Measuring the Market Effects of Utility Programs: Lessons from California

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ABSTRACT

As part of electric industry restructuring in 1998, California shifted the emphasis of its energy efficiency programs from resource acquisition to market transformation. In preparation for full-scale implementation of market transformation policies, the California DSM Advisory Committee (CADMAC) budgeted approximately $1.7 million to conduct 14 studies expressly intended to measure short-term market effects and long-term market transformations resulting from utility DSM programs.

These studies were intended to provide information to meet multiple objectives: (a) identify strengths and weaknesses of current program designs for creating lasting market effects; (b) identify strengths and weaknesses of various evaluation methods; (c) develop recommendations for improving future evaluations of market transformation programs; (d) identify future market effect research needed; and (e) test the effectiveness of designing market effects studies around the market transformation framework outlined in the Scoping Study previously commissioned by CADMAC.

This paper provides a comparative review of the first four studies. The paper includes a summary of the factual aspects of the four studies, and discusses the contributions the studies made toward the five objectives described above. This paper summarizes lessons learned to date and makes recommendations for conducting future market effects studies.

Introduction

As part of electric industry restructuring in 1998, California is shifting the emphasis of its energy efficiency programs from resource acquisition to market transformation. In preparation for full-scale implementation of market transformation policies, the California DSM Advisory Committee (CADMAC) has budgeted approximately $1.7 million to conduct fourteen program studies expressly intended to measure short-term market effects and long-term market transformations due to utility DSM programs. The full list of fourteen studies is provided in Table 1, below.

These studies are intended to provide information to meet multiple objectives that are considered critical for design, implementation, and evaluation of future market transformation programs. Among the key objectives are:

- identify strengths and weaknesses of current program designs for creating lasting market effects;
- identify strengths and weaknesses of various evaluation methods;
- develop recommendations for improving future evaluations of market transformation programs;

- identify future market effect research needed; and
- test the effectiveness of designing market effects studies around the market transformation framework outlined in the Scoping Study (Eto, Prahl, Schelgel, 1996) previously commissioned by CADMAC.

Table 1. Market Effects Study List

RFP TITLE	UTILITY	PROJECT PHASE
Market Effects of Residential New Construction Programs	PG&E, SCE	1
Market Effects of DOE Labeling Program	SCE	1
Market Effects of SCE's Customer Technology Center	SCE	1
Market Effects of Agricultural Testing Program	SCE	1
Market Effects of Appliance Rebate Programs	PG&E	2
Market Effects of CEEI Lighting Programs	PG&E, SDG&E	2
Market Effects of Pacific Energy Center	PG&E	2
Market Effects of PG&E Program on Supermarket Market	PG&E	2
Commercial/Industrial Customer Decision Baseline	PG&E	2
Market Effects of High Quality CFB Program	SCE	2
Market Effects of SCE Commercial & Industrial Programs	SCE	2
Market Effects of SCG's Residential Information Program	SCG	2
Market Effects of SCG's and SDG&E New Construction Program	SCG, SDG&E	2
Indirect Costs and Benefits of SDG&E Commercial Lighting Program	SDG&E	2
Multi-year Billing Analysis	All utilities	2

The DSM programs under consideration were designed as resource acquisition programs rather than market transformation programs. Thus, the intent of the market effects studies was to learn as much as possible from past experience rather than to condemn the programs as failures if they did not fully satisfy the performance criteria of mature market transformation programs.

To better understand the key results from each of these studies, CADMAC commissioned a summary study project to review the reports, synthesize results, draw general conclusions, and develop recommendations for making the transition from DSM to market transformation. The project proceeded in three steps, the first step involved development of a work plan. As part of the work plan the study team prepared an analysis of the Scoping Study and a bibliography of the key market transformation and market effects literature. A listing of key references from that bibliography is included at the end of this paper.

The second step was to review the first four market effects studies finalized and prepare a Phase 1 report documenting the findings of that review. The third step was to review the remaining ten studies and to prepare a final summarizing the findings for all 14 studies. This paper discusses results based on the authors' review of the first four studies, conducted as part of Phase 1 of the project. The findings from the final report (Peters, Mast, Megdal & Ignelzi, 1998) will be included in the conference presentation.

Program Summaries

The four program studies reviewed as part of phase 1 of the summary study were:

- Market effects of PG&E and SCE's residential new construction programs
- Market effects of DOE labeling program
- Market effects of SCE's Customer Technology Applications Center
- Market effects of SCE's agricultural testing program

The first study analyzed the market effects of SCE's Welcome Home program and PG&E's Comfort Home program. These programs provided energy efficiency information to homeowners and realtors, promoted energy-efficient mortgages, and worked directly with builders and subcontractors, offering incentives for the use of energy-efficient measures and setting standards for ductwork installation, among other efforts.

The second study characterized the market targeted by SCE's Energy Star appliance labeling pilot program. This program was a joint partnership with the US Department of Energy (DOE) and the US Environmental Protection Agency (EPA). The program, which commenced as a pilot in 1996, provided target levels for "high efficiency" appliance classifications and rated the efficiency of refrigerators, dishwashers, and room air conditioners. Program collateral materials included a program training guide for the retail dealer's sales people, static-cling ENERGY STAR labels for qualifying appliances, and point-of-purchase banners, posters, product "tents," and customer brochures for each type of appliance in the program. The pilot Program involved 30 Circuit City retailers in SCE's service area.

The third study assessed the effectiveness of SCE's Customer Technology Application Center (CTAC). This program provided workshops and seminars on HVAC and lighting issues for SCE's commercial and industrial customers.

The fourth study examined the market effects of an extremely long-standing (over 80 years) SCE information program that provides services to agricultural and municipal water pump end-users. The program provides pump-testing services at no cost to the participants. This testing provides information that is expected to influence maintenance procedures, increase the energy efficiency of the

pumps, and increase the purchase of more energy efficient pumps. The program was originally designed as a marketing and customer service program.

Strengths and Weaknesses of Current Program Designs

A certain tension exists between the Summary Study authors' mandate to determine the strengths and weaknesses of current program designs and their mandate to provide insights into appropriate evaluation methods and key design issues for market transformation programs. The first mandate implies an historically focused perspective whereas the second mandate implies a forward-looking perspective. Nevertheless, a few general strengths and weaknesses of current program designs are evident, even from the studies that adopted a forward-looking perspective.

Focus on End Users

The four studies covered in phase 1 assess programs targeted at a variety of market actors: home builders, refrigerator retailers, agricultural and municipal pumping customers, and C/I customers. However, these programs are not representative of the types of programs toward which the majority of DSM funds have been targeted in California. Of the four sets of programs evaluated as part of phase 1, only the residential new construction programs are shared savings programs, the program category that is most heavily funded in the state. Shared savings programs must rigorously quantify program impacts but, in exchange, they offer the greatest financial benefits to utility shareholders. This historical emphasis on quantifiable program impacts has implicitly encouraged utilities to focus on programs targeted to end users.

A review of the four phase 1 studies indicates that an exclusive program focus on end users, while perfectly rational under the historical DSM rules in effect in California, may not be efficient from a market transformation perspective. The studies provide abundant evidence that a variety of market barriers exist throughout the production-distribution-consumption chain for all types of energy efficient goods and services. Maximizing program leverage through market transformation will require program interventions targeted at a variety of market actors, specifically designed to reduce and remove key barriers.

Emphasis on Incentives

A review of the four phase 1 studies indicates that exclusive reliance on incentives to market actors is unlikely to produce lasting market changes. The studies identified significant evidence that a number of market barriers substantially limit the penetration of energy-efficient technologies and practices to economically and socially optimum levels. These barriers are not addressed by incentives to market actors and generally fall into the following categories:

- Information or search costs
- Performance uncertainties
- Asymmetric information and opportunism
- Transaction costs
- Hidden costs
- Access to financing

- Bounded rationality
- Organization practices or custom
- Misplaced or split incentives
- Product or service unavailability
- Externalities
- Nonexternality mispricing
- Inseparability of product features
- Irreversibility

Success at reducing or eliminating these barriers is most likely to come from a coordinated strategy of program interventions that explicitly target identified barriers. Such a strategy may or may not include financial incentives to targeted market actors.

Need for a Well-Established Baseline

From a market transformation perspective, a major shortcoming of current program designs is that they do not incorporate a measure of baseline conditions that can be used to benchmark program effects. Three studies tried to mitigate this problem by relying to varying degrees on reconstructing baseline conditions from market actor interview responses. This method suffers from several inevitable weaknesses. Most notably, the method is vulnerable to bias due to poor recall on the part of interviewees and potential bias due to interviewees tendency to represent past actions and conditions in a light that is most favorable to their current and future situation.

One study adopted a cross-sectional approach to establishing the baseline. In this case, selection of the comparison area and its rationale was thoroughly performed, well argued, and sufficiently supported with empirical evidence of its similarity to the program area. However, as a general evaluation strategy, we believe cross-sectional baselines will have limited application. As market transformation programs proliferate and their scope expands to the regional and national level (the natural level of their target markets), identification of a valid comparison area will become increasingly problematic.

As programs are designed specifically to meet market transformation objectives, our preferred strategy for establishing evaluation baselines is for comprehensive market characterizations to be incorporated in the program design. This strategy offers several advantages:

- It provides key information for prioritizing market barriers to be targeted
- It provides the comprehensive understanding of market dynamics needed to design effective program interventions
- It establishes baseline market conditions against which progress toward the program's objectives can be realistically measured. This baseline will be less prone to biases that threaten baselines constructed after the fact.

Strengths and Weaknesses of Evaluation Methods

Market Characterization Studies

All of the programs studied lacked a market characterization study as part of program design. We found that the quality of the market effects studies would have been greatly improved with inclusion of a market characterization study as a preliminary step in the research process. One study conducted a market characterization study and used the results to design its research on the program's market effects. A second study focused entirely on characterizing the market. The remaining two studies developed their lists of expected market effects from hypothetical market conditions. Neither study conducted a market characterization to provide a basis for prioritizing market barriers and hypothesized market effects for the market effects analysis. They thus lacked an essential precursor for developing a market effects work plan that offered a reasonable expectation of adequately studying the key market barriers and effects without either overlooking an essential element or spending project resources studying minor barriers and effects.

We believe adopting a two-tiered approach, the first tier being a market characterization study and the second tier being a market effects study designed around the first tier results, should be a high priority element of any evaluation that attempts to assess the market effects of programs that were not explicitly designed as market transformation programs.

Participant/Nonparticipant Comparisons

In our opinion, the quality of two of the studies reviewed was significantly compromised by the lack of market focus. Both studies focused their data collection efforts on program participants and ignored the larger market. Thus both studies lacked quantitative data regarding overall market size and market share for the efficient technologies and practices targeted. Both studies lacked information needed to compare sampled customers to the population they presumably represented. As a consequence, both studies were unable to comment on the programs' effects on the overall market.

Analytic Hierarchy Process

One study showed significant innovation in its approach to quantitative analysis of program market effects. This study, in addition to a qualitative data analysis, included a quantitative analysis using Analytic Hierarchy Process (AHP). Based on this study, AHP would appear to hold great promise for application in market transformation contexts. However, the application in this study was significantly compromised by resource constraints that limited the amount of data that could be collected to support the analysis. Our initial review suggests that the method requires a significant primary data collection effort. A comparison of the method's benefits relative to its resource requirements may have to wait a future application.

Measurement of Sustainability

In general, discussions of designing market transformation programs for sustainability and assessing sustainability are still in their infancy. The market effects' studies reviewed in Phase 1 did not approach the sustainability issue in a systematic fashion. They lacked specific criteria for

sustainability given the programs' interventions, did not measure sustainability according to relevant defined criteria, and then did not analyze sustainability accordingly.

Based on our initial review, we would recommend that researchers refer to the goals and objectives of the effort and determine what sustainable effects are likely to emerge. Then these potential sustainable effects should be measured and an assessment made as to how likely the transformation will be permanent given:

- new market entrants,
- position and momentum in the diffusion process,
- institutional adoption,
- physical and market structure transformation, and
- the development of profitable private market entities to facilitate continued market transformation.

Data Collection

Overall, the quality of the data collected was quite good. Most of the studies followed data collection procedures consistent with industry standards. The data completeness assessment in this first phase review identified several issues:

- Obtaining sufficient data to examine program market effects for the market as a whole;
- Selecting and prioritizing data collection efforts;
- Collecting data relevant to the program's expected mark effects on each market barrier identified;
- Collecting enough data for defensible results; and
- Making full use of data collected in prior studies.

In general, we encountered analysis results derived from unacceptably small samples. We also found samples drawn without reference to the parent population, leaving no basis for drawing any general conclusions about the population. In some cases, the studies made little use of data from prior studies; whereas in one case the study design relied on an existing data source that proved to be less than adequate for the study's needs.

Prioritizing the data collection appeared to present a problem. On the one hand, several studies did not collect data relating to key market actors. Hypotheses about potentially significant market effects relating to those actors could not be tested. On the other -hand, the studies also collected significant amounts of data that bore little apparent relation to the hypothesized market barriers and expected market effects.

For future studies, we believe greater priority will need to be given to allocating sufficient resources to data collection. Programs targeted at an entire market require evaluations targeted at an entire market, which is necessarily resource intensive. The good news is that our understanding of market dynamics is cumulative. Over time market transformation evaluations may be able to make increasing use of prior research results, thereby reducing the need for primary data collection.

Effectiveness of Designing Studies Around the Scoping Study Framework

Based on our review of these first four studies, we found the Scoping Study to be an extremely useful framework for the design and evaluation of market effects from utility DSM programs. The following preliminary recommendations for making modifications to the framework represent primarily clarifications and additional detail that would increase the usefulness of the framework to industry professionals as they move to design, implement, and evaluate market transformation programs.

- **Emphasize knowledge of market structure.** The focus of market transformation programs is on markets, not isolated groups of customers. To be successful, the program design, implementation, and evaluation must all be firmly rooted in a detailed understanding of market dynamics.

- **Collapse barriers.** For purposes of a general industry vocabulary, the differences between the barriers of information costs, performance uncertainties, asymmetric information, and bounded rationality are largely academic. We believe these categories could be combined with minimal loss of information. On the other hand, we believe the design, implementation, and evaluation of market transformation programs may be significantly improved with more widespread understanding of the theoretical underpinnings of the key barriers that remain.

- **Clarify the definition of market barrier, distinguishing between market barriers and market conditions.** As noted above, an operational definition of market barrier should permit one to distinguish between a true barrier that merits intervention and a normal condition of a real-world market.

- **Distinguish between market effects and market changes.** While the Scoping Study includes the notion of market change, it may get overlooked by the casual reader. One solution would be to elevate the notion of market change to the status of formal concept, complete with definition.

- **Emphasize links between market barriers, program interventions, and market effects.** Industry practitioners should be clear on the notion that program interventions should be tailored to address specific identified barriers in the marketplace and that market effects selected for tracking throughout the program should provide direct evidence of changes in those barriers as a result of the program interventions.

- **Elaborate on measurement standards for sustainability.** The notion of sustainability or lastingness should be clearly defined in such a way that provides unambiguous direction for its measurement.

References

Eto, Joseph, Ralph Prahl, and Jeff Schlegel. 1996. *A Scoping Study on Energy-Efficiency Market Transformation by California Utility DSM Programs*. Earnest Orlando Lawrence Berkeley National Laboratory, Berkeley, Calif.

Peters, Jane S., Bruce Mast, Lori Megdal, Patrice Ignelzi. 1998. Final Report: Market Effects Summary Study. California Demand Side Management Advisory Committee. (forthcoming).

Bibliography of Market Effects and Market Transformation Evaluation Literature

Boston Edison Company. 1997. *Five Year Energy Efficiency Plan, Impact 2002, Initiatives for Managing Production & Conservation Technologies & Transformations*, September 2.

deLaski, Andrew, and Ted Pope. 1996. "Spinning Toward High-Efficiency Clothes Washers: Progress and Directions of a National Market Transformation Initiative," *Proceedings of the 1996 ACEEE Summer Study*, Asilomar, Calif.: 2.53–2.61.

Eklund, Ken, Tom Hewes, Tom Lineham, and Mike Lubliner. 1996. "Manufactured Housing in the Pacific Northwest: Moving from the Region's Largest Utility-Sponsored Market Transformation Venture to an Industry Marketing Program," *Proceedings of the 1996 ACEEE Summer Study*, Asilomar, Calif.: 2.63–2.70.

Feldman, Shel. 1995a. "How Do We Measure the Invisible Hand?" *Proceedings of the 1995 International Energy Program Evaluation Conference*, Chicago, Ill.: 3–8.

Feldman, Shel. 1995b. "Measuring Market Effects: Sales Data Are the Last Thing You Should Look At," *Proceedings of the 1995 AESP Annual Meeting*, Competition: Dealing With Change, Boca Raton, Fla.: 83–90.

Feldman, Shel. 1996. *On Estimating the Value Added Through Market Transformation*, Oak Ridge National Laboratory, ORNL/Sub/96-ST788, U.S. Department of Energy contract DE-AC05-960R22464, Oak Ridge, Tenn.

Feldman, Shel. 1997. "Apres Nous, Le Deluge? What will Happen to Energy Efficiency Markets in a Restructured Industry?", *Proceedings of the 1997 International Evaluation Conference*, Chicago, Ill.: 533–539.

GDS Associates, Inc. 1997. *Evaluation Methodology, Market Assessment Plans and Tier 2 Incentive Indicators for Boston Gas Company Market Transformation Programs*, Draft Report prepared by: Richard Spellman, Shel Feldman, Kenneth Keating and Lori Megdal, Marietta, Ga.

Goldstone, Sy. 1995. "Restructure: A Stimulus to Improving Utility DSM, How Economists Might Help." *Proceedings Western Economic Association, 70th Annual Conferences.* San Diego, Calif. July.

Goldstone, Sy. 1996. *The Changing Nature of Public Interests in Energy Efficiency Due to a Restructuring: A Foundation Paper.* California Energy Commission, Sacramento, CA. April.

Gordon, Frederick, and Tom Eckman. 1995. "Planning for Market Transformation: Slicing the Cake From a Different Angle," *The Energy Services Journal.* 1 (2): 129–142.

Haeri, Hossein, Sami Khawaja, Jennifer Stout, and Jamshid Hosseini. 1997. "Market Transformation: Measuring the Immeasurable," *Proceedings of the 1997 Energy Program Evaluation Conference,* Chicago, Ill.: 311–318.

Hall, Nicholas P. and John H. Reed. 1996. "Marketing Energy Efficiency As a Commodity," *Proceedings of the 1996 ACEEE Summer Study,* Asilomar, Calif.: 5.61–5.68.

Hastie, Steve, and Chris Granda. 1997. "Evaluation of the IFC/GEF Poland Efficient Lighting Project (PELP)," *Proceedings of the 1997 Energy Program Evaluation Conference,* Chicago, Ill.: 634–635.

Herman, Patricia, Shel Feldman, Shahana Samiullah, and Kirsten Stacey Mounzih. 1997. "Measuring Market Transformation: First You Need A Story...," *Proceedings of the 1997 Energy Program Evaluation Conference,* Chicago, Ill.: 319–325.

Herman, Patricia and Elizabeth Hicks, "From Theory Into Practice: One Utility's Experience with Applying the Value Test," *Proceedings of the 1994 ACEEE Summer Study,* Asilomar, Calif.: Vol. 8.

Lee, Allen D., and Robin Conger. 1996. "Market Transformation: Does It Work?—The Super Efficient Refrigerator Program," *Proceedings of the 1996 ACEEE Summer Study,* Asilomar, Calif.: 3.69–3.80.

Levine, Mark and Richard Sonnenblick, "On the Assessment of Utility Demand Side Management Programs," Energy Policy 22, (10), October 1994, Special Issue Markets for Energy Efficiency.

McMenamin, J.S., F. Monforte, and I. Rohmund. 1994. "DSM Technology Forecasting: Market Transformation and the Dynamic Baseline", *Proceedings of the ACEEE 1994 Summer Study on Energy Efficiency in Buildings*: 10.155–10.162.

Meberg, Bruce, Shel Feldman, Corey Stone, and Elizabeth M. Tolkin. 1997. "Converging on the Effects of Utility Lighting Efficiency Programs," *Proceedings of the 1997 Energy Program Evaluation Conference,* Chicago, Ill.: 327–334.

Megdal, Lori, Steve Pertusiello, and Bonnie Jacobson. 1997. "Measuring Market Transformation Due to Prior Utility Efforts", *Proceedings from the 1997 Energy Program Evaluation Conference,* Chicago, Ill., August: 163–170.

Messenger, Michael. 1996. "From Resource Value to Market Transformation: The Case for a Change in the Design Goals of Publicly Funded DSM Programs," *Proceedings of the ACEEE 1996 Summer Study on Energy Efficiency in Buildings,* Asilomar, Calif.: 7.105–7.113.

Nolden, Sandra L. and Stephen J. Morgan. 1996. "Super-Efficient Refrigerators for Apartments: The NYPA/NYCHA Project as a New Market Transformation Model," *Proceedings of the 1996 ACEEE Summer Study*, Asilomar, Calif.: 2.181–2.185.

Peach, H. Gil, Pamela Brandis, C. Eric Bonnyman, and Agenta Persson. 1996. "Market Transformation in Manufactured Housing: A Pacific Northwest Experience," *Proceedings of the 1996 ACEEE Summer Study*, Asilomar, Calif.: 3.115–3.122.

Pigg, S., R. Prahl, and M. Wegener. 1997. "Motor Market Transformation in a Time of Utility Restructuring—The Wisconsin Story," *Proceedings of the 1997 Energy Program Evaluation Conference*, Chicago, Ill.: 447–453.

Prahl, R. and J. Schlegel. 1993. "Evaluating Market Transformation", *Proceedings of the 1993 Energy Program Evaluation Conference* Chicago, Ill. August: 469–477.

Prahl, R. and J. Schlegel. 1994. "DSM Resource Acquisition and Market Transformation: Two Inconsistent Policy Objectives?" *Proceedings of the 1994 ACEEE Summer Study*, Asilomar, Calif.: 6.157–6.166.

Raab Associates, Ltd. 1995. "Discussion Paper: Evaluating Programs With Market Effects", prepared for the New York Public Service Commission Staff (51 pages).

Raab, Jonathan and Jane S. Peters. 1997. *First Year Status Report: Evaluation of Regional Market Transformation Efforts.* NARUC RFP #96-02. October.

Reed, John, and Nicholas Hall. 1997. "Methods for Measuring Market Transformation," *Proceedings of the 1997 Energy Program Evaluation Conference*, Chicago, Ill. August: 177–184.

Rogers, Everett. 1995. *Diffusion of Innovations*, 4th edition, Free Press: New York, NY.

Rosenberg, Mitchell. 1995. "Strategies to Quantify Market Transformation and Spillover Effects of DSM Programs," *The Energy Services Journal* 1 (2): 143–157.

Saxonis, William P. 1997. "Market Transformation: Real Problems, Real Answers," *Proceedings of the 1997 Energy Program Evaluation Conference*, Chicago, Ill.: 171–176.

Schlegel, Jeff, Miriam Goldberg, Jonathan Raab, Ralph Prahl, Marshall Keneipp, Daniel Violette. 1997. *Evaluating Energy-Efficiency Programs In a Restructure Industry Environment: A Handbook for PUC Staff.* National Association of Regulatory Utility Commissioners, Washington, D.C., April.

Suozzo, Margaret, and Steven Nadel. 1996. "Learning the Lessons of Market Transformation Programs," *Proceedings of the 1996 ACEEE Summer Study*, Asilomar, Calif.: pp. 2.195–2.206.

Synergic Resources Corporation. 1996. *Market Transformation In A Changing Utility Environment.* National Association of Regulatory Utility Commissioners, Washington, D.C., March.