	92.2	5	18	15
9/ 15/ 2003	90.9	2	19	15
9/ 29/ 2003	90.3	2	20	15
9/ 12/ 2003	90.1	6	21	14
9/ 30/ 2003	89.3	3	22	14
9/ 26/ 2003	88.3	6	23	15
9/ 16/ 2003	88.0	3	24	15
9/ 25/ 2003	87.1	5	25	15
8/ 21/ 2003	86.4	5	26	15
8/ 22/ 2003	86.3	6	27	15
9/ 17/ 2003	85.9	4	28	15
9/ 8/ 2003	85.6	2	29	14
10/ 1/ 2003	83.8	4	30	15
9/ 10/ 2003	80.7	4	31	16
9/ 24/ 2003	80.0	4	32	14
9/ 9/ 2003	77.0	3	33	15

Table 2: Remaining 21 days

Of course, this analysis is just a guideline since almost certainly the remaining weather in 2004 will be different than in 2003, and weather forecasts are not always accurate. But I assume you will continuously monitor the number of curtailments you have made and make adjustments to the preceding guidelines if you are experiencing too few or too many curtailments.

RECOMMENDATION: Given that we expect 12 usable days for data collection for the summer of 2004, we recommend that you alternate curtailment and non-curtailment days when the temperature is forecast to be 94 or greater in the San Bernardino/Riverside area as a guideline for the entire system, to achieve the remaining six test days.

Curtailment Hours

Another issue is selecting the hours to be curtailed. Figure 3 shows the distribution of the temperature peak hours among these 33 days. The figure also shows that about two-thirds of the time the high temperature most frequently occurred during the hour ending 3 pm, and about one-third of the time one hour earlier. Therefore the most promising period for the curtailment (in order to develop a time/temperature matrix model) can be expected to be the two-hour period from 2 pm through 4 pm.

We note as shown in Figure 1, several of the curtailments so far have been during later hours, in order to reflect a coincidence with peak pricing or system peak coincidence. We suggest that most of the remaining curtailments should be during the two-hour period from 2 pm through 4 pm, in order to more accurately develop the matrix model.

RECOMMENDATION: All remaining curtailments should include the two-hour period from 2 pm through 4 pm.

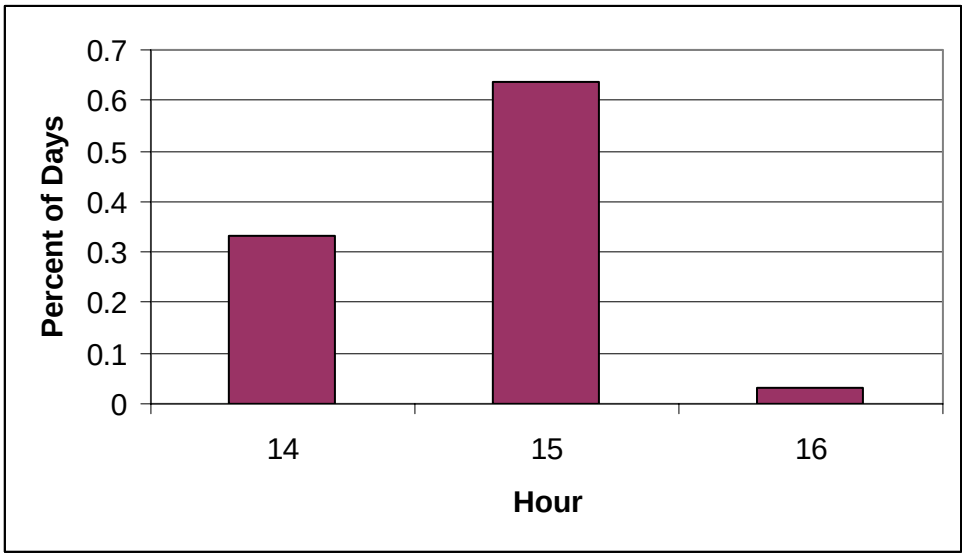


Figure 3: Distribution of Peak Hour in Remaining Weekdays

Duration of curtailment

As previously discussed, one of the key measures of the impact is the duration for each site. In our prior evaluations studies we have assessed the duration of the impact, considering the program as a whole. This analysis suggests that most of the impact has been obtained in the first two hours of the curtailment. But on theoretical grounds we expect the site-specific duration to depend on the characteristics of the site. We hypothesize that a better understanding of this issue may suggest ways of extending the duration of the program. In order to inform this type of analysis, we would like to have curtailments lasting four hours so that we could observe the maximum duration of the impact for individual sites, unconstrained by the curtailment period.

RECOMMENDATION: At least two of the remaining curtailments should be four-hour curtailments, e.g., from 1 to 5 pm.

Advanced Notification or Instantaneous Call

A related issue is whether the curtailments should be called in advance or instantaneously. We suspect that some of the units have problems with their time settings. With advanced notification, an incorrect time setting will cause the curtailment to occur at the incorrect time. Conversely with an instantaneous curtailment, the curtailment will occur at the time of the call, regardless of the time setting of the thermostat. Therefore, we would like to explore the effect of instantaneous calls.

RECOMMENDATION: Two of the remaining curtailments should be instantaneous.

Repeat Calls

In at least one instance in the past, you made an instantaneous call extending the curtailment well into a scheduled curtailment. We noticed, to our surprise, that the second call restored a substantial portion of the diminished savings of the first call. We don't know whether this is because of the second call was instantaneous, or because some of the overrides were unintentional.

RECOMMENDATION: In two of the remaining curtailments, you should make a second instantaneous two-hour call after two hours into the initial call.

Temperature Offset

In prior evaluations we have seen that 2-degree offsets have a much smaller effect than 4-degree offsets. Moreover having a mix of 2-degree and 4-degree offsets adds complications to the analysis.

RECOMMENDATION: We suggest that you use 4-degree offsets for all curtailments.

Run Time Data

Finally there is the question of the AC run time data that are provided by the thermostat during curtailment and non-curtailment days. The run time data are a key element of the analysis plan for the new participants added to the program under the summer 2004 initiative. It is essential that we have run time data for each of the remaining curtailment days for all program participants, including any new participants. Given that the run time can be collected at one time for a five-day past period, we suggest that the run time data be collected on Friday evenings for each of the remaining weeks of August and September.

RECOMMENDATION: set up the Itron system to collect data either automatically for the remaining six weeks, or manually collect the run time and verify data have been collected, on a weekly basis.

Roger Wright

Appendix 8. Cost Effectiveness Calculations Screenshot[51]

PROJECTIONS

			2006	2007	2008	2009	2010	2011	2012
Participants & Installations									
1	Units Installed (per year)		4,500.0	4,500.0	0.0	0.0	0.0	0.0	0.0
2	Annual Drop-outs (000) - 2.5% Yearly Dropout Rate+ expired thermostats		90.0	88.2	176.4	172.9	169.4	166.1	162.7
3	Units in Service		4,410.0	8,821.8	8,645.4	8,472.5	8,303.0	8,136.9	7,974.2
4	Units in Program		4,410.0	8,821.8	8,645.4	8,472.5	8,303.0	8,136.9	7,974.2
5	Derated for Deadbeat Signals		4,101.3	8,204.3	8,040.2	7,879.4	7,721.8	7,567.4	7,416.0
Output=Benefits									
1	Program Peak Load Reduction per hour	MW	5.8	11.5	11.3	11.1	10.8	10.6	10.4
2	Annual Peak Hour Energy Savings due to Curtailments	MWH	132	265	259	254	249	244	239
3	Annual Additional Energy Savings due to thermostat	MWH	333	665	652	639	626	614	601
4	Annual Value of Capacity Benefits	$US nominal thousands	415	831.0	814.3	798.1	782.1	766.5	751.1
5	Annual Value of Critical Peak Energy Savings	$US nominal thousands	10.7	21.3	20.9	20.5	20.1	19.7	19.3
6	Annual Value of Energy Efficiency due to Thermostat	$US nominal thousands	20.0	39.9	39.1	38.3	37.6	36.8	36.1
8	Total Program Benefits	$US nominal thousands	426.0	852.3	835.2	818.5	802.1	786.1	770.4
9	Total Program Benefits with extra Energy Efficiency Assumption	$US nominal thousands	446.0	892.2	874.3	856.9	839.7	822.9	806.5
Input=Costs									
Expansion Costs									
1	New Installation Equipment Costs	$US 2005 thousands	990.0	990.0	0.0	0.0	0.0	0.0	0.0
2	Installation Costs	$US 2005 thousands	450.0	562.5	0.0	0.0	0.0	0.0	0.0
3	Non-Installation Expenses (fails)	$US 2005 thousands	33.8	33.8	0.0	0.0	0.0	0.0	0.0
4	Extra 1st Year Participant Incentive	$US 2005 thousands	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Total Expansion Costs		1,473.8	1,586.3	0.0	0.0	0.0	0.0	0.0
Maintenance Costs									
6	Participant Incentives Cost	$US 2005 thousands	330.8	661.6	648.4	635.4	622.7	610.3	598.1
7	Program Management Costs	$US 2005 thousands	242.6	485.2	475.5	466.0	456.7	447.5	438.6
8	Internet Access Marketing		75.0	75.0	75.0	75.0	75.0	75.0	75.0
9	Other								
10	Maintenance Costs		648.3	1,221.8	1,198.9	1,176.4	1,154.4	1,132.8	1,111.6
11	Total Annual Program Expenditures		2,122.1	2,808.1	1,198.9	1,176.4	1,154.4	1,132.8	1,111.6
Other=Transfers									
1	Customer Penalties	$US 2005 thousands	94	187	183	180	176	173	169
2	Participant Electricity Bill Savings Due to Curtailments	$US 2005 thousands	15	29	29	28	27	27	26
3	Participant Electricity Bill Savings Due to Thermostat	$US 2005 thousands	37	73	72	70	69	68	66
4	Net Payments to Participants (Incentives-Penalties)	$US 2005 thousands	237	475	465	456	447	438	429
5	Lost Margin to Utility (Participants' bill reductions-avoided energy cost)	$US 2005 thousands	274.7	62	61	60	59	58	56

[51] The numbers in the calculations vary by scenario and adjust based on the forecasting variables and assumptions.

Appendix 9. Cost-Effectiveness Source Documentation

SOURCE DOCUMENTATION

Program Characteristics

E$T Program Characteristics - from 2004 Program Evaluation				
1	Thermostat Unit Cost	230.00	$US 2002	RLW Analytics, Program Evaluation of the 2004 SCE Energy$mart Thermostat℠ program
2	Thermostat Unit Life	11.00	Years	Database for Energy Efficiency Resources 2004
3	Maximum Number of Curtailments	12.00	Events/year	RLW Impact Evaluation, p.1
4	Incentive	150.00	Annual, per thermostat	RLW Impact Evaluation, p.1
5	Over-ride Penalty	10.00	Per Event	RLW Impact Evaluation, p.1
7	Installed Units	4,600.00	Thermostats	RLW Impact Evaluation, p.1
8	Installed Tons	19,700.00	Tons	RLW Impact Evaluation, p.2
9	Average Tonnage/Unit	4.28	Tons/thermostat	Installed Tons / Installed Units
10	Deabeat Rate	0.07	Percent (per event)	RLW Impact Evaluation p. 13
11	Over-ride Rate	0.19	Percent (per event)	RLW Impact Evaluation p. 14 - The override rate ranged from 18% to 21%
12	Average Annual Electricity Use	58.50	Mwh/Customer per year	RLW Data Analysis from 2004 program data. Provided by RLW on 9-23-05.
13	# of Thermostats Per Customer	1.80	Thermostats/customer	RLW Data Analysis from 2004 program data. Provided by RLW 9-23-05.
14	Average Cooling Load per Thermostat	6.22	Mwh/Thermosta	RLW Data Analysis from 2004 program data. Provided by RLW 9-23-05.
15	Percent Cooling Load	19.1%	percentage	It's a calculation based on items 13, 14, and 15 above.
Load and Energy Impacts* - Used to calculate benefits				
1	Maximum Load Reduction Per Ton	0.49	kW/ton	RLW Impact Evaluation p.4 (detail on p. 32)
2	Hour 1 Reduction Per Ton	0.33	kWh/ton	RLW Impact Evaluation p.4 (detail on p. 32)
3	Hour 2 Reduction Per Ton	0.21	kWh/ton	RLW Impact Evaluation p.4 (detail on p. 32)
4	Average Reduction Per Ton	0.27	kW/ton (hours 1 & 2)	Calcuted by averaging the per ton reductions in hour 1 & 2
5	Maximum Load Reduction Per Unit	2.10	kW/thermostat	*Calculations convert line 2 from tons to units*
6	Hour 1 Reduction Per Unit	1.41	kWh/thermostat	*Calculations convert line 3 from tons to units*
7	Hour 2 Reduction Per Unit	0.90	kWh/thermostat	*Calculations convert line 4 from tons to units*
8	Average Load Reduction Per Unit	1.16	kW/thermostat (hours 1 & 2)	Calcuted by averaging the per unit reductions in hour 1 & 2
9	Annual Peak Hour energy savings per curtailment	6.48	kWh/ton per year	Average reduction per ton*2 (for two hour curtailment) * the maximum # of curtailments
10	Annual Peak Hour Energy Savings per unit	27.73	kWh/thermostat per year	(Energy Savings per curtailments*controlled tons) / (# of installed units)
11	Average Snapback per ton	-0.02	kWh/ton per year	RLW Impact Evaluation p. 32
12	Average Snapback per unit	-0.10	kWh/thermostat per year	*Converts units to tons.* Avg. Snapback per unit * (max load reduction per unit / max load reduction per ton)
13	Annual Net Peak Hour Energy Savings per unit	25.71	kWh/thermostat per year	Avg. Peak Hour Saving per unit + Avg. Snapback per unit (a negative #)
Program Benefits used for 2002-2005 Analysis				
1	Generation Capacity Cost	85.00	Kw-Year	R.02-06-001 ruling issued in July 21, 2004. Appendix B.
2	Critical Peak Demand Energy Adder	63.00	$US 2005/MWh	R.02-06-001 ruling issued in July 21, 2004. Appendix B.
3	Congestion Value Energy Adder	7.00	$US 2005/MWh	R.02-06-001 ruling issued in July 21, 2004. Appendix B.
4	Avg Marginal Energy Cost	60.00	$US 2005/MWh	SCE 2006 GRC
5	Planning Reserve Margin (PRM)	0.15	Per unit of energy	Resource Adequacy OIR (R.04-04-003 D.04-01.050)
6	Cumulative LOLP Allocation	0.90		Based on program characericistics

Appendix 10. Baseline Forecasting Assumptions

BASELINE FORECASTING ASSUMPTIONS

	Benefit Assumptions			
1	Generation Capacity Cost	69.70	kW-Year	Fixed for all scenarios
2	Critical Peak Demand Energy Adder	63.00	$US 2005/MWh	Fixed for all scenarios
3	Congestion Value Energy Adder	7.00	$US 2005/MWh	Fixed for all scenarios
4	Avg Marginal Energy Cost	60.00	$US 2005/MWh	Fixed for all scenarios
5	Planning Reserve Margin (PRM)	0.15	Per unit of energy	Fixed for all scenarios
6	Cumulative LOLP Allocation - top 24 hours	0.90		Fixed for all scenarios
	Expansion Assumptions			
1	Annual Expansion (New Units)	4,500.00	installations/year	Manipulable
2	Years of Expansion (Starting '05)	2.00	years	Manipulable
3	Equipment Cost (per new unit)	$220.0	$US 2005/thermostat	Manipulable: The base number was provided by SCE and is based on 2006 planning
4	Installation Costs	$100.0	$US 2005/thermostat	Manipulable: The base number was provided by SCE and is based on 2006 planning
5	Expansion Costs	$25.0	$US 2005/thermostat	Manipulable
6	Non-Install Rate	15.0%	per unit installed	Manipulable: The base number was provided by SCE and is based on 2006 planning
7	Non-Install Costs	$50.0	$US 2005/non-installation	Manipulable: The base number was provided by SCE and is based on 2006 planning
	Future Program Characteristics	$0.0		
8	Discount Rate***	8.2%		Manipulable: All scenarios keep the number at 8.15% - the SCE capital cost from R.04-04-025 Draft Decision 3/18/05
9	Program Life*	10.00	Years	Manipulable
10	# of program events per year (2005-2024)	12.00	per year	Manipulable: Based on 2004 and 2005 program practices.
11	Average Electricity Rate	110.00	$US 2005/MWH	Manipulable:
12	Annual Drop-out Rate (2005-2024)	2.0%	per year	Manipulable: current numbers are Based on 2004 program numbers
13	Average Tonnage/Unit	5.20	Tons/thermostat	Manipulable: the base number anticipates that some cost-ineffective units are likely to be shed.
14	Average Annual Electricity Use - Participant	39.49	MWh/thermostat	Manipulable: The initial number is based on RLW Data Analysis of 2004 program data and prorated.
15	Average Percent Cooling Load	19.1%		Manipulable: The initial number is based on RLW Data Analysis of 2004 program data
16	Assumed Energy Efficiency effect	0.0%		Manipulable. The initial number is a conservative assumption applied only to cooling load.
	Maintenance Costs			
17	Incentive Payment	$75.0	$US 2005	Manipulable: The base number was provided by SCE and is based on 2006 planning
18	Per Unit Program Management Costs**	$55.0	$US 2005/thermostat	Manipulable: The base number was provided by SCE and is based on 2006 planning