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Transforming the energy efficiency market in California: Key findings, lessons learned and future directions from California's market effects studies

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HIGHLIGHTS

- We summarize three market effects studies and provide lessons learned.
- Collect baseline market data as early as possible and throughout program lifecycle.
- Estimate market effects throughout a program's lifecycle.
- Require hypothesis testing as part of the evaluation.
- Include elements of market effects evaluation in other program evaluations.

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ABSTRACT

In the last three years, the California Institute for Energy and Environment (CIEE), along with the California Public Utilities Commission (CPUC), managed three market effects studies that were funded by the CPUC. This paper summarizes the key findings from these studies that focused on compact fluorescent lamps (CFLs), residential new construction (RNC), and high bay lighting (HBL),[1] with a particular focus on changes to California's market effects evaluation protocol and lessons learned during the evaluation of market effects. This paper also summarizes the key results from a survey that was conducted by CIEE in February 2011 to determine what additional studies should be conducted in the evaluation of market effects.

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1. Introduction

In an October 2007 decision (D.07-10-032), the CPUC directed its staff to explore (during 2008–2009) the ability to credibly quantify and credit "nonparticipant spillover" market effects, and to report on the ability of current protocols to measure nonparticipant spillover savings for the 2006–2008 program cycle. The market effects evaluation protocol provides the following definition of market effects (California Public Utilities Commission (CPUC), 2006):

> A change in the structure of a market or the behavior of participants in a market that is reflective of an increase in the adoption of energy-efficient products, services, or practices and is causally related to market interventions…" where a "market" is defined as "the commercial activity (manufacturing, distributing, buying and selling) associated with products and services that affect energy usage.

In the October 2007 decision, the CPUC directed its staff to report its findings following the process evaluation and market impact studies of the 2006–2008 program cycle on the ability of current protocols to measure such "nonparticipant spillover" savings and to propose possible revisions to market effects protocols, utility savings goals, or performance incentive mechanisms for subsequent action by the CPUC. Consequently, the CPUC decided to examine possible market effects in CFLs, RNC, and HBL (referred to as the "market effects studies"). Working with the CPUC, CIEE developed study plans for, and assisted in overseeing, each of these market effect studies.[2]

The market effects studies had three primary objectives (Vine, 2011):[3]

- Understand the cumulative effects of California's energy-efficiency programs on the target market.

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[1] High bay lighting refers to a diverse group of technologies that are used to light spaces in commercial and industrial facilities with ceiling heights 15 ft and above.

[2] The CIEE market effects study plans are available at http://uc-ciee.org/planning-evaluation/7/lbrsearch.

[3] The Residential New Construction Market Effects Study included a fourth objective: Assess the effects of pre-2006 IOU programs on the adoption of more efficient technologies and practices in the 2005 Title 24 code.

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Table 1
Summary of market effects evaluations.

Data collection	Data analysis	Comparison states	Energy savings	Claim savings as a resource?
CFL • Review of program material and related literature • Review of IOU program data • Telephone surveys with customers, retailers, manufacturers • In-person interviews with program managers and evaluators • In-home audits • Stocking inventories	• Descriptive statistics • Multivariate regression modeling	• Georgia • Kansas • Pennsylvania	• Total net impacts for 2008 were 23% of IOU's claimed gross savings	• Not for the 2006–2008 program cycle
High bay lighting • Review of program material and related literature • Review of IOU program data • Telephone surveys with program managers, implementation contractors, lighting contractors, lighting distributors, and end users • In-depth interviews with manufacturers, distributors and installation contractors	• Descriptive statistics	• Mississippi • Georgia • Alabama • South Carolina	• 15.1 to 27.2 GW h per year in savings due to the net out-of-program adoptions of HBL technologies	• Yes for the 2006–2008 program cycle
Residential new construction • Review of program material and related literature • Review of IOU program data • Telephone surveys with homebuyers, builders, contractors, Title 24 consultants, HERS raters, window distributors, lighting fixture and control distributors • Onsite visits and audits of non-program homes • In-depth interviews with program managers, building code officials/inspectors	• Descriptive Statistics • Compliance modeling • Delphi (expert) panels	• None	• Average new home built used 7.6% less energy than permitted to use under state building code	• Yes for the 2006–2008 program cycle (and already covered in the codes and standards program evaluation)

- Quantify 2006–2008 kW-h and kilowatt savings (if any) caused by the above potential market effects and not claimed as direct or participant spillover savings.
- Support the CPUC's strategic planning efforts by clarifying whether savings from potential market effects can be quantified with sufficient reliability to be treated as a resource.[4]

2. Overview of the market effects studies[5]

As shown in Table 1, each of the studies addressed the above objectives with evaluation methodologies relying on a diverse set of data collection methods and sources of data, including the review of program material and related literature, review of investor-owned utility (IOU) program data, telephone surveys, in-person interviews, in-depth interviews (in person or by phone), in-home audits, onsite visits, and stocking inventories. Most of the analyses relied on descriptive statistics, but multivariate regression modeling was used in one study (CFLs), and compliance modeling and Delphi (expert) panels were used in another study (RNC). Comparison states were used in two studies (CFLs and HBL) to serve as a baseline. While energy savings were calculated for all three studies, two studies (HBL and RNC) claimed that the energy savings could be quantified with sufficient reliability to be claimed as a resource, while the third study (CFLs) could estimate savings but the savings could not be claimed as a resource for the 2006–2008 program cycle.

We provide more detail on the specific studies below.

2.1. CFL study

The CFL study (The Cadmus Group et al., 2009, 2010) included telephone surveys with approximately 2500 end-use customers, telephone interviews with about 600 CFL retailers and manufacturers (representing the vast majority of market-level CFL sales in California), in-home audits of 269 homes, comprehensive retailer lighting shelf stocking inventories in 185 stores (representing over one million stocked bulbs), and interviews with 17 residential lighting program managers, policymakers, and evaluation consultants familiar with historic California or other residential lighting programs across the U.S.

The analysis included qualitative and quantitative data approaches, including descriptive statistics and multivariate regression modeling techniques. Primary research was conducted in California and in three comparison states (Georgia, Kansas, and Pennsylvania) selected to serve as a baseline for California. The customer survey and in-home audit data were combined with primary data from 11 additional states (in a collaborative effort conducted with other program states, and analyzed in a single set of models) as part of the analysis.

The study was guided by the development of a logic model and researchable questions that were developed as part of a CFL market effects scoping study. These research questions addressed leading market indicators including CFL awareness, availability, pricing, and satisfaction, as well as coincident and lagging market indicators such as CFL sales and saturation, respectively.[6]

[4] The market effects studies focused on methodological issues. The authors of the report were neutral going into the studies on whether there were market effects. And the CPUC was not planning on using the results for determining utility performance on meeting their energy savings goals and its impact on shareholder incentives.

[5] Each of the studies is listed in the References section at the end of this paper.

[6] Leading indicators are early indications of changes in the level of CFL market activity. They may be used to predict a forthcoming change in CFL market activity. Coincident indicators are signs that the level of CFL market activity is changing that occur concurrently with the altered level of activity. Lagging indicators are indications of changes in the level of CFL market activity that occur after the level has changed.