More and Faster: Increasing the Achievable Energy Efficiency Potential through Best-Practice Processes and Data Management Tools

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ABSTRACT

As states begin aggressively promoting energy-efficiency as an energy resource, providers must work towards not only technological innovation, but also more efficient implementation. In addition to compact fluorescents and variable speed drives, the viability of energy-efficiency programs depends on the fluid integration of the complex, multi-stage, multi-party delivery process. From site assessment to economic analysis to utility incentives to validation, critical data must be captured and conveyed in a timely manner to the appropriate agents. In addition many "efficiency reserves" are in hard-to-reach customer segments that can only be cost-effectively tapped through efficient implementation. In this paper, we first argue that optimizing the delivery process is essential to energy-efficiency's transition from a "social program" to a reliable long-term energy resource. Second, we analyze the impact of various process-improvements and advanced data management tools on success criteria such as customer participation, customer satisfaction, program impact, delivery time, worker productivity, and conserved-energy costs. Finally, we describe a successful implementation of an integrated best-practices program delivery process used by Southern California Edison to cost-effectively reduce 3.1 MW of demand and 13.8 GWh annual savings at 3,350 small commercial hard-to-reach customer sites in less than sixteen weeks during the summer of 2005.

Introduction

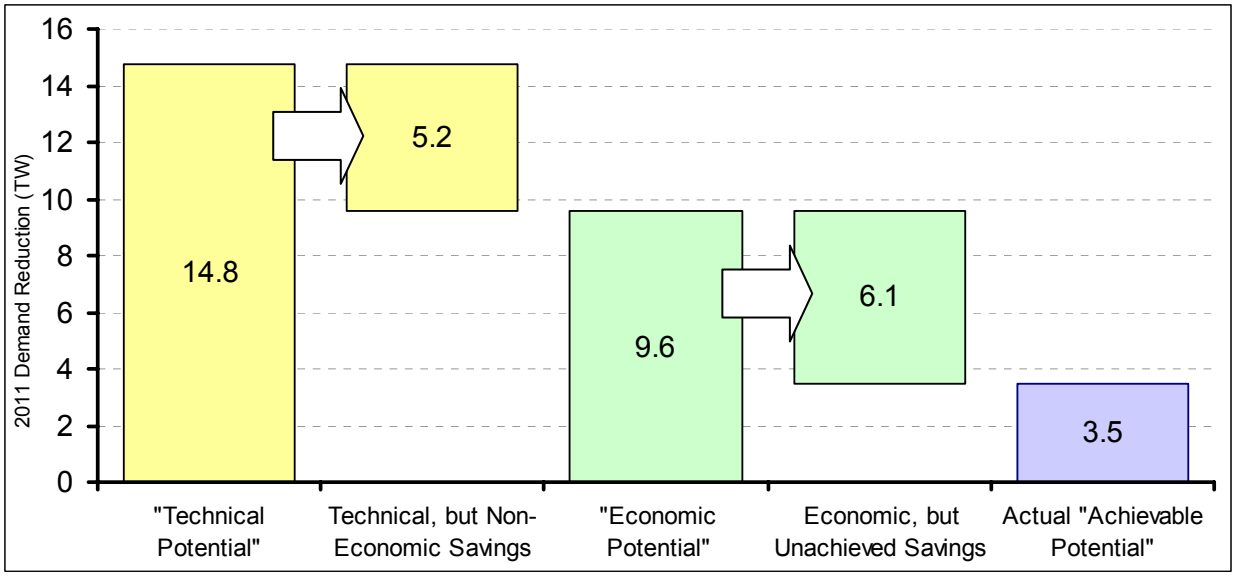
Energy efficiency has become a critical component of energy policy. Electric Utility Demand Side Management (DSM) Programs have reduced the US peak electric demand by 23 GW avoiding the need to build 50 large power plants (DOE 2005). Energy efficiency has helped reduce the US energy intensity (energy consumed per GDP) by 49% between 1970 and 2004.

As we look to the future, all market participants—from utilities to policy makers to energy service companies (ESCO's) to end-users—must ask the question, "How much can we reduce energy consumption through efficiency?" There is no consensus on this issue with published estimates ranging from 10% to over 50% (Nadel et al. 2004). A common framework for these analyses involves three calculations. First, the *technical potential* is the savings that would be achieved if available energy-efficiency technologies were implemented immediately. Second, the *economic potential* only includes technologies that meet established economic criteria.[1] Third, the *achievable potential* considers the extent to which homes and businesses will actually implement available cost effective technologies. The *achievable*

[1] Widely varying economic criteria are one cause of the variation in estimates as economic models vary depending on the assumed time horizons, time-value of money, externalities, and whether economics are computed from the perspective of end-users, utilities, or society as a whole.

potential must be considered within the context of market conditions such as public policy, economic incentives, DSM programs, education, and general end-user behavior that affect rates of adoption. **Figure 1** depicts these results for California and shows the economic potential to be less than 65% of the technical potential, and the achievable potential less than 40% of the economic potential (Rufo & Coito 2002).

Figure 1. Technical, Economic, and Achievable Potential Demand Reductions in California



Data Adapted from Rufo & Coito. (2002)

In this paper, we begin by describing needs and barriers of historically *hard-to-reach* (HTR) markets. Then we discuss several improvements to various process steps beginning with the initial site assessment through installation and validation. These improvements are specifically tailored to the needs of the HTR market and significantly increase penetration rates. Since an integral part of many of these improvements is a mobile computing and data management system, we describe the elements, uses, and benefits of such tools. Finally we highlight two energy-efficiency programs at Southern California Edison that have integrated process improvements with a mobile computing system to significantly improve program results in HTR markets. The success of such programs not only taps a rich energy surplus, but improves the public perception of energy-efficiency and leads policy-makers to value energy-efficiency as an essential component of a sustainable and secure energy policy.

Hard To Reach Markets

Market Overview

Market segments with low penetration of energy-efficient technology and low participation rates in energy efficiency programs are classified as *hard-to-reach* (HTR) markets and represent a large untapped efficiency reserve. Specific definitions of HTR vary but typically include customers with small facilities that do not have easy access to program information or generally do not participate in energy efficiency programs due to language (i.e., primary

language non-English), business size (less than ten employees); or geographic (i.e., outside major metropolitan areas,. These customers have limited knowledge about potential efficiency upgrades and vendors find it difficult to overcome a high fixed cost of marketing to these potential small buyers. **Table 1** suggests that over 50% of the U.S. electric consumption (residential and commercial buildings <100,000 square-feet) could be considered HTR because of the relatively low annual kWh per facility Although this paper focuses on only small commercial markets, many of the process improvements discussed apply to the broader HTR markets.

HTR Market "Needs and Wants"

Since 2000, the California Energy Commission and the California IOU's commissioned several studies to identify barriers, evaluate market needs, and evaluate the impact of existing programs in HTR markets (Quantum 2001, 2004, 2005; Quantum & Xenergy 2001; Khawaja et al. 2004). These studies and the authors' direct experience with HTR markets are used as the foundation for developing process improvements.

HTR customers want reliable sources of information customized to their business. These customers trust their utility company for energy information and consider their community-based organizations (CBOs) or trade associations (of which over 50% are members) as reliable sources.[2] Since HTR customers are very busy and not energy experts, they need a process that minimizes their direct involvement and delivers very clear and concise information. Most HTR customers have not installed high-efficiency equipment and are unlikely to do so in the absence of incentive programs.[3] The hard-to-reach classification can be sub-segmented into "very-hard-to-reach" markets such as strip-malls, renters, and facilities with <10 employees (typically <20kW) with specific needs. Strip-mall customers were one-ninth as likely to have participated in programs as the overall HTR market (Quantum 2001). Small business owners manage very constrained budgets. They are driven primarily by the threat of higher electric bills, but still hesitate to spend money today on future uncertain savings.[4]

Historic Barriers of HTR Markets

The extensive literature exploring general barriers to adopting energy efficient technology can help close the gap between the economic and achievable efficiency potentials. Customers are rarely energy experts and perverse incentives compensate equipment vendors and designers based on the quantity that they install rather than the efficiency of what they install. A split incentive in the market often masks the buyers of energy equipment from the energy bills borne by tenants.

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[2] Quantum (2001) found that when energy questions arise, 60% of HTR customers call their utility company, and 11% call installers/contractors. Khawaja's (2003) evaluation report found that 80% of participants felt SCE's sponsorship was important to their participation.

[3] 80% of the very-hard-to-reach customers would have been "Not at all likely" to install lighting measures in the absence of a program and less than 25% customers surveyed by Quantec reported making any energy-efficiency improvements prior to participating the program (Khawaja 2003).

[4] Approximately 84% of HTR customers will take no cost actions to reduce their bill (more important than consumption), but participation drops to about 50% on measures with a 1-year payback (Quantum/Xenergy 2001).

Table 1. Distribution of U.S. Electrical Consumption by Sector and Size in HTR Markets

Market Segment	Number of facilities	Total U.S. Annual Electric Consumption (Billion kWh/year)	Percent of Total U.S. Annual Electric Consumption	kWh/facility/ year
Residential	**112,090,064**	**1,145**	**35%**	**10,215**
Commercial Bldg (SqFt)				
1,001 to 5,000	2,186,000	122	3.7%	55,810
5,001 to 10,000	1,036,000	83	2.5%	80,116
10,001 to 25,000	688,000	109	3.3%	158,430
25,001 to 50,000	253,000	109	3.3%	430,830
50,001 to 100,000	143,000	145	4.4%	1,013,986
Total Com. Bldgs.	**4,306,000**	**568**	**17%**	**131,909**

Source: 1999 Consumption data from EIA CBECS Table C9

Quantum/Xenergy's 2001 statewide survey quantifies some of these barriers in the HTR market. 49% of customers are concerned that their actual savings will be less than the estimated savings. HTR customers do not have expert energy staff making these decisions and they are therefore at a disadvantage for evaluating energy-efficiency opportunities. 48% of customers are uncertain about the reliability of information provided by non-utility firms. 38% of customers say that selecting a contractor to perform the work in small facilities is too time consuming and too much of a hassle given other business priorities. 35% of customers lack information about what energy efficient technology would benefit them most and how those measures would be installed. Finally, 33% of customers identify lack of financing as a barrier.

In addition to the above customer barriers, vendors and ESCO's find it difficult to market to these customers because of their high fixed transaction costs relative to the uncertain small sale. These barriers become more pronounced in the very-hard-to-reach markets where more customers rent, have even less cash flow, and are more skeptical about future benefits. We will show how engaging these customers with a process that specifically addresses these barriers will significantly increase the impact of the program.

Importance of HTR Market

The under-served nonresidential HTR markets are important for many reasons. Most obviously they represent 17% of national electric usage (52% including residential). Second, they can be a large active population within the local community. Third, this market represents a rich untapped energy reserve since much of the "low-hanging fruit" has not yet been picked. Fourth, an efficient process with a low transaction cost can reach many customers very quickly. These customers in turn can decide to act very quickly as they are not encumbered with layers of corporate management and budgeting processes. Fifth, this market can be used for localized load management. Canvassing these customers is most effective in areas of high concentration which may also suffer from congestion in the electrical distribution system.[5] Many of the measures applicable to this market also reduce peak load and can provide relief to these areas. Finally, when customers save energy they become more profitable and add to the general economic health of a community. Many CBOs and chambers of commerce have programs cultivating economic development among their local businesses. Amidst the growth of national chains,

[5] Many utilities have landlocked, constrained substations where the marginal costs of adding distribution capability (MDCC) can be greater than $1,000/kW (Heffner 1998)

these small local businesses are often the soul of a community with residents intentionally seeking out their services. Helping them reduce their bills not only supports a sustainable energy policy but supports economically sustainable communities.

Improving the Process of Engaging Customers

Successful energy efficiency programs often tailor each program element to the specific needs of the target market. Some program elements are common to nearly all programs and include marketing the program, identifying energy-conservation-measures (ECMs), quantifying costs and benefits, communicating results, installing measures, and assuring proper payments. In this section, we present ten critical program elements. Within each of the program elements we discuss specific high-impact activities that will help improve results in the HTR market. In a later section, we discuss how a data management system can enable many of these activities.

Identify targets. Identify HTR customers by analyzing the Customer Information System of the utility or a partnering CBO.[6] When available, prioritize these customers by geography[7], energy intensity, or business type (NAICS Code). Be aware of communities that may require information in various languages. Some programs have produced custom reports and material in over six different languages.

Engage customer. The primary considerations here are to be credible and efficient. These customers are busy and often have few, if any, other employees to handle the business if they are distracted. Armed with lists of potential customers, program representatives can canvass small businesses quickly door-to-door. Quantec (2004) showed that 91% of customers learned about one successful HTR program by cold walk-in contact. The "sale" should be completed during this initial contact. The customers are too small to support the higher costs of multiple visits and may not be available or lose interest. Carefully track customer status to avoid duplication, assure maximum contact, and track reasons for non-participation if applicable. Demonstrate credibility by mentioning an affiliation with their local utility, CBO, or neighboring customers (who have agreed to be referenced) who have already realized benefits. Describe the program, emphasize program funding levels, and bring samples of ECM equipment. In few cases, customers may contact the utility to validate the program and the identification of the representative, so utilities should be prepared with the representatives' details.

Identify Measures. Quickly but accurately conduct an energy audit to identify measures. Historically the roles of "sales representative" and "technical auditor" have required very different skill-sets, costs, and thus were conducted by different people. However, in this market these roles can be combined since the suite of ECMs is not excessively technical. Auditors can use rules-based mobile computing technology to quickly walk customers through a series of questions with pre-loaded approved ECMs. When the handheld devices communicate wirelessly with the Internet, the auditor can send digital photographs with peculiar conditions to a more

[6] Although CIS systems provide great data for qualifying customers, one must consider associated privacy policies.
[7] Lower-rate regions are often more successful since few measures have already been implemented. Although these customers will see lower dollar savings, the measures will often still be economical from a public perspective. Utilities can also target areas of higher value such as behind congested substations and feeders.

experienced project manager. A database can suggest a measure mix tailored for a specific business type, climate, or SIC code. Once the auditor has recorded the site information, the mobile computing platform can identify the ECMs and calculate their costs and benefits in seconds.

Communicate results. When the audit is complete, a short and clear document should show the estimated cost and savings (totaled and for each measure), the value of the incentive, and the net benefits to the customer (in dollars as well as kWh). This report should have name or logo of the utility company and any other credible program sponsors. To assure consistency and accuracy of the calculations and to minimize the interaction time, successful programs capture all costs and savings calculations in a central internet-based processing engine. The handheld auditing tools then connect with this processing engine and battery-powered printers to generate customized documents in real-time. During this single visit, the representative should generate all required documents such as customer reports, contracts, work authorizations, and warranty statements. The handheld computers can also benchmark facilities energy usage against others in the program (e.g. Watts-per-square-foot), in their NAICS Code or in their local area. This helps customers see that their competitors are realizing the benefits of lower operating costs and can motivate participation. These documents are most effective in a customer's native language.

Communicate program details. At this point, the customer has to make a decision whether to participate. They will have more questions about the details of the program. The potential facility improvements may be attractive, but customers will want to know how the program really works. Customers respond well to printed materials, integrating colorful and intuitive graphics, with an articulate program representative who can walk them through the process and address any questions.

Payment. Since HTR customers have limited funds available for energy upgrades, the most successful program will cover 100% of the installation costs and eliminate the need for any payment from the customer. Quantum/Xenergy (2001) explored this price elasticity and found that 94% of HTR customers are "willing" or "somewhat willing" to make efficiency improvements that are installed at no cost, but that "willingness" drops to 79% when they had to pay a share of the measure (with a one-year or less payback). When customers need to pay a portion of the costs, representatives should offer simple options like a credit card payment (mobile computers can accept and approve a credit card directly and securely). Financing the balance on their utility bill can be attractive to customers because their overall bill may still decrease if finance payments are less than the savings. Although third party leases can also be available to finance the balance of the ECM costs, it generally increases the complexity of the sales process. Where necessary, credit-check can be conducted quickly using wireless handheld devices or a cell phone to the project office.

Installation. Installing the ECMs should be integral element of the program. The hassle of finding a qualified contractor to install the energy efficiency measures has been a barrier in past HTR markets. If the customer has to take additional action at this point, the likelihood of participation will drop even in cases where they receive a list of "qualified" contractors. A more seamless approach pre-selects contractors (through an appropriate bid/RFP process) with the

necessary skills and fixed pricing for specific measures. Contractors would have to charge much more if they were inspecting and bidding on each site individually. In cases where CBOs are participating in the program, they may recommend one of their members to install the ECMs.

Sign the contract. At this point the customer knows exactly what will be done, they have an estimated savings, they know the costs, and they know how/when the ECMs will be installed. The process has made it very easy for them to say "yes". Using a portable printer, the representative can print a contract. Many small business owners in large cities are non-native English speakers. Program managers should be able to generate contract in multiple languages for their diverse customer base. In some cases, representatives and customers can execute documents in real-time with widely accepted encrypted digital signatures.

Validate savings. Policy makers and program managers need to learn how effective these programs are. A portion of the participants will be evaluated to determine customer satisfaction, evaluate the accuracy of reported ECMs delivered, measure the in-situ performance of some ECMs, and determine the expected long-term persistence of the savings. When data management systems support these programs, evaluation costs can be greatly reduced because "wizards" can walk the evaluator through the ECMs and their location (even with attached digital photographs). Evaluators can simply click to validate the installation or report a discrepancy.

Continual feedback. When program managers continually monitor program goals, they can catch problems and guide their performance back on track. In some programs auditors were successfully conducting over 15 audits per day. With such a high volume of projects, auditors and managers can learn about which aspects work best and optimize performance.

Data Management Systems Supporting Program Elements

A data management system will enable many of the best-practice program elements discussed above. A well designed system must consider three key components: 1) various sources of data, 2) hardware and software to store data and management inputs and outputs, and 3) information and reports required by various program stakeholders.

Elements of a Data Management System

We identify six key types of data critical to managing a successful HTR program. *Customer data* includes information such as customer names, addresses, size, rate schedule, and historical usage. *ECM Data* contains the approved lists of measures, the methods for calculating savings, detailed lists of parts/materials per measure, incentives, and associated pricing. *Site data* captures the existing on-site equipment configurations and feasible ECMs identified during the audit. *Program data* includes lists of participants, participation rates, program goals, conversion rates, approved contractors, payment structures, program budgets, and actual allocations. *Best practice data* includes historic information about best-practice watts/ft^2 and can be used to evaluate ECM penetration, auditor effectiveness, and generally optimize the program. The program is a great opportunity for utilities to capture additional *Customer Relationship Management (CRM) data*. A few simple survey questions can be included in the audit process to

capture customers' specific desires, interests, and satisfaction levels. Interested customers can enroll in workshops relative to their specific business (e.g. refrigeration or food service) which helps drive adoption.

To be used effectively, this data must be inputted, managed, and extracted with supporting hardware/software. The foundation of such a system is a *relational database and web server* that can securely store and share data from all data sources. *Web-based applications* allow multiple parties in multiple locations (i.e. contractors, program managers, customers, program evaluators, technical experts, etc.) to generate dynamic reports showing their components of the program from a common dataset. A *mobile computing platform* such as PDA's or tablets with wireless communication are effective for collecting on-site information, performing real-time ECM analysis, and interfacing with all other related sources of data. *Portable printers* allow on-site program representatives to generate professional credible documents customized for each customer.

The benefits of this system are fully realized when various program stakeholders have efficient access to the information they need. *Program managers* use the web-interface to track real-time results, manage program allocations, employee productivity, ECMs, and general program goals. *Auditors* can generate customized benchmark reports, audit reports, and customer contracts. *Contractors* can receive reports (either electronically or on paper) specifying the exact EMCs and parts-lists required for each customer's job. *Program evaluators* will use this data to determine how to sample participants to determine program impact. As the experience from these programs grow, the data can be mined to develop additional programs, identify under-served market needs, and even identify the need for new products.

Benefits of a Data Management System

All stakeholders benefit from an efficient data management system. *Customers* benefits because their time is used efficiently, they receive clear timely information, and they feel confident in the program's benefits. *Utility staff* benefit by running a more effective program, reaching a broader range of customers, and realizing more energy savings. A comprehensive data management system also improves general data integrity and reduces errors associated with manual data entry or manually merging the various data sources (e.g. different contractors, programs, auditors, etc.). They can also quickly update centralized calculation methods, ECMs, or pricing by simply editing data in the server. Program management and account executives can use first-hand CRM data and program data to better understand their customers and design future programs. *Implementers* reduce their transaction costs and improve the quality of their work. Auditors efficiently capture site data, eliminate duplicate data entry, and automatically calculate costs and benefits. The electronic wizards and built-in help menus allow less experienced and less expensive employees to conduct audits. If an auditor identifies unfamiliar equipment, he wirelessly sends a digital picture to an offsite technical expert who provides guidance. Contractors have also reduced employee turnover as auditors enjoy the productivity resulting from the tools. Contractors arrive on-site with necessary equipment since they receive a detailed list of ECMs and materials directly from the data management system.

Two Specific Examples at Southern California Edison

Background and History

Southern California Edison (SCE) is one of the nation's largest electric utilities with $9.5B revenues (2005) and serves 12 million people in California. SCE has a long history of running successful energy-efficiency programs and proposes to spend $675 million between 2006-2008 to reduced peak demand by over 700 MW by 2008 (CPUC 2005). SCE participated in the statewide study of the HTR market (Quantum/Xenergy 2001) and has incorporated many of these elements into successful programs in these markets. In this section we look at two such programs and discuss how they successfully include many of the program elements and data management systems discussed above. We first look at SCE's *Non-Residential Audit Program* and then the *Southern California 2005 Summer Initiative Direct Install Program* targeting very-small commercial customers. These programs both achieve high penetration rates of energy-efficient technologies in their target markets. This paper does not attempt to serve as program evaluation(which is required by law, typically hundreds of pages, and released one to two years after the year closes), but rather highlight some recent tangible examples.

Small Business Audit Program

California's Statewide Nonresidential Audit Program recommends energy conservation measures tailored to individual participants. In 2003 (the most recent year for which official results are available) nearly 30,000 customers participated statewide with one-third receiving on-site audits (Quantum 2005). This year SCE will conduct over 4,000 on-site nonresidential audits using wireless tools delivering one-stop transactions. In the past roughly 80% of these audits have served very-small (<20 kW customers on rate GS-1) with the balance serving customers with less than 100 kW peak demand. These audits specifically identify ECMs that qualify for California's Express Efficiency Statewide Standard Offer Program that provides fixed financial incentives for specific ECMs and high-efficiency equipment (e.g. include T-8 lamps, CFLs, strip-curtains, refrigerator gaskets, etc.). Although incentive levels vary depending on the type of equipment, incentives may cover up to 75% of the costs and the balance must be covered by the participant. Nearly 100% of the audits identify some opportunity for improving efficiency that typically payback in less than 2 years (before applying program incentives).

The first step is to reach out and educate customers to encourage enrollment. SCE's program managers and account executives often collaborate with community based organizations (CBOs) such as local chambers of commerce or trade associations to target a portion of the CBOs members with program information. Then, SCE's staff will canvas the business armed with mobile computing technology and the printed materials from both SCE and the CBO. As most customers had previously received information from the CBO, customers are often very willing to agree to an audit. Using their hand-held computers the auditor quickly captures site information (e.g. site area, lighting fixture counts, HVAC data, lamp/ballast types, window area, etc.) which is sent wirelessly back to a host server that returns the computed costs and savings in seconds. The mobile computer connects wirelessly to a portable color printer and generates a summary report and a completed rebate form (if desired). This process quickly and efficiently engages the customer, minimizes errors, and improves program efficiency. In turn, SCE's

representative can spend more valuable time with their customer discussing the program and answering questions instead of tediously performing energy calculations and filling out forms.

The Audit Program is an informational and recommendation program only that works with the Express Efficiency program that provides financial incentives. After receiving the audit, the customer is responsible for implementing the recommendations. Traditionally, this is a common point where customers drop-off and do not realize their savings. SCE is able to provide a list of vendors updated twice annually, but they cannot recommend one over another. However, when the programs are supported with CBO participation, depending on the organization, a CBO may suggest one of their members to actually install the ECMs. This overcomes two historic barriers - the customer's hassle of finding a qualified contractor as well as the contractor's high-fixed cost of marketing to a small customer. Contractors also are able to provide lower prices because their risk is managed over many customers (easier ones will offset harder ones) and they will be better qualified to deliver measures efficiently and correctly.

The overall effect of delivering a well designed program shows in the results. Program evaluations have commended SCE for surpassing their goals, their strong relationships with CBOs, and their innovative use of mobile computing (Quantum 2004, 2005). Although the statewide evaluation report will calculate the program's official results, preliminary results suggest that ECMs are installed by 40-50% of customers who have on-site audits. These high installation rates are due to SCE collaborating with a business or trade association member(s) who can facilitate the installation process. In contrast, when audited customers have to select a contractor on their own the installation rate drops to about 10%. This dramatic four-fold difference is not driven by varying incentive levels, but rather by a change in the program's process. Overall, when SCE performs an on-site, small commercial audit, they expect that roughly 20% of those customers will install the recommended measures. Reasons customers give for not installing the measures include cash constraints, the hassle of finding a contractor, issues around leasing their space, or most often, that they are just preoccupied with other business priorities.

The data management system has been critical to the success of this program. The hand-held computers link data seamlessly with all stakeholders instantly. Program managers rely on the real-time web portal to track goals daily (or hourly like a stock ticker) and accurately forecast program performance, manage the program budget, track worker productivity, monitor the mix of measures, and generate reports for management and the CPUC. SCE regularly surveys around 7% of their audited customers to monitor customer satisfaction and continue to optimize the program. Another key to the program's success is that SCE understands their customers and have developed a process well-tailored to them. They realize that the customers' primary objective is running their own business, moving merchandise, or providing a service. For example when energy-efficient lighting is found on-site it will be the wrong color or lighting level. SCE's staff can show the customers that they will realize non-energy benefits that will make the facilities more attractive and more profitable.

Direct Install Program

In autumn 2004, the California Public Utilities Commission (CPUC) contacted SCE to determine whether additional programs could be quickly implemented to reduce peak electric demand during the summer of 2005. SCE already was conducting a successful direct install

program that paid for the full cost of standard efficiency measures at very small commercial customers. SCE expanded this program in response the CPUC's request and began the 2005 Summer Initiative Direct Install Program. It expanded the existing program by engaging two additional contractors (Energy Controls & Concepts and California Retrofit Incorporated) to retrofit 8,000 sites between May and August. Here we discuss results from Energy Controls and Concepts (ECC) who used a mobile computing platform to provide the pre-retrofit audit for 3,350 customers.[8]

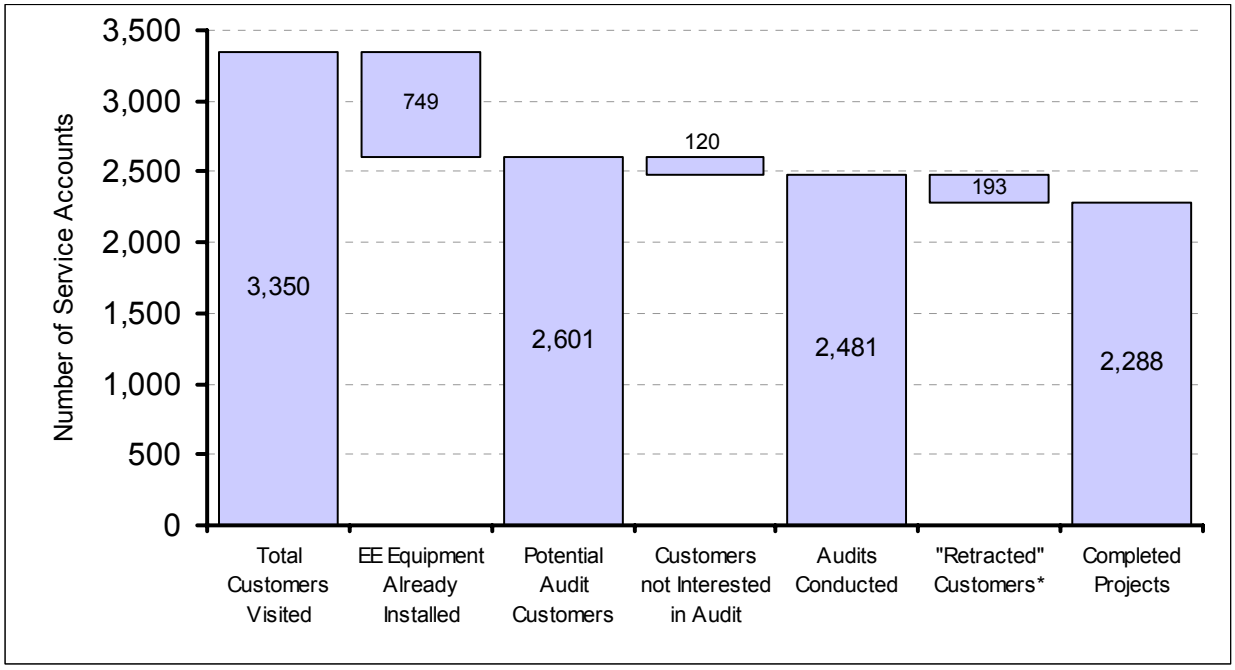
The process was very similar to SCE's Nonresidential Audit Program discussed above with three important exceptions. First, the contractors (versus an SCE employee) canvassed the businesses, performed the audits, and enrolled customers. The contractors carried identification associating them with the SCE program. Second, this was a direct installation program that covered the cost of 100% of the recommended ECMs. This eliminated the customer's cash constraints and hassle factor as barriers. Third, once the customer decided to implement the ECMs, the auditing contractor was responsible for completing the work. The customer was not required to take additional action. The results show these three differences made it very easy for the customers to say "Yes"

ECC's portion of the Summer Initiative successfully met their program goals and saved 3,076 kW of demand and 13.8 M kWh/yr at 3,350 sites in the small hard-to-reach commercial customer segment. The results presented in **Figure 2** have interesting implications for the achievable energy efficiency potential for this market. ECC visited a total of 3,350 customers. Roughly 22% (749) of these customers already had efficient equipment. 3.5% of the customers (120) were not interested in the audit or the program. This was driven primarily by language barriers (despite the fact that the program was offered in 4 languages), landlord concerns, or being too busy. The remaining 2,481 facilities qualified for the program. 193 (7.8%) of these audits were "retracted" by either SCE or the customer for various reasons including landlord concerns or general hesitation. Interestingly, after seeing the improvements provided by the program to their neighbors some of the customers re-expressed interest. Conservatively assuming that all of these "re-interested" customers did in fact remain inefficient, SCE realized a penetration rate over 90% of the 3,350 customers contacted (only 120 "uninterested" plus 193 "retracted" customers remained with inefficient equipment). These encouraging results suggest that the *achievable energy efficiency potential* may be close to the *economic potential* for these measures with similar program support.

SCE's success was driven by many of the best-practices described in this paper. They understood the customers' needs, eliminated many common barriers, and interacted with them very efficiently using handheld computers. They generated customer reports and contracts in a single visit in multiple languages. Since the object of the Summer Initiative was to reduce peak load, energy saving measures that did not reliably reduce peak were not included in the measure mix. However, SCE took this opportunity to capture information about additional equipment in the facility using the hand-held devices. Program management and account executives will use this first-hand information to better understand their customers and plan future programs.

[8] We refer to an actual "service account" as a "customer" although there is slight difference (~3%) as one facility or person may have multiple meters and thus multiple accounts.

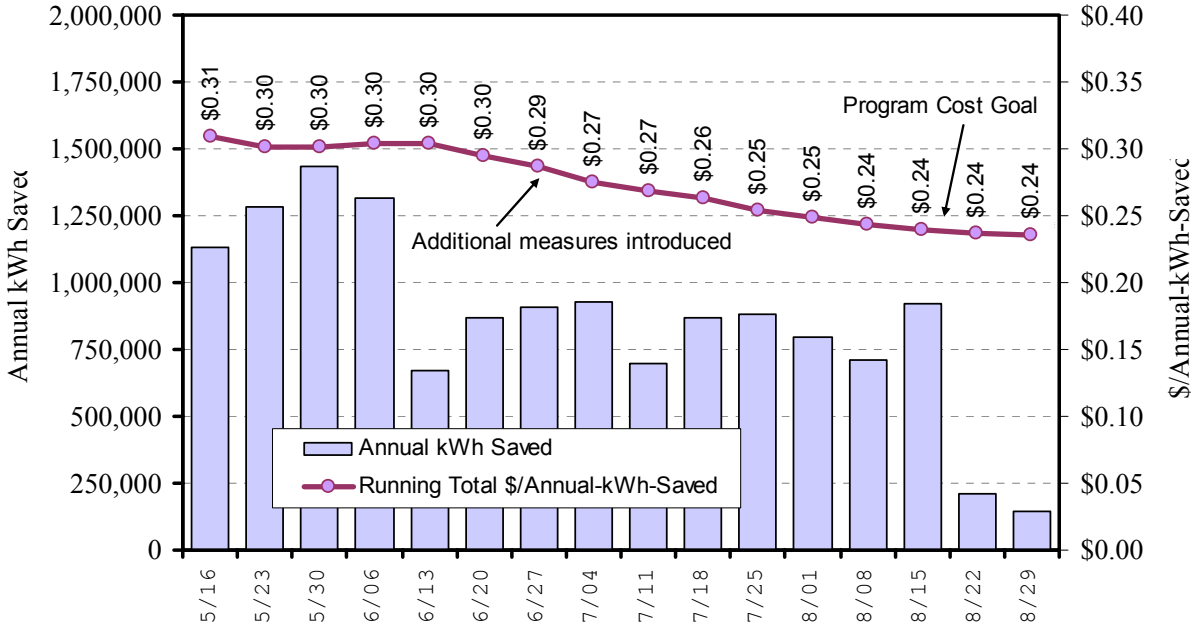
Figure 2. SCE's 2005 Summer Initiative Conversion Results from ECC



Using a real-time data management system helped SCE management keep their program on track. **Figure 3** shows the programs weekly progress and graphs both the annual-kWh-savings achieved as well as the running total ECM costs per total annual-kWh-saved[9] over the program period. As the program began, managers used their real-time tracking tools to see that $/kWh metric was hovering at above $0.30 when the program goal was roughly $0.24. They were immediately able to look at the measure mix and learn that they overestimated the potential for screw-in CFLs. They refined the measure mix to include some additional high-efficiency equipment and eventually surpassed their goal. This real-time system allowed managers to see results and realize benefits before it was too late.

[9] Utility managers commonly use this as a performance metric and it is not used as an economic metric since it only includes one year of savings and ignores the time-value of future cash flows or measure life-cycle.

Figure 3. SCE's 2005 Summer Initiative Program Results from ECC



Conclusions

Energy efficiency still represents a substantial untapped energy reserve in large segments of U.S. market. Estimating this potential requires understanding the market forces driving the gap between the *achievable* and *economic* potential. This gap can be reduced significantly with best practices and processes that address specific needs and barriers of specific customer segments. The hard-to-reach market represents one of these underserved communities that have been traditionally slow to uptake high efficiency equipment. Recent studies have advanced our understanding of the specific needs and barriers within this important sector. In addition, advances in mobile computing and web-based applications have enabled many new effective program elements. As a result utilities have tailored more programs specifically towards these markets.

Such programs are producing successful results. The 3,350 customer-visits sampled from Southern California Edison's 2005 Direct Install Program demonstrated penetration rates of nearly 90% in hard-to-reach markets when measures were provided at no cost. SCE's Nonresidential Audit Program has seen conversion rates as high as 50% (when provided with a clear implementation option) and incentive levels in the 50-75% range. Both of these programs included many best-practice program elements and data management systems discussed in the paper. As these techniques are applied to additional segments of inefficient energy users, the achievable savings potential will increase through greater adoption of energy efficiency measures. This will ensure that energy efficiency plays a more significant and reliable role in an economic and sustainable energy policy.

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