

Tracking Market Shares of High-Efficiency Measures for Evaluating Market Transformation Initiatives in California

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ABSTRACT

This study, conducted for the California Board for Energy Efficiency (CBEE), developed a plan for tracking the market shares of specific energy efficiency products and services in California. The primary function of the CBEE is to oversee the administration of publicly funded energy efficiency programs and to promote efficiency market transformation in the State of California. The study is comprised of three major phases: 1) a needs assessment that was designed to identify a list of 20 residential and nonresidential measures to be considered priorities for tracking, 2) a methods assessment that entailed the identification and assessment of a wide range of alternatives for tracking market shares and other market effects, and 3) a feasibility assessment that identified and evaluated feasible tracking alternatives for each priority measure. The primary results of the study are four residential and three nonresidential recommended tracking initiatives that detail the appropriate strategies and associated cost estimates for tracking market shares of the priority measures. This study also considers additional priorities for tracking strategies and related issues to augment the CBEE's market transformation evaluation plan, including tracking other market effects indicators, tracking competing products, and tracking additional measures and/or services that are not included in priority list of measures if the marginal cost of doing so is low. The results of this study will comprise a significant portion of the CBEE's plan to assess and evaluate market transformation initiatives in California.

Introduction

This paper discusses the results of an analysis of strategies for tracking the market shares of energy efficient products and services in the California market. The study was conducted for the California Board for Energy Efficiency (CBEE). As an advisory board to the California Public Utilities Commission (CPUC), the CBEE is spearheading a major effort to transform markets for energy efficiency in California. Assessing the effects of programs covered by this statewide effort will be critical from the perspective of both public policy and program planning. While success will be gauged by a variety of indicators of market effects, tracking efficiency market shares of products and services will be an absolutely essential element of the market assessment and evaluation (MA&E) process.¹ Market shares of cost-effective high-efficiency products and services reflect the

¹ In this context, we use the term market share to refer to the proportion of products/services that are "energy efficient," or to efficiency distributions, or to overall average efficiency levels of end uses.

economic efficiency with which markets are actually operating, and act as the ultimate indicators of the effectiveness of both specific programs and the overall market transformation process.

Project Objectives and Overview

The objective of this study was to formulate recommendations for tracking the market shares of key energy efficiency measures in the California market. Early in the project, it was determined that tracking data should meet four requirements: they represent unit sales as well as relative shares; they should be amenable to segmentation by efficiency level; they should be available by region, at least at the state level; and they should be available by decision type (new construction and replace-on-burnout/retrofit/net acquisition) when applicable.

As shown in Figure 1, this scoping study is comprised of three major phases:

1. A Needs Assessment to identify priority measures for which tracking systems should be developed,
2. A Methods Assessment to characterize the markets of priority measures and identify alternative methods that could be used to implement tracking, and
3. A Feasibility Assessment to compare and evaluate the feasibility of each viable method for tracking the priority measures.

The final result of this scoping study is a set of recommended initiatives for tracking the market shares of the priority efficiency measures. The methodology and results of these three phases and an overview of RER's recommendations are summarized in the following sections.

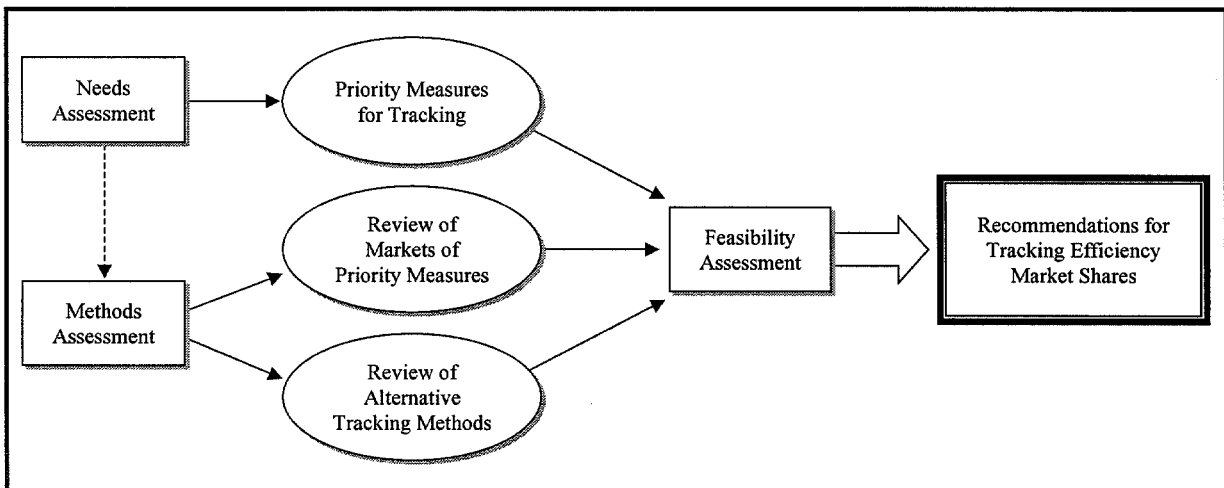


Figure 1: Project Overview

Needs Assessment

As noted above, the objective of the Needs Assessment was to identify the specific energy efficiency measures for which a tracking system should be developed. The primary product of the Needs Assessment was a list of 20 measures identified as priorities for tracking. The methodology for selecting the measures as priorities and the results of this assessment are summarized below.

Criteria and Methodology

The process of identifying energy efficient measures and services as priorities for tracking, and market transformation evaluation in general, was based upon four primary criteria:

- **Cost-Effective Savings Potential.** The first criterion refers to the overall potential for cost-effective savings associated with various energy efficiency technologies. In general, it will be prudent to design a tracking system that focuses on the measures with greatest potential for cost-effective energy and demand savings in the absence of any market barriers.
- **Marketing Efforts.** This second criterion refers to the extent of marketing effort that will be expended to promote certain high efficiency measures through the transition period. All else equal, it will be most important to track the shares of the measures that are being more heavily marketed than to track other measures receiving little attention.
- **Severity of Market Barriers.** From a public perspective, the severity of market barriers associated with individual measures should be included as a criterion for the design of the tracking system. Given other factors, it may be judicious to focus programs on measures with the highest barriers.
- **Susceptibility of Barriers to Market Intervention.** The efficacy of targeting publicly funded programs at specific energy efficiency measures also partly depends on the extent to which program intervention can reduce or mitigate key market barriers.

To initiate the Needs Assessment phase of this study, it was first necessary to compile a comprehensive list of high efficiency measures available to both the residential and nonresidential sectors for a variety of end uses. Several information sources were utilized for this task, including 1998 utility DSM program plans, utility program results, DSM market potential studies, and other resources, including market effects studies and RER staff engineers. The initial list of residential measures included 36 unique measures covering five end uses, and the initial list of nonresidential measures included 68 unique measures covering 10 end uses. Nearly all measures appeared twice on the list, as it was necessary to distinguish between decision types (e.g., installations in new construction or as retrofits/replace-on-burnouts).²

² There are two primary reasons for distinguishing between measures installed in new construction and those as retrofit or replace-on-burnout. First, for some measures the savings potential is likely to be different between these decision types. Second, tracking strategies might be different to the extent that delivery mechanisms differ between decision types for the same measures.

A two-step stakeholder interview process was undertaken to derive the final list of priority measures. The primary objective of the first set of interviews was to derive a preliminary short list of measures from the larger initial list of energy efficiency measures. A variety of energy efficiency industry experts and participants were recruited to rate energy efficiency measures according to the four criteria we used as a basis for this assessment. Interview participants rated each measure according to its potential for cost-effective savings, expected marketing emphasis to promote the measure, seriousness of market barriers impeding the measure adoption, and the extent to which program intervention can reduce or mitigate such barriers. A second round of in-depth interviews was then used to obtain information and feedback from industry experts and participants to compile a final list of priority measures for which tracking systems should be developed.

Needs Assessment Results

Table 1 includes the measures selected as priorities for tracking using the methodology described up to this point. It should be noted here that there is no distinction between decision types (new construction, retrofit, and replace-on-burnout) in Table 1. The distinction was considered for nearly all measures throughout the study thus far, but made almost no difference in how any particular measure fared in the derivation of this priority list. In other words, all applicable decision types for nearly every measure included in Table 1 survived the final elimination round. The distinction between decision types for each measure was further considered during the Methods and Feasibility Assessment phases of this study.

Table 1: Priority Measures for Tracking Initiatives for Market Transformation Assessment

Residential Sector Measures	Nonresidential Sector Measures
Duct Sealing	High Efficiency Windows
High Efficiency Central Air Conditioning	High Efficiency Packaged Air Conditioning
Compact Fluorescent Fixtures	High Efficiency Chillers
Horizontal Axis Washers	High Efficiency Motors
High Efficiency Windows	Adjustable Speed Drive Fans
Compact Fluorescent Lamps	32 Watt/T8 Lamps with Electronic Ballasts
High Efficiency Gas Furnaces	Energy Management Systems
High Efficiency Refrigerators	High Eff. Packaged Refrigeration Equip.
High Efficiency Dishwashers	Adjustable Speed Drive Pumps
High Efficiency Gas Water Heaters	Compressed Air System Optimization

Methods Assessment

The primary objective of the Methods Assessment is to identify and investigate alternatives for tracking market shares for the 20 priority residential and nonresidential measures included in Table 1. The methodology and results of this second phase of the study are summarized below. The overall approach to this Methods Assessment was to answer two key questions:

1. At which point in the distribution channel does it make the *most sense* to collect market share data for the priority measures?
2. What methods or strategies could be implemented to collect market share data at various distribution points?

In general, the distribution channel reviews followed a three-step approach. First, priority measures were grouped into markets according to similarities in measure characteristics and distribution channels. Second, the market for each priority measure was characterized and potential points in the distribution channel for data collection were identified. Third, implications for tracking were derived.

The review of market share tracking alternatives also involved a straightforward approach. First, an initial list of market share tracking alternatives was compiled from numerous sources. Second, a template for the information to be collected about each method was developed. Third, a thorough review of market share tracking alternatives was conducted through the use of several types of data sources, including in-person and telephone interviews and discussions with a variety of potential data suppliers, interviews with individuals involved in the market share tracking initiative in Wisconsin, and Internet resources.

The results of the Methods Assessment include 1) a set of possible points in the distribution channel for collecting the data required for efficiency market share tracking, for each measure and applicable decision type, and 2) a set of viable tracking methods for each priority measure and applicable decision type.

Feasibility Assessment

The objective of the Feasibility Assessment, the third and final phase of this study, is to evaluate alternative tracking methods for each priority measure in a systematic, consistent manner and devise final tracking recommendations. This assessment essentially integrates the first two phases of the study—the Needs Assessment, which prioritized efficiency measures, and the Methods Assessment, which identified and reviewed alternative methods for efficiency market share tracking. The data and information utilized for this analysis include the following: a review of existing tracking initiatives and interviews with tracking system developers; and interviews with key market actors, industry participants, and potential tracking data suppliers. The information and data collected during the Methods Assessment were used to evaluate the feasibility of each tracking alternative for each measure according to the nine criteria defined below.

- The capability of the method to yield data required for tracking shares,
- The accuracy and consistent availability of the data,
- The cost of developing and operating a tracking system,
- The extent to which economies can be realized by tracking numerous measures with the same tracking initiative,
- The time lapse between the onset of development and the time at which the first tracking data point will be available,
- The likelihood that the method can be implemented as designed,
- The extent to which existing CBEE relationships with other market actors can be used to facilitate the collection of data,

- The ability of the tracking system to generate information on other market effects, like awareness, key perceptions, stocking practices, and product availability, and
- The ability of the system to yield comparable data from a control area or multiple areas.

Recommendations for Tracking Priority Residential Measures

RER recommended that the market shares of the residential measures be tracked with four initiatives:

- Integrating on-site surveys and data obtained from building department records for new construction installations,
- Conduct on-site surveys of a sample of prescreened residential sites to track retrofit measures,
- Collect distributor sales data for tracking replace-on-burnout purchases of HVAC and water heating equipment, and
- Obtain tracking data collected under the ENERGY STAR[®] program in addition to data from smaller, independent retailers in California.

When combined, these four initiatives recommend approaches for tracking all of the priority residential measures for all decision types. These initiatives recommend collecting data at the end-user level using on-site surveys, from building departments for new construction, from retailer records, and from distributors. Where possible, these initiatives utilize significant economies from collecting information about numerous priority measures at one market node using a single customized approach. Alternative approaches that require data collection from market nodes other than from consumers require either a multi-node tracking initiative or the omission of a significant portion of the market.

Residential Initiative I: Integrating On-Site Surveys and Building Department Data

RER recommended tracking new construction installations of several residential measures at the end-user level—through data collected via on-site surveys and through building department compliance forms, in particular. The initiative proposed here integrates data from quarterly on-site surveys in the residential new construction sector with data from building department verification records. This tracking initiative would be the primary source of market tracking for seven priority measures in the residential new construction sector, including duct sealing (practices), central air conditioning equipment, compact fluorescent fixtures, windows, gas furnaces, gas water heating equipment, and dishwashers. This initiative would also be a secondary data source for new construction installations of clothes washers, compact fluorescent lamps, and refrigerators.

This initiative entails data collection from three samples of newly constructed residential sites. A quarterly sample of 400 on-site surveys would be conducted using a stratified sample of newly constructed homes. These data will be augmented with the collection of data from at least 1,100 Installation Certificates (CF-6R Form) from a sample of building departments throughout California. In addition, for 50 of the 400 on-site surveys, both building department data and on-site survey data will be collected each quarter. Data from these three samples will verify the accuracy of the building department data, calibrate the timing of the installation of energy using equipment in

newly purchased homes, generate useful tracking parameters, collect data on other market effects indicators, and ultimately populate a measure efficiency tracking database.

RER estimated that this initiative could be developed and operational within six months of its inception. Development and first year estimated costs are \$442,000 to \$560,000.

Initiative II: On-Site Surveys of Prescreened Residential Sites

RER recommended tracking the retrofits of two residential measures – windows and duct sealing – at the customer level.³ On-site surveys would be conducted for sample of residential sites that have replaced windows or that have retrofitted air distribution ducts. This initiative could also be used as a primary data source for replace-on-burnout or net acquisition installations of air conditioning and water heating priority measures, including central air conditioning equipment, gas water heating equipment, and gas furnaces. RER estimated that this method could be developed and operational within six months of the onset of development. Estimated first year costs range from \$356,000 to \$445,000

Initiative III. Collecting Distributor Sales Data

RER recommends tracking the replace-on-burnout and net acquisition purchases of residential HVAC and water heating measures at the distributor level. The measures covered by this initiative include central air conditioning equipment, gas furnaces, gas water heating equipment, and packaged air conditioning equipment. Collecting data at the distributor level does not allow for the tracking measures at the decision type level. However, if Initiative I is implemented, detailed data on HVAC and water heating equipment will be known for new construction installations. Because distributor data would represent both new construction and replace-on-burnout/net acquisition purchases, replace-on-burnout and net acquisition shares could be inferred by subtracting new construction shares from the distributor sales data. The major benefit of using the distributor survey as opposed to a pre-screened on-site survey is cost. The development and operation of data collection from distributors is considerably cheaper than conducting quarterly on-site surveys. Furthermore, collecting data at the distributor level will provide an accurate representation of the size and efficiency mixes of the California HVAC and water heating markets overall. RER estimated that this initiative can be developed within six to nine months and will cost roughly \$96,000 to \$170,000 during the first year of implementation.

Initiative IV: Energy Star[®]/EGIA Retail Tracking

RER recommended tracking the replace-on-burnout and net acquisition purchases of several residential measures at the retail level. This recommended initiative is an integrated approach involving current ENERGY STAR[®] data collection efforts, reinforced by collection of comparable data for retailers not participating in the ENERGY STAR[®] program. The latter effort would make use

³ This could also be a primary source for gas water heaters, central air conditioners, and gas furnaces. Insofar as these are replace-on-burnout or *net-acquisitions*, a purely random sample of homes is unlikely to yield a sufficient number of transactions for the covered measures. Consequently, this approach recommends on-site surveys of a prescreened sample of residential sites that have only recently purchased or replaced windows or upgraded their air distribution system.

of the support of trade organizations like the Electric and Gas Industries Association. This initiative would be the primary data source for replace-on-burnout and net acquisition purchases of the following priority measures: compact fluorescent fixtures and lamps, clothes washers, refrigerators, and dishwashers. It would also be a secondary data source for replace-on-burnout and net acquisition purchases of central air conditioning equipment, residential windows, and gas furnaces. RER estimated that this initiative can be developed within six to nine months and will cost roughly \$160,000 to \$230,000 during the first year of implementation.

Recommendations for Tracking Priority Nonresidential Measures

RER recommended that the market shares of the nonresidential measures be tracked with the following three initiatives:

- Integrate data collected with CEC on-site surveys with data obtained from building department records to track nonresidential new construction measures,
- Integrate CEC on-site surveys of a prescreened sample of commercial sites and a telephone survey of commercial and industrial sites to collect data on retrofit and replace-on-burnout installations, and
- Obtain sales data from major chiller manufacturers to track new construction and replace-on-burnout chiller installations.

These recommendations offer tracking approaches for most of the priority nonresidential measures, with the exception of packaged refrigeration equipment and non-HVAC motors. Initiatives V and VI entail collecting data at the end-user level using on-site surveys and data obtained from building department records for new construction, and on-site surveys augmented with a telephone survey for retrofit/replace-on-burnout installations. Because of the rather unique structure of the chiller market, data useful for efficiency market share tracking can be obtained from major chiller manufacturers.

Initiative V: Integrating CEC On-Site Commercial Surveys and Building Department Data

RER recommends tracking new construction installations of several nonresidential measures at the end-user level, through data collected via on-site surveys and from building department compliance forms. This initiative is the recommended primary data source for new construction installations of the following priority measures: nonresidential windows, packaged air conditioning, adjustable speed drive pumps and fans (HVAC and water heating applications), 32 watt T8s with electronic ballasts, and energy management systems. This initiative can also provide secondary data for motors installed in the commercial sector and chillers.

Initiative V entails quarterly data collection from three samples of newly constructed nonresidential sites. A quarterly sample of 350 on-site surveys will be conducted using a stratified sample of newly constructed buildings. These data will be augmented with the collection of data from at least 1,100 Compliance Certificates (ENV-1, MECH-1, and LTG-1 Forms, at a minimum) from a sample of building departments throughout California. In addition, for 100 of the 350 on-site surveys, both building department data and on-site survey data will be collected each quarter. Data from these three samples will verify the accuracy of the building department data, calibrate the

timing of the installation of energy using equipment in newly constructed buildings, generate useful tracking parameters, and ultimately populate a measure efficiency tracking database.

RER anticipates that this initiative can be developed and operational in six months. The estimated costs for the development and first year of implementation depend upon the possibility of leveraging the on-site data collection efforts planned by the California Energy Commission. If these efforts can be incorporated into the tracking system, the cost of this approach would be \$172,000 to \$233,000. If not, the budget of this initiative would be \$868,000 to \$1,345,000 during the first year of implementation.

Initiative VI: Integrating On-Site Commercial Surveys and Commercial and Industrial Sector Telephone Surveys.

This initiative integrates the planned CEC commercial on-sites surveys and a telephone survey of commercial and industrial customers to collect data on retrofits of several priority measures. This initiative is the recommended primary data source for retrofits of adjustable speed drive pumps and fans (HVAC applications), 32 watt T8s with electronic ballasts, energy management systems, and compressed air optimization. This approach uses on-site commercial surveys to collect tracking data wherever possible, and attempts to make use of CEC on-site survey efforts. However, the CEC survey does not cover the industrial sector and the proposed sample sizes will not be sufficient to support a statistical analysis of market shares. To mitigate these shortcomings, RER recommended a telephone survey of at least 2,000 commercial and 2,000 industrial sites. This initiative can be developed and operational in six months. If CEC on-site surveys can be integrated into the system, the estimated costs for the development and first year of implementation are \$499,000 to \$695,000. If not, the budget for the development and first year of implementation of this initiative would be \$810,000 to \$1,196,000.

Initiative VII: Chiller Manufacturer Data Collection

RER recommended tracking efficiency market shares of chiller installations in new construction, as well as chiller replacements, with data collected from chiller manufacturers. Tracking efficiency market shares of chillers in California at the manufacturer level, rather than through midstream market actors or at the site level, is favored for several reasons, most of which relate to the structure of the chiller market and relative costs of implementing tracking alternatives. RER expects this initiative to be developed and operational within three to six months. RER estimates development and first year implementation costs to be \$90,000 to \$150,000.

Additional Observations

Several general observations on market share tracking are in order. First, clearly, tracking market shares is an essential ingredient in the overall assessment of the market transformation effort. This is true in two respects. First, access to market share data will be critical for the support of decisions relating to the continuation of public funding for energy efficiency programs as the close of the transition period draws closer. Second, the availability of comprehensive market share tracking systems will greatly facilitate the assessment of the effectiveness of individual programs, program elements, and intervention strategies. Program administrators will need access to tracking data to assess the effectiveness of these activities. If they are not available from a set of statewide

initiatives such as those recommended here, they will need to be developed in the course of individual MA&E projects. Arguably, the available of a single set of consistent tracking systems would be preferable to piecemeal tracking as part of periodic program assessments. We argue that the availability of uniform tracking data would foster more effective use of other MA&E funds allocated in 1999 and beyond.

Second, depending upon the specific options chosen, the development of a comprehensive tracking system covering the priority measures could cost around \$2 million in the first year and between \$1 and 2 million per year thereafter. We understand that policy makers may consider these costs quite high. However, we would suggest that these costs be evaluated in the context of the overall cost of market transformation efforts. In California, for instance, roughly \$300 million will be spent to promote market transformation over the next year. The cost of the recommended initiatives would amount to less than 1% of the total energy efficiency budget.

Third, developing the recommended market share tracking initiatives will take time. Depending upon lags in procurement and difficulties in implementing our recommendations or some other initiatives, it is likely that tracking results in California will not be available until the end of 1999. However, tracking is a long-run need. Even in California, where energy efficiency programs may be scaled back significantly in 2002, tracking should continue to be a priority beyond the transition period. It will be important to know, for instance, if the reduction in publicly funded program interventions at the end of the transition leads to the degeneration of energy efficiency in the State.

Fourth, one of the criteria used to select tracking options was the ability to yield information on other (non-California) areas. Such information could clearly be useful in assessing market effects, insofar as it would provide cross-sectional comparisons of market shares. One of the disappointments of the study was that very few options provide context in this sense at a reasonable cost. Of course, it is always possible to duplicate an initiative in another area (e.g., we could always conduct on-sites in other states to obtain comparison data); however, such data collection efforts would be likely to quite expensive.

Fifth, the recommended tracking methods are capable of tracking market shares by decision type when decisions differ substantially by these market events. This capability was imposed as a data requirement for tracking because programs relating to these measures are categorized and designed by market event. If new construction programs and retrofit programs are to implemented to promote transformation, for instance, it seems logical to track new construction and retrofit shares separately. We understand that the requirement of this capability results in tracking budgets that are sometimes higher than they would otherwise be. Nonetheless, we would argue that the additional costs are warranted.

Sixth, it may make sense to use multiple approaches for tracking energy efficiency measures. Two primary benefits result from tracking at multiple points. First, doing so provides a "sanity check," or helps to cross-reference results of tracking efforts. Second, tracking from multiple nodes can provide indicators of the extent of market transformation on national as well as regional perspectives.

Seventh, while this study has identified logical points in the distribution channel for collecting data and the alternative methods for doing so, the *actual* data that should be collected for market share tracking has not specifically been addressed. One of the four data requirements for market share tracking in California is that data must be segmented by efficiency level. One cannot assume, however, that market actors keep sales or inventory records by efficiency level. Most often, sales and inventory records are maintained by product codes, model or part numbers, and

possibly other parameters that would uniquely define a product, such as size or manufacturer. The point here is that the data collected will need to be converted or coded to be useful for market share tracking.

Eighth, we have not explicitly addressed the means of collecting baseline data to provide an historical perspective on market shares in California. Another study being conducted by Xenergy is addressing this issue. We should note, however, that some of the methods discussed and recommended here (data collection from upstream market actors, in particular) might be able to yield historical data on market shares.