10
9-20-96 JSD

LBNL-39058
UC-1322

ERNEST ORLANDO LAWRENCE
BERKELEY NATIONAL LABORATORY

A Scoping Study on Energy-Efficiency Market Transformation by California Utility DSM Programs

J. Eto, R. Prahl, and J. Schlegel
Energy and Environment Division

July 1996

DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor The Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or The Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof, or The Regents of the University of California.

Ernest Orlando Lawrence Berkeley National Laboratory
is an equal opportunity employer.

LBNL-39058
UC-1322

A Scoping Study on Energy-Efficiency Market Transformation by California Utility DSM Programs

Prepared by

Joseph Eto, Ralph Prahl, and Jeff Schlegel[1]

Energy & Environment Division
Earnest Orlando Lawrence Berkeley National Laboratory
University of California
Berkeley, California 94720

Prepared for

The California Demand-Side Measurement Advisory Committee

Project 2091T

MASTER

July 1996

The work described in this study was supported by the California Demand-Side Measurement Advisory Committee (CADMAC), and by the Assistant Secretary of Energy Efficiency and Renewable Energy, Office of Utility Technologies, Office of Energy Management Division of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098.

---

[1] Authors are listed in alphabetical order. Ralph Prahl and Jeff Schlegel are independent consultants to the California Public Utilities Commission, Commission Advisory and Compliance Division.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

Recycled Paper

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Contents

Tables iii

Figures v

Acknowledgments vii

Acronyms and Abbreviations ix

Executive Summary xi

Chapter 1: Introduction 1

1.1 Sources of Information 2
1.2 Summary of Tasks 4

Chapter 2: Market Barriers, Market Effects, and Market Transformation 7

2.1 Definitions of Key Terms 7
2.2 Market Barriers Relevant to Utility Energy-Efficiency Programs 11
2.3 Market Effects Attributable to Utility Energy-Efficiency Programs 17

Chapter 3: Evidence for Market Transformation from Recent California Utility Energy-Efficiency Programs 21

3.1 Approach to Utility Energy-Efficiency Program Reviews 21
3.2 A Graphical Tool for Program-Specific Analysis of Market Effects 23
3.3 Residential, Commercial, and Industrial Customer Incentives Programs . . . 26
3.4 Information Programs 50
3.5 New Construction Programs 58
3.6 Direct Assistance Programs 68
3.7 Summary 72

Chapter 4: Does California's Current DSM Policy Framework Support the Objective of Market Transformation? 75

4.1 California's DSM Policy Framework Promotes Resource Acquisition 76
4.2 The DSM Policy Framework Provides Mixed Incentives for Market Transformation 78

4.3 California's M&E Protocols Do Not Encourage Measurement of Market Effects 88
4.4 There Are Modest Compensations for Market Transformation in the Existing Policy Framework 96
4.5 Conclusions 98

Chapter 5: Conclusions and Recommendations 101

5.1 Summary of Conclusions 101
5.2 Recommendations 104

References 121

Appendix A: List of Interviews and Interview Guides 123

Tables

Table 1-1. California Utility Energy-Efficiency Programs Reviewed 3
Table 2-1. List of Market Effects Potentially Attributable to Utility Energy-Efficiency Programs 20

Figures

Figure 2-1. Organization of Market Actors in an "Idealized" Market 17
Figure 3-1. Sample Market Influence Diagram 25
Figure 3-2. C & I EEI: Lighting Incentive and Information Program 35
Figure 3-3. RAEI: Refrigerator Incentive and Information Program 39
Figure 3-4. Manufacturer Incentive Program 44
Figure 3-5. Prototypical Customer Information Program 56
Figure 3-6. New Construction Program 59
Figure 3-7. SCG Direct Assistance Programs 70

Acknowledgments

We would like to express our appreciation to the California Demand-Side Measurement Advisory Committee (CADMAC) and especially to the Market Effects Subcommittee for their support of this project. We are grateful for the thoughtful comments provided on drafts of the report by members of both the Committee and Subcommittee, including Athena Besa, SDG&E, Bob Burt, CMA, Elsia Galawish, PG&E, Pierre Landry, SCE, Mike Messenger, CEC, Peter Miller, NRDC, Don Schultz, CPUC/DRA, and Ed Vine, CIEE, as well as those provided by Shel Feldman, Gary Fernstrom, Chuck Goldman, Fred Gordon, and Ken Keating.

The work described in this study was funded by the CADMAC (through PG&E, SDG&E, SCE, and SCG), and by the Assistant Secretary of Energy Efficiency and Renewable Energy, Office of Utility Technologies, Office of Energy Management Division of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098.

Acronyms and Abbreviations

A&E	Architectural and engineering
C&I	Commercial and industrial
CADMAC	California Demand-Side Measurement Advisory Committee
CBO	Community-based organization
CEEI	Commercial energy-efficiency incentives
CHEERS	California Home Energy-Efficiency Rating System
CPUC	California Public Utilities Commission
CTAC	Commercial Technology Applications Center
DISCo	Distribution company
DSM	Demand-side management
EEI	Energy-efficiency incentives
EMS	Energy management services
HVAC	Heating, ventilation, and air conditioning
IEEI	Industrial energy-efficiency incentives
LIHEAP	Low-Income Home Energy Assistance Program
M&E	Measurement and evaluation
NREMS	Nonresidential energy management services
PG&E	Pacific Gas & Electric Company
RAEI	Residential appliance efficiency incentive
REMS	Residential energy management services
RWRI	Residential weatherization retrofit incentive
SCE	Southern California Edison Company
SCG	Southern California Gas Company
SDG&E	San Diego Gas & Electric Company
VSD	Variable speed drive

Executive Summary

Market transformation has emerged as a central policy objective for future publicly-funded energy-efficiency programs in California. California Public Utilities Commission (CPUC) Decision 95-12-063 calls for public spending to shift to activities designed to transform the energy market. However, there are numerous questions that must be answered before this objective can be pursued effectively. For example, how should market transformation be defined? Which current utility energy-efficiency programs, if any, have had market-transforming effects? To what extent do current regulatory policies and practices encourage or discourage utilities from running programs designed to transform energy-efficiency markets? Should the policies be modified to promote market transformation? If so, how?

This scoping study, conducted at the request of the California Demand-Side Measurement Advisory Committee (CADMAC), under the Market Effects Subcommittee, seeks to answer these questions. In the study, the authors:

1. Propose an operational definition of market transformation that is based on assessing the degree to which utility programs have had market effects and have overcome underlying market barriers to energy efficiency in a lasting fashion.

2. Review selected recent California utility energy-efficiency programs to examine the market barriers they address, and tentatively identify market effects that might be studied to determine the success of the programs in reducing market barriers and transforming markets.

3. Review California's DSM regulatory policies [including the DSM policy rules, shareholder incentive mechanisms, and measurement and evaluation (M&E) protocols] to assess how they encourage or discourage the utilities to use DSM programs to transform energy-efficiency markets.

4. Examine the extent to which the M&E protocols encourage utilities to capture evidence on the market effects of utility energy-efficiency programs.

5. Present recommendations intended to help align California's DSM regulatory policies with the objective of market transformation.

Supporting information for the study came from three main sources. First, we reviewed the literature on market barriers and market transformation in order to develop a sound analytical foundation. Second, we reviewed extensive background materials on each utility's recent energy-efficiency program offerings. Finally, we interviewed senior utility program staff and

selected program managers on the influence of current DSM regulatory policies on their energy-efficiency program design and implementation decisions.

Findings

The definition of market transformation adopted for this report is based on the need to have a standard by which to judge market interventions in a regulatory environment. Under this definition, market transformation means a reduction in market barriers due to a market intervention, as evidenced by a set of market effects, that lasts after the intervention has been withdrawn, reduced or changed. A market effect is 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-efficiency products, services, or practices and is causally related to market interventions. If an energy-efficiency program yields no lasting market effects, then the market has not been transformed, because the reduction in market barriers has been only temporary. If a program does yield lasting market effects but further intervention is still warranted, then the market has only been partially transformed. Finally, if there are lasting market effects and the most important and relevant market barriers have been reduced to the point where further intervention is no longer deemed appropriate, then the market has been completely transformed.

Given this broad definition of market transformation, all utility energy-efficiency programs have the potential to transform markets. Therefore, *a priori* exclusions of any program types from the category of "potentially causing market transformation" appear unwarranted. Market transformation is not a label that uniquely identifies certain energy-efficiency program designs to the exclusion of others. It is instead an objective that all energy-efficiency programs have at least a theoretical potential to achieve to varying degrees. However, a program's success in achieving market transformation cannot be settled in the abstract. It must instead be established by a review of the program's design intent and execution, and of the market effects attributable to the program.

How successful, then, have California's recent energy-efficiency programs been in transforming markets? Our review of a selection of these programs shows mixed results. Many programs, particularly those offering financial incentives to customers or trade allies, do appear to have produced significant market effects. Some of the more common effects suggested by our review include the following:

- Changes in products and product attributes (including improvements in product quality);
- Changes in production levels and schedules;
- Changes in promotional practices among dealers and manufacturers;
- Changes in stocking practices among dealers and distributors;

- Increases in product and service availability;
- Reductions in the incremental costs of energy-efficiency products and services;
- Changes in design and specification practices;
- Changes in new construction codes and in enforcement of existing codes;
- Changes in awareness and knowledge of energy efficiency among customers, manufacturers, and other businesses in the distribution chain; and
- Changes in decision-making practices among organizations (especially those with multiple sites).

However, there is little evidence documenting the existence or extent of these market effects. This lack of evidence appears to be due in part to the strong emphasis the California M&E protocols place on the measurement of direct load impacts, which has had the effect of diverting utility attention away from other types of evaluation research that would shed more light on the market effects of utility energy-efficiency programs. Recent underspending by the utilities of their evaluation budgets suggests that funds for additional evaluation (including market evaluation) are available. However, staffing limitations, combined with a desire to contain costs, appear to have limited utility interest in performing any studies, such as evaluations of market effects, that are not directly required for purposes of shareholder incentives or for other explicit commitments.

If they have in fact occurred, the market effects listed above have the potential to lead to reductions in many of the market barriers impeding the effective functioning of energy-efficiency markets, including information cost, hassle and search costs, performance uncertainty, product unavailability, organization practices and custom, and asymmetric information. However, both economic reasoning and the results of our interviews with program managers suggest that many of these reductions in market barriers may be temporary in nature.

The market effects that appear to be most likely to last are those associated with energy-efficient lighting, changes in decision-making practices within some organizations (especially those with multiple sites), changes made to manufactured equipment (e.g., technological improvements to chillers), changes in design and specification practices, and changes in codes and standards. Although these are only a portion of the market effects identified in this report, they would result in large savings and benefits for customers and society.

An analysis of California's current DSM policy framework—the DSM policy rules, shareholder incentive mechanisms, and M&E protocols—suggests that whatever market effects have occurred are likely to be less significant than those that could occur under a framework explicitly designed to promote market transformation as a policy objective. The existing policy framework was developed to promote resource acquisition, or the generation of energy savings which are sufficiently reliable, predictable, and measurable to replace supply-side options in the planning process. Existing policies have been very successful in

achieving this objective. However, for several reasons, some of the same policies that have been effective in promoting resource acquisition are likely to discourage the utilities from attempting to transform energy-efficiency markets.

First, under the current DSM policy framework, utilities are more likely to be punished than rewarded for causing beneficial market effects, because of the emphasis placed by the M&E protocols on comparisons between customers who actively participate in energy-efficiency programs and those who do not. Because most market effects tend to reduce consumption among nonparticipants, such comparisons tend to understate the savings attributable to the program being evaluated. The effects of this penalty appear to outweigh any potential rewards for market effects, such as increased measure availability leading to increased participation in resource programs, or reductions in incremental costs leading to increases in the net benefits attributable to each measure claimed under an energy-efficiency program.

Second, the emphasis on reliable and predictable savings encourages the utilities to focus their programming efforts on a few select marketing approaches which tend to limit the range of market barriers that can be effectively addressed. For example, the utilities have an incentive to target customers rather than other market actors, which limits the potential for programs to address market barriers that do not directly involve customers. The utilities also have an incentive to focus on specific customer purchasing decisions rather than on broader behavioral patterns, which tends to limit the potential for addressing market barriers which cannot easily be influenced by changing an individual purchase decision. Finally, the utilities have an incentive to emphasize financial incentives over other marketing methods, which may be less effective in addressing market barriers that are not financial in nature.

Third, the current shared savings shareholder incentive mechanisms, which offer utilities a fixed, uniform percentage of the net benefits their programs achieve, strongly encourage a focus on promoting only the most cost-effective measures. This tends to discourage the utilities from promoting promising new technologies which require commercialization efforts in order to increase production volumes and thus lower incremental costs over standard technologies. It also tends to discourage the utilities from marketing to the residential sector, which simultaneously raises equity issues and limits the potential for energy-efficiency programs to transform markets for residential energy-efficiency products and services.

Fourth, while the current M&E protocols have been very successful in encouraging the utilities to accurately measure the resource benefits of their programs, they tend to discourage the utilities from trying to use market effects studies to meet filing requirements. Although both the basic research philosophy and some of the key definitions underlying the protocols are theoretically adaptable to the measurement of market effects, the utilities face substantial disincentives to trying to apply them in this manner. These disincentives include: (1) the requirement that measurement activities focus solely on load impacts, rather than on indicators of market effects; (2) the required use of concepts that, if not explicitly disallowing

the measurement of market effects, at least make such measurement fundamentally risky; (3) the lack of agreed-upon methods for estimating market effects, which are enshrined in the protocols; and (4) reporting requirements that are not easily adaptable to the measurement of market effects.

Although various attempts have been made in recent years to adjust California's policy environment to make it more conducive to market transformation, these adjustments have not been sufficient to significantly alter the fundamental structure of incentives and disincentives that discourage the utilities from actively pursuing market transformation as a program objective. Furthermore, it appears that under most future industry restructuring scenarios, business considerations alone will not provide utilities with much incentive to pursue many socially desirable market transformation activities

For all of these reasons, we conclude that, if the CPUC wishes to pursue market transformation as a policy objective, some changes in California's DSM policy framework will be needed.

Recommendations

The last chapter of this report provides a number of recommendations regarding how California's policies, programs, and incentive mechanisms can be changed to better promote the objective of market transformation. In the remainder of this executive summary, we summarize these recommendations. We begin by discussing needed *policy* changes in the overall strategic orientation of California's energy-efficiency efforts. Next, we outline a broad *evaluation and research* agenda that encompasses but also extends beyond the current role of evaluation solely as a means for verifying performance incentive claims. We then present recommendations on *performance incentives* for market transformation. Finally, we address *transition issues.*

Overall Regulatory Policies

1. Given that market transformation is a strategic objective of the CPUC, and that the recent increase in emphasis on this objective represents a shift in public policy, we recommend that the energy-efficiency policy framework be revised to align it more with the strategic objective of market transformation. All energy-efficiency and DSM policies—policy rules, incentive mechanisms, and M&E protocols—need to be reconsidered with the strategic objective of market transformation consciously in mind.

2. As a first step toward revising and realigning the policy framework to provide support for market transformation, we recommend that the CPUC clarify the strategic objective of market transformation. Working through the details of aligning the policy framework with the strategic objective of market transformation will require further clarification of what the CPUC and others mean by "market transformation." We recommend that the CPUC and others consider using the definitions presented in this report.

3. We recommend that the CPUC and other policy decision makers make fully informed and conscious choices when making any changes to the policy framework. Although we support the CPUC's increased emphasis on market transformation, we recommend that decision makers remain realistic about the associated risks and rewards. In addition, we recommend that the potential risks and rewards of market transformation be balanced with those of the current resource acquisition framework. One way to do this might be to develop a two-tiered policy framework for publicly-funded energy-efficiency efforts. For certain measures, customer sectors, or markets, the policies, incentive mechanisms, and programs developed under the resource acquisition framework could be continued; for others, a new policy framework focused on market transformation could be developed. Over time, as more is learned about both the specific market effects of traditional DSM programs, and the ability of market transformation initiatives to change markets, informed decisions could be made regarding which policies, incentive mechanisms, and programs from the first tier are appropriate to retain under a market transformation framework.

4. Changes to the existing policy framework need not be global, and should not be made without considering the value of other objectives, including resource acquisition. Although market transformation is an important strategic objective, it is only one strategic objective of publicly funded energy-efficiency that can be employed to attain social goals.

5. We recommend that the CPUC ensure a stable policy framework and policy environment for market transformation. While we recognize that the industry is going through many changes associated with restructuring, we recommend that the CPUC make special efforts to ensure the stable policy environment that is necessary to support market transformation objectives.

6. Revisions to the policy framework should depend in part on the agents selected to implement the policy objectives. Many of our remaining recommendations are framed according to whether or not they presume that the CPUC or others wish to use the utilities as the agents of market transformation efforts. In addition, we distinguish between agents acting as *implementors* responsible for marketing efforts and agents acting as *administrators* responsible for selecting and overseeing implementors.

7. We recommend that the revised policy framework increase focus on programs and interventions addressing markets (as opposed to individual customers), on reducing market barriers in a lasting manner (as opposed to short-term marketing efforts), and on long-term impacts on the structure and function of markets (as opposed to customer participation in a single year). This will require a shift in focus and strategy, and a shift in some program activities. However, this recommendation does not mean that all current efforts should be discarded, or that there should be any *a priori* limits regarding what types of programs are viewed as possibly helping to transform markets.

8. We recommend that the CPUC and others consider adopting broad definitions of performance and success. Revised definitions of performance and success should be considered for all purposes and potential agents, including utilities, statewide administrators, and state agencies. This reconsideration of the meaning of "success" should not be limited to or dominated by performance incentive issues, which are treated separately. Estimates of market transformation benefits will be less certain than estimates of resource acquisition savings, and often the true success of a market transformation initiative will not be known for several years. Therefore, relying on ultimate outcomes (such as direct load impacts) as the primary indicator of success is not practical or viable for most market transformation initiatives. Instead, we recommend relying on either indicators of market effects or on good-faith execution of an implementation plan.

9. We recommend that CPUC oversight, monitoring, and review efforts focus on ensuring long-term performance and success. Decision makers should stay focused on achieving the long-term objectives of market transformation, rather than on the performance of one initiative in a single year. In addition, tracking, accounting, and reporting processes and procedures will need to be modified and/or developed to address the fact that market effects may (1) be due to several programs, (2) be due to several program years, (3) be caused by programs of other utilities and organizations, including those from other states, and (4) become evident over long time periods.

10. We recommend that the existing rigorous cost-effectiveness framework not be applied to market transformation initiatives. Instead, further research should be undertaken to develop a practical and meaningful framework for assessing the cost-effectiveness of market transformation efforts.

Evaluation and Research

11. Evaluation and research efforts should be refocused to ensure that the information needs of a market transformation approach are better met. The CPUC, utilities, and other parties will not be able to make effective progress on market transformation in the absence

of critical information. In order to have this information available, greater focus is needed on assessing markets, evaluating market effects, and evaluating reductions in market barriers.

12. Evaluation and research related to market transformation efforts should not be focused solely on end results, or be used primarily for performance incentives. There are many other purposes for evaluation and research of market transformation, including supporting program planning activities, providing guidance regarding the implementation of market transformation initiatives, and providing indicators of the effectiveness of specific market transformation strategies.

13. Regardless of the policy framework, or of who is responsible for evaluating market transformation initiatives, efforts to evaluate the market effects of programs and interventions should recognize that market effects can be measured only imprecisely. The reasons for this imprecision revolve around the characteristics of markets themselves. Markets are complex, dynamic, and constantly evolving—all of which increase evaluation challenges. The resulting imprecision in the estimation of market effects increases the potential for subjectivity and gaming on the part of agents. Institutional procedures and mechanisms will need to be developed to minimize the impact of any potential gaming.

14. The approach to evaluation and research will depend to some degree on the agents selected to administer the overall market transformation effort, implement the specific programs and interventions, and conduct the evaluation studies—and on the responsibilities assigned to these agents. There are three main options for evaluation and research agents: utilities (assuming utilities will continue to be administrative agents), a statewide entity, or an independent third party. Several issues should be considered when selecting an evaluation agent, including: (1) the importance of independent and objective research, especially because of the larger uncertainties associated with the evaluation of market transformation; (2) threats to objectivity arising from perceived or real conflicts of interest; and (3) integration and coordination of evaluation efforts, so that ongoing monitoring efforts of implementors can feed into the overall evaluation efforts of the evaluation agent without undue duplication of effort, or intrusions on customers or other market actors.

15. The limits to precision surrounding the measurement of market effects will require the development of new evaluation methods, practices and approaches. Among other things, we recommend that evaluations of market effects:

- Articulate specific theories about what market effects and reductions in market barriers specific interventions are expected to have;
- Measure a wide range of market indicators, both before, during, and after interventions, using a variety of methods;
- Compare observed changes in market indicators (i.e., market effects), and the sequence of these changes, to what would be expected if the program is working as intended, as

well as to estimates of what would have occurred in the absence of the intervention (i.e., identify market effects caused by the program); and

- Link observations of market effects to reductions in market barriers.

16. We recommend that the CPUC, utilities, and other parties assess the role and value of the existing M&E protocols in supporting a revised policy framework with greater focus on market transformation. We recommend that the M&E protocols be revised to reduce the frequency and/or the intensity of required traditional utility impact evaluations, in exchange for explicit requirements that the utilities conduct collaboratively-designed evaluations of market effects and reductions in market barriers. In addition, at least for the short term, we believe that informal collaboration among the parties should probably play a larger role than formal protocols in establishing the research methods to be pursued.

Performance Incentives

17. We recommend that policymakers develop performance incentives specifically intended to encourage support for, and effective implementation of, market transformation initiatives. Performance incentives are almost always useful in aligning the private interests of an agent selected to pursue a social goal with those of society as a whole; incentives are particularly appropriate when the goal being pursued is as challenging as changing the structure and functioning of energy-efficiency markets. We can identify at least three types of market transformation agents for whom performance incentives could be useful: (1) utilities; (2) a nonprofit organization; and (3) a state agency. We attempt to be clear regarding whether we view our recommendations as being universally applicable, or specific to one or more of the above agents. In particular, we will distinguish between two roles that these agents might play: (1) program administrator; and (2) program implementor.

18. The specific nature of the performance incentives developed should depend in part on whether the targeted market transformation agent is a program administrator or program implementor. Administrators should be held accountable for the overall effect of their actions on energy-efficiency markets (at least to the extent feasible), while implementors should be held accountable only for the extent to which their actions are effective within the constraints set by the administrator.

19. The specific nature of the performance incentives developed should also depend in part on whether the targeted market transformation agent is a utility, nonprofit organization, or state agency. For example, the disincentives to the pursuit of market transformation ventures that utilities or their successors are likely to face suggest that performance incentives for these organizations would need to be larger than for a nonprofit or a state agency. Similarly, use of a nonprofit or a state agency as the agent for market transformation efforts would require that performance incentives not be based on profit. In addition, if a nonprofit

organization were used as the agent, accomplishing its mission (the transformation of energy-efficiency markets to the point where intervention is no longer needed) could eliminate the need for the organization's continued existence. Therefore, performance incentives directed at the organization's officers may be needed to ensure that they have an adequate incentive to accomplish the organization's mission.

20. Regardless of the agent or agents for whom an incentive mechanism is intended, any incentive mechanisms intended to encourage the pursuit of market transformation initiatives should be:

- Carefully and thoughtfully aligned with explicit policy objectives;
- Clear in their intended message;
- Understandable and accessible;
- Composed of rewards and/or penalties tied to outcomes the agent can affect;
- Reasonably balanced between risks and rewards for the agent and society as a whole;
- Large enough to attract and retain the attention of the agent's management;
- Timely; and
- Relatively easy to monitor with respect to evaluating performance.

21. Regardless of the agent or agents selected, performance incentive mechanisms intended to encourage the pursuit of market transformation initiatives must take into account the nature of markets and of market effects. First, the challenges surrounding the measurement of market effects suggest that it will generally be neither feasible nor desirable to base performance incentive mechanisms for market transformation on direct load impacts. Instead, such incentive mechanisms will need to be based either on indicators of market effects or on the good-faith implementation of planned tasks. Second, because not all markets are structured at the level of end-uses or programs, these may not be appropriate categories by which to structure market transformation incentive mechanisms. Instead, it will be necessary to establish the structure and boundaries of individual energy-efficiency markets, and structure incentive mechanisms along the lines of targeted markets. Third, because markets change only gradually, performance incentives based on market effects must allow sufficient time—in some cases, at least several years—for the effects to occur.

22. Regardless of the agent or agents responsible for market transformation efforts, incentive mechanisms based on market effects must take into account the limited precision with which the market effects of energy-efficiency programs can be measured. This imprecision creates a fundamental challenge, revolving around the potential risks to ratepayers, as well as the potential for systematic gaming of the results. This challenge might be approached either by establishing appropriate caps on incentive payments, by delegating some or all responsibility for the evaluation of market effects to a neutral third party, by combining different market transformation initiatives in portfolios, or by basing performance incentive payments on multiple indicators of market effects.

Transition Issues

23. We recommend that the CPUC, the utilities, and other parties begin *now* to gain valuable experience and gather useful information during the transition to a restructured industry, and to revise the DSM policy framework to increase its support for market transformation. Incremental progress on many of the policy framework issues identified above should be made now while restructuring decisions are being implemented. Below are three of our near-term recommendations:

- We recommend that the M&E protocols should be revised to reduce the frequency and/or the intensity of required traditional impact evaluations, in exchange for explicit requirements that the utilities conduct collaboratively-designed evaluations of market effects and reductions in market barriers.

- We recommend that performance incentive mechanisms based on indicators of market effects should be explored. For programs with existing shared savings or performance adder mechanisms, mechanisms based on indicators of market effects should be implemented either in place of or in addition to the existing shareholder incentive mechanisms. In addition, a performance incentive mechanism for commercialization efforts should be designed and implemented.

- We recommend that the CPUC consider directing the utilities to allocate a portion of the M&E budgets, which have been underspent in recent years, to fund studies of market effects and reductions in market barriers. Alternatively, the necessary funds could be transferred to a third party to conduct the studies.

Individuals and organizations in California have a great opportunity now to begin to shift the focus of the policy framework and existing practice towards increased support of market transformation objectives. Failure to make progress and increase the experience and knowledge of market transformation beginning now and continuing over the next two years will hinder the development of the new energy-efficiency framework that the CPUC envisioned in its restructuring decisions.

CHAPTER 1

Introduction

Market transformation has emerged as a central policy objective for future publicly-funded energy-efficiency programs in California.[2] California Public Utilities Commission (CPUC) Decision 95-12-063 calls for public funding to shift to activities designed to transform the energy-efficiency market (CPUC 1995).[3] The CPUC envisions that funding "would only be needed for specific and limited periods of time to cause the market to be transformed" (page 156). At the same time, the CPUC also acknowledges that "there are many definitions of market transformation" ... and does "not attempt to refine those definitions today " (also page 156).

We argue that a definition of market transformation is essential. The literature is now replete with definitions (see, for example, Feldman 1995), and an operational definition is needed for the CPUC to decide on which programs should be supported with public funds. The CPUC decision initially indicated a preference for programs that do not provide financial assistance to customers.[4] However, energy-efficiency programs that rely on financial assistance to customers have traditionally accounted for a substantial portion of California utility's DSM programs, so the CPUC's direction to use ratepayer funds to support programs that will transform the market raises critical questions about how to analyze what has happened in order to plan effectively for the future: Which utility energy-efficiency programs, including those that provide financial assistance to customers, have had market transforming effects? To what extent do current regulatory rules and practices encourage or discourage utilities from running programs that are designed to transform the market? Should the rules and programs be modified, and, if so, how, to promote market transformation?

This scoping study, conducted at the request of the California Demand-Side Measurement Advisory Committee (CADMAC), under the Market Effects Subcommittee, examines whether the energy-efficiency programs offered by California's four investor-owned utilities (Pacific Gas and Electric Company or PG&E, San Diego Gas and Electric Company or SDG&E, Southern California Edison Company or SCE, and Southern California Gas

---

2 The notion of market transformation first appeared as a regulatory issue at the CPUC in 1993 when it was used in a CPUC-directed study by the Wisconsin Energy Conservation Corporation (WECC) to assess shareholder incentives for California utilities (Schlegel et al. 1993). Following the WECC report, the CPUC called for workshops on the market transformation issues raised by WECC and other program definition issues (CACD 1993). Since then the issue of market transformation has been considered and assessed at the CEC and in various CPUC proceedings (e.g., ex-post measurement proceedings, 1995 AEAP, PG&E 1995 GRC).

3 See Conclusions of Law 82 and 84, CPUC Decision 95-12-063.

4 See Conclusions of Law 83. Subsequently, the CPUC indicated interest in revisiting this preference based on input from the California Energy-Efficiency Services Working Group.

Company or SCG) and the policies underlying them support the goal of market transformation. We address this question in several ways:

(1) We propose an operational definition of market transformation that is based on assessing the degree to which utility programs have had market effects and have overcome underlying market barriers to energy efficiency in a lasting fashion (Chapter 2).

(2) We review selected recent California utility energy-efficiency programs to examine the market barriers they do and do not address, and we identify market effects that might be studied to determine the success of the programs in transforming markets (Chapter 3).

(3) We review California's DSM regulatory policies [including the DSM policy rules, shareholder incentive mechanisms, and measurement and evaluation (M&E) protocols] to assess how they reward and/or penalize the utilities for transforming markets with energy-efficiency programs. For the M&E protocols, which are of primary interest to CADMAC, we examine the extent to which these protocols encourage utilities to capture evidence on the market transforming effects of energy-efficiency programs (Chapter 4).

(4) After summarizing our findings, we develop a list of recommendations to help align California's DSM regulatory policies with the objective of market transformation (Chapter 5).

1.1 Sources of Information

Information for our analysis comes from three main sources. First, we reviewed the literature on market barriers and market transformation in order to develop a sound analytical foundation. Second, we reviewed extensive background materials on each utility's complete energy-efficiency program offerings; these materials included annual DSM program summary reports, minutes from DSM advisory committee meetings, program impact and process evaluations,[5] and program-specific descriptions and promotional materials. Third, we interviewed senior utility staff and selected program managers.[6] Our interviews with senior energy-efficiency staff sought utility views on the influence of current DSM regulatory policies (i.e., the DSM policy rules, shareholder incentive mechanisms, and M&E protocols) on the design and implementation of utility energy-efficiency programs in relation to the goal of market transformation. Our interviews with utility energy-efficiency program staff sought

---

5 We did not conduct technical reviews of the savings claims from the evaluations, but instead reviewed them only to determine the extent to which they contained evidence regarding market transformation. Thus, our comments on the evaluations should not be confused with independent professional judgements regarding their adequacy or accuracy.

6 Appendix A contains a list of the interviews we conducted.

information on the market transformation effects of recent utility energy-efficiency programs as well as on the influence of regulatory policy.

Our interviews of individual program managers were a critical source of information for our evaluation of the market transformation effects of recent California utility energy-efficiency programs (see Table 1-1). In selecting individual programs to review, we tried to satisfy a number of objectives. We wanted to make sure we covered: (1) all four utilities; (2) all major categories of energy-efficiency programs; (3) both residential and nonresidential sectors; (4) the programs responsible for the largest expenditures, savings, and shareholder incentives (generally the commercial energy-efficiency incentive/industrial energy-efficiency incentive programs); (5) both information/energy management services (performance-based incentive) programs and resource (shared savings incentive) programs; (6) all major market barriers; (7) all major market effects generally identified or discussed in California; (8) programs that planned explicitly to reduce market barriers or achieve market effects; (9) programs with research (process evaluations or load impact studies) that claimed to observe or estimate market effects from the programs; and (10) programs that could provide unique insights into the compatibility of California's policies and programs with market transformation objectives. Because of resource constraints, we did not cover all programs operating in California.

Our observations on the market transformation effects of California utility energy-efficiency programs are based on information provided by the utilities (either in written form or through interviews) or on prior work by the authors. (We did not interview market actors, such as customers or trade allies, or other interested parties.) The information is limited for the most part to recent or current energy-efficiency program offerings by the utilities (i.e., from about 1994 to early 1996). Hence, we offer limited observations on the market transforming effects of older California utility energy-efficiency programs.

Table 1-1. California Utility Energy-Efficiency Programs Reviewed[7]

	Pacific Gas and Electric	San Diego Gas and Electric	Southern California Edison	Southern California Gas
Residential				
Information		X	X	
Energy Management Services			X	
Appliance Efficiency Incentives	X	X		
New Construction		X		X
Direct Assistance				X
Nonresidential				
Information			X	
Energy Management Services	X		X	
Energy-Efficiency Incentives	X	X	X	X
New Construction	X			X

1.2 Summary of Tasks

We divided our work into seven tasks, described below:

1. *Develop (a) a list of market effects and (b) a systematic framework for reviewing market barriers, reductions in market barriers, and other market effects.*

This task is taken up in Chapter 2. We define key terms used in our study, including market barriers, market effects, and market transformation, and the related concepts of market failure and market intervention. We describe a number of market barriers relevant to utility DSM programs and an important clarification to the market barrier most frequently cited by DSM practitioners, high first cost. We list the market effects that might be examined as evidence that a utility energy-efficiency program has reduced market barriers. (This list is also intended

[7] See California's DSM Policy Rules for definitions of these program types.

to fulfill the request made of CADMAC in the 1995 AEAP to provide such a list for EMS programs as well as for other program types).

2. *Review current utility energy-efficiency programs to determine the extent to which they are designed and implemented to reduce market barriers and achieve market effects.*

This task is taken up in Chapter 3. We reviewed descriptions of programs based on utility filings and program materials. We identified a subset of programs to evaluate in detail (see Table 1-1). We interviewed key program managers to help determine market barriers addressed by the programs, the extent to which the programs have been successful in reducing market barriers, and evidence of market effects. We introduce a graphical tool, called market influence diagrams, to present our findings.

3. *Review DSM policy rules to determine the extent to which they support market transformation objectives.*

4. *Review current shareholder incentive mechanisms to determine the extent to which they are designed to encourage utilities to reduce market barriers and measure market effects.*

5. *Review current M&E protocols and assess the extent to which the protocols measure reductions of market barriers and other market effects of utility programs.*

Tasks 3, 4, and 5 are taken up in Chapter 4. We reviewed the DSM policy rules, which also describe the shareholder incentive mechanisms and the role of M&E activities, and we reviewed the M&E protocols. We also interviewed senior and program staff, at each of the four utilities (PG&E, SDG&E, SCE, and SCG) to understand their perspectives on the regulatory framework created by California's DSM policy. We focused on how policy has influenced the design and implementation of programs and the ability of programs to transform markets. Starting from our conclusion that the three areas of policy (DSM policy rules, shareholder incentive mechanisms, and M&E protocols) send a comprehensive, integrated (but sometimes conflicting) set of signals to utilities regarding market transformation, we initially present a single set of findings on the overall regulatory environment created by the three. We then describe specific market transformation issues embodied in M&E protocols and in the shareholder incentive mechanisms.

6. *Prepare a draft report that contains the list of market effects; the systematic framework; reports on the reviews of the programs, protocols, and shareholder incentive mechanisms; and recommendations based on our reviews.*

The draft report was submitted to CADMAC on June 12, 1996. Our recommendations are contained in Chapter 5.

7. *Prepare a final report that contains the material in the draft report and incorporates or responds to the review comments of CADMAC.*

This is the final report. It responds to comments received from both the members of CADMAC and from a small group of outside reviewers.

CHAPTER 2

Market Barriers, Market Effects, and Market Transformation

This chapter presents three critical elements of our analysis of the market effects of California utility energy-efficiency programs: (1) definitions and discussion of relationships among market barriers, market effects, market transformation, and the related concepts of market failure and market intervention; (2) detailed descriptions of market barriers to energy efficiency that are relevant to utility energy-efficiency programs; and (3) a framework for examining the market effects of utility energy-efficiency programs and a categorized list of market effects that are most often discussed.

2.1 Definitions of Key Terms

Controversy about the market transforming properties of utility energy-efficiency programs results from confusion about the terms market barrier, market failure, and market transformation. We have adopted the following definitions for the purposes of our study:

Market Barrier - any characteristic of the market for an energy-related product, service, or practice that helps to explain the gap between the actual level of investment in or practice of energy efficiency and an increased level that would appear to be cost beneficial.

We recognize that what is cost beneficial depends on one's perspective and is influenced by both energy and non-energy considerations. We propose to limit discussion in this report to activities that are cost beneficial either from a consumer's point of view or from society's.[8] We use the term "consumer" to refer to both individuals and firms. With this definition, one form of evidence for the presence of market barriers relies on comparing the implicit discount rate observed in consumers' energy-efficiency purchase decisions with the discount rate applied by consumers to comparable activities (i.e., those with comparable risks and liquidity) or those with an even lower social discount rate. Other forms of evidence include findings from studies in conservation behavior, transaction costs economics, and cognitive psychology.[9]

---

8 To the extent that a utility has an obligation to overcome market barriers, the utility's perspective must also be accounted for. Ensuring alignment of utility and customer or utility and societal perspectives, however, is a matter of regulatory policy, which we examine in Chapter 4.

9 See Goldstone (1996) for a recent discussion of the contributions of these disciplines to our understanding of market barriers to energy efficiency.

It is logical that if a market barrier is lowered, market adoption of energy-efficient products, services, or practices will increase. We recognize, however, that reducing any one market barrier may not lead to increases in adoption because other barriers may remain or be reinforced, or new barriers may be introduced.

Market Failure - a condition of a market that violates one or more neoclassical assumptions (e.g., perfect information, costless transactions, no externalities, rational behavior, etc.). These assumptions define an ideal market for products or services.

Market failure is a formal economic concept.[10] It is widely agreed that the existence of a market failure provides necessary but not sufficient justification for government intervention.[11] Market barriers, on the other hand, were defined by practitioners attempting to characterize what they believed was wrong with current energy service markets (i.e., what explained the "efficiency gap"). Not surprisingly, market barriers defined under these practical conditions do not appear to derive from a unified conceptual framework of human behavior as is required by the formal structure of neoclassical economic analysis, although some market barriers are formally recognized as market failures by economists (such as externalities). Recently, analysts have shown that, in fact, many market barriers can be seen as particular examples of accepted market failures, notably those associated with imperfect information. These analysts have shown that market barriers are generally consistent with the transaction cost economics notion of market failure.[12]

Whether the existence of market barriers provides justification for government intervention in markets is still hotly contested. Resolution of this debate is outside the scope of this report.[13] We rely on the precedent of Jaffe and Stavins (1994): "[T]hose market barriers that might justify public policy intervention to overcome them, we denote as [neoclassical] market failures." In other words, if there is an intervention that is net beneficial (enhances societal welfare) for a specific market barrier, then this market barrier is a market failure and we have a justification to intervene.

Market Intervention - a deliberate effort by government or utilities to reduce market barriers and thereby change the level of investment in (or practice of) energy efficiency.

---

10 See, for example, Harris and Carmen (1983) for a comprehensive listing of market failures.

11 The existence of market failure is not sufficient to justify intervention and does not by itself point to the appropriateness of any particular form of intervention. A proposed intervention must demonstrably improve social welfare; interventions might also decrease social welfare.

12 See Golove and Eto (1996) and Goldstone (1995), which use concepts from transaction cost economics to describe market barriers. See Williamson (1989) for an introduction to transaction cost economics.

13 See Golove and Eto (1996) for a recent treatment of these issues.

For the purpose of this report, utility energy-efficiency programs are examples of market interventions;[14] that is, interventions are defined as activities designed to reduce market barriers. An intervention's success in reducing market barriers, therefore, hinges on whether it leads to or causes a net beneficial outcome from a societal perspective. A net beneficial outcome requires that the increase in the adoption, procurement, or practice of energy efficiency is not offset by other losses (such as the cost of the intervention or its consequences).

We recognize that there other justifications for market interventions to achieve other societal objectives (such as equity). In this report, we are concerned primarily with those associated with economic efficiency (broadly defined to include environmental costs and benefits).

Market Effect - 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 intervention(s).

Market effects, as we have defined them, are evidence of whether and to what extent a market barrier(s) has been addressed effectively. If there is no observable market effect, then by our definition the relevant market barriers have not been reduced to a noticeable degree. For example, a market effect may not be observed because reductions in some market barriers may be accompanied by off-setting increases in others.

Market effects may be difficult to observe for reasons including the possibility of lagged market response to an intervention.[15] For example, market effects in the form of changes in consumer's attitudes, incentives, and knowledge are hard to observe independent of specific energy-efficiency actions, such as purchases.

If there is an observable market effect, it is necessary to be able to attribute this effect to a particular market intervention(s) in order to use this finding as evidence that the intervention reduced the market barrier(s). Markets change for many reasons. There are two alternative possibilities that are important to consider when trying to relate observable changes in markets to market interventions: (1) market changes that result from reductions in market barriers, but that are not caused by the particular market intervention being examined (i.e., the barrier would have been reduced without the intervention); and (2) market changes which do not result from any reduction in market barriers. Technological breakthroughs or producer pricing policies, for example, may change the incremental cost of the energy-

---

14 There are many other examples of market intervention, ranging from standards to public exhortation. One objective of this report is to identify the market effects of utility energy-efficiency programs in order to establish a common framework within which to assess their value as models for future interventions.

15 We also recognize that market effects could be defined as a change in the pattern of adoption of energy-efficient products, services, or practices, independent of any net increases in adoption. For the purpose of this report, we are concerned primarily with those market effects that lead to net changes in adoption.

efficiency features of products or services, leading to changes in the purchases of these products or services. However, changes in product or service costs are not by themselves evidence that any market barrier (or barriers) has changed. Only the conditions under which the market barrier originally prevented adoption of energy-efficiency measures have changed. Nevertheless, these changes may be sufficient to make intervention no longer needed (see discussion of the market barriers associated with first cost in the next section of this chapter).

Our definition allows for positive and negative market effects. The focus of this report is on positive effects; that is, on those effects that lead to increases net social welfare. Moreover, we are concerned only with those market effects that result from the operation of a utility's energy-efficiency program. In this regard, we will also consider market effects that may be unintended consequences of a utility energy-efficiency program. Ascertaining whether a market effect would have occurred in the absence of the energy-efficiency program (i.e., "but for") may be a useful test for establishing a causal link between an intervention and a market effect in this regard.

Strictly speaking, individual purchases of and subsequent load impacts from energy-efficiency measures acquired through a utility energy-efficiency program are also among the market effects of the program; however, we are far more interested in market effects that are "outside" the program, effects beyond the individual act of participation by the customer. These effects could include changes in dealer stocking practices of the measure promoted and changes in manufacturing practices in response to increased demand for the measures; they could also include additional energy-efficiency measures or practices adopted by the participating customer (see section 2.3). These effects are more important for our study of market transformation because they are more likely to indicate there have been lasting changes in the market. That is, we view markets as on-going systems of exchange. The transaction between the utility and the customer (e.g., the purchase of an energy-efficient measure) cannot by definition be a lasting market effect; it is a singular market effect in space and time. Thus, we do not consider a single transaction, by itself, to be evidence that a market barrier has been reduced in a lasting fashion. Instead, we are interested in the lasting consequences of such transactions.

Market Transformation - a reduction in market barriers resulting from a market intervention, as evidenced by a set of market effects, that lasts after the intervention has been withdrawn, reduced, or changed.

Our definition is based on the need to have a standard by which to judge market interventions in a regulatory environment; it is not intended to describe the actions of private-sector market actors seeking to profit from their efforts to "transform" markets. Our definition covers three possibilities: (1) if there are no lasting market effects, then the market has not been

transformed (because the reduction in market barriers has been only temporary);[16] (2) if there are lasting effects but further intervention is still warranted, then the market has only been partially transformed; and (3) if there are lasting effects and the most important and relevant market barriers have been reduced to the point where further intervention is no longer deemed to be net beneficial to society, then the market has been completely transformed. These distinctions reflect our concern to ascertain the permanence of market effects from energy-efficiency programs.

All utility energy-efficiency programs have the potential to transform markets under our definition. Market transformation is not a label that uniquely identifies certain utility energy-efficiency program designs to the exclusion of others. It is instead an objective that utility energy-efficiency programs all succeed in achieving to varying degrees. Evidence of success, then, rests on determining to what extent market barriers have been lowered. Whether they have been lowered to the point where further intervention is not warranted, determines whether the market is fully transformed. In other words, the degree of success cannot be settled in the abstract. It must be established by a review of the program's design intent and execution, and of the market effects attributable to the program.

We recognize that there are different opinions on (1) how long market effects must last, and (2) how much (or in what way) a market intervention can be changed (if it is not withdrawn entirely) so that whatever market effects are observed can still be considered evidence for some degree of market transformation.

2.2 Market Barriers Relevant to Utility DSM Programs

As early critics were quick to point out, market barriers are not classified based on a consistent conceptual framework; there is no well-defined, all-encompassing set of market barriers comparable to the major market failures formally recognized by economists.[17] Therefore, an inescapable degree of subjectivity plays a role in assembling a list of market barriers that is (1) comprehensive but not extremely long, and (2) robust in the sense that any particular market barrier is not immune to re-interpretation as a different manifestation of another market barrier or vice versa. We address these limitations by describing market

16 Our interest in market transformation is not intended to suggest that we believe public support for activities that only temporarily reduce market barriers is not warranted. Programs that do not transform markets are legitimate strategies for improving social welfare.

17 Harris and Carmen (1983) list eight major market failures: imperfect competition, excessive competition, anticompetitive conduct, imperfect information, side effects (such as externalities), public goods, (de)merit goods, and income maldistribution. As noted earlier, this chapter does not analyze the derivation of our list of market barriers from these market failures, as defined by economists. See Golove and Eto (1996) for a discussion of these linkages.

barriers most frequently referred to by utility DSM practitioners. Where appropriate, we indicate important relationships among barriers and identify areas in which they overlap.

As noted earlier, many market barriers have been analyzed as examples of market failures associated with imperfect information or as situations fraught with high (yet, presumed reducible) transaction costs. Information, risk, and incentives emerge as three recurring themes in many market barriers. Information-related market barriers include a variety of difficulties associated with the availability, cost, and trust-worthiness of information. Risk-related market barriers include difficulties associated with assessing and managing risk. Incentive-related market barriers involve the financial and nonfinancial rewards or penalties to individuals and organizations for pursuing energy-efficiency opportunities that would appear to be cost-effective measured by standard economic means.

We do not include *high first cost* on our list of market barriers, even though it was routinely identified by our utility energy-efficiency program interviewees as the single most important market barrier addressed by their programs (see Chapter 3). High first cost arises naturally in DSM programs; many are designed to increase market adoption rates for energy-efficient products or services by reducing their first cost (for example, through rebates or other forms of financial assistance). We think there is a basic difference between market barriers and the strategy used to overcome them. Thus, while reducing first cost may be as effective strategy to increase market adoption, we do not consider high first cost to be the market barrier, which this strategy has overcome.

We believe it is essential to understand precisely why high first cost is thought to be a barrier to energy efficiency and how, by reducing first cost, it has been addressed. If, in fact, high first cost is considered to be a market barrier and is, in this sense, the *only* market barrier addressed by a program, then discontinuation of the program would *by definition* result in a reversion to purchasing and operating practices that existed prior to the program.[18] As a result, there would be no evidence of market transformation. In order to understand how reductions in first costs might lead to market transformation, we have broken down the concept of high first cost into a number of distinct market barriers that we believe might be addressed programs that lower first cost as a strategy for addressing these market barriers.

In analyzing the market barriers underlying high first cost, we clarify an important policy objective that is sometimes addressed by utility energy-efficiency programs, which reduce first cost, equity. Equity is a distinct policy objective from economic efficiency. The poor are certainly not immune from the economic-efficiency market barriers associated with high first cost listed below; in fact, the poor are often at the greatest disadvantage from these barriers. However, successfully addressing these barriers would not change the basic income constraint

[18] In this example, we are assuming that the increase in demand for the product, due to its lower cost to the consumer, does not also result in any upstream market effect, for example, increases in production volumes that generate significant manufacturing economies that are then passed on to consumers in the form of lower prices.

faced by the poor: lack of money.[19] In this report, we are concerned primarily with the ability of utility energy-efficiency programs to transform markets in order to improve economic efficiency; we do not comment on the ability of these programs to effect permanent changes in the distribution of wealth in society.

Having addressed high first costs, we offer the following working list of market barriers to energy efficiency:

A. *Information or search costs*—the costs of identifying energy-efficient products or services or of learning about energy-efficient practices. These can include the value of time spent finding out about or locating an energy-efficient product or service or hiring someone else to do it on the consumer's behalf. Search costs can be thought of as costs of acquiring information.

B. *Performance uncertainties*—the difficulties consumers face in evaluating claims about future benefits, which are made for many energy-efficiency investments and activities. This market barrier is closely related to high search costs; acquiring the information needed to evaluate claims regarding future performance is rarely costless. In some cases it may be impossible to obtain the relevant information; one may not be able to generalize from existing information but instead must "experience" the energy performance as it is affected by one's own unique operating conditions, practices, or preferences. Producers, as well as consumers, face these costs in forecasting the market response to decisions they make to manufacturer, promote, stock, or offer energy-efficient products.

C. *Asymmetric information and opportunism*—another aspect of the difficulties consumers face in evaluating the veracity, reliability, and applicability of claims made by sales personnel for a particular energy-efficient product or service. This barrier reflects the fact that sellers of energy-efficient products or services typically have more and better information about their offerings than do consumers. It also reflects the incentive that sellers have to provide misleading information. This market barrier is closely related to high information costs and performance uncertainties because obtaining the information required to assess claims adequately may be costly or impossible.[20] This barrier is different from high

---

19 When the distinction between the equity and economic-efficiency rationales for programs designed to lower first cost is clear, one can better understand the basis for a key critique of utility energy-efficiency programs. This critique holds that utility energy-efficiency programs have not had lasting market effects or made lasting reductions in market barriers. As a result, they represent no more than a transfer of wealth, which, according to these critics, is inappropriate because it is inequitable. Addressing this challenge in the context of this report requires showing that there have been net improvements in economic efficiency (i.e., lasting reductions in market barriers), as opposed to mere transfers of wealth.

20 The differences among information cost, performance uncertainties, and asymmetric information are referred to in the transaction cost economics literature as the differences among search, experience, and credence goods (Goldstone 1996).

information costs however, in that appropriate use of the information may require specialized knowledge held only by the vendor; thus, opportunism on the part of those with the specialized knowledge is a special concern.[21] This barrier is also related to bounded rationality, described below.

D. *Hassle or transaction*[22] *costs*—the indirect costs of acquiring energy efficiency and are also closely related to information or search costs. These costs include the time, materials, and labor involved in obtaining or contracting for an energy-efficient product or service.

E. *Hidden costs*—unexpected costs associated with reliance on or operation of energy-efficient products or services. These costs could include additional operating and maintenance costs associated with energy-efficient equipment or additional staff costs associated with monitoring or servicing transactions (e.g., contractor supervision). They might also include additional costs resulting from the quality of installation. Many of these unplanned costs are incurred after the acquisition of an energy-efficient product or service. To some extent, they can also be thought of as performance uncertainties.

F. *Access to financing*—the difficulties associated with the lending industry's historic inability to account for the unique features of loans for energy savings projects (i.e., that future reductions in utility bills increase the borrower's ability repay a loan) as distinct from the other factors affecting the evaluation of a borrower's credit-worthiness. In principle, accounting for energy-efficiency improvements funded by loans ought to result in lower borrowing costs. This market barrier can be analyzed as reflecting lenders' uncertainty regarding the reliability of future savings and reflecting the additional costs associated with formally recognizing this feature of energy savings projects (another aspect of hassle costs described previously). Institutionally, this market barrier manifests in the absence of secondary financial institutions such as those established in other markets to allow investors to "lay-off" separately the unique risks associated with the future performance of energy-efficiency investments.

G. *Bounded rationality*—the behavior of an individual during the decision making process that may seem inconsistent with a individual's goals. Everyone relies on "rules of thumb" to varying degrees. Sometimes rules of thumb are referred to as matters of habit or

---

21 In fact, opportunism pervades many of these first three market barriers. In lay terms, there is a significant cost associated with knowing who to trust when making energy-efficiency related decisions precisely because one may lack knowledge for one of these three reasons.

22 Transaction cost as used here, should not be confused with the term used in the formal study of transaction cost economics (see, for example, Williamson 1989). Transaction cost economics refers to a powerful perspective from which to examine both market and nonmarket interactions based on the relationships established among various participants. Some believe that many if not all of the market barriers on our list could be profitably examined using transaction cost economics concepts. (See, for example, Golove and Eto 1996.) In this report, we use transaction costs only as defined here.

custom. Rules of thumb serve to limit the focus or scope of considerations for a given decision. Such behavior is hardly irrational, in view of the potentially high search and information processing costs associated with trying to make every decision based on first principles, e.g., net present value. As a result, behavior is often described as rational in intention, but limited in its execution. This barrier has sometimes been construed to include examples of what can only be characterized as plainly irrational behavior or behavior inconsistent with one's articulated goals and understanding. This barrier is distinct from high search costs, performance uncertainties, and asymmetric information because more or better information alone may be insufficient to change behavior. Instead, this barrier refers to the way in which individuals process and act (not necessarily logically) on whatever information they may have.

H. *Organization practices or custom*—organizational behavior or systems of practice that discourage or inhibit cost-effective energy-efficiency decisions. This barrier is closely related to bounded rationality but applies to organizations or social networks rather than to individuals. A good example is institutional procurement rules, policies, and practices that make it difficult for organizations to act on energy-efficiency decisions based on economic merit. This barrier is also closely related to hassle costs or subsequent hidden costs, which in this case might be faced by individuals acting within organizations.

I. *Misplaced or split incentives*—institutional relationships which mean that the incentives of an agent charged with purchasing energy efficiency are not aligned with those of the persons who would benefit from the purchase. One example is in new construction where builders attempting to minimize first cost do not install higher-first-cost energy-efficiency features that would be valued by the future building owners who must pay the utility bills. In this case, the builder has no incentive to minimize utility bills she will not pay and every incentive to increase her profit by minimizing the first costs she does incur. A second example arises in rental property where the landlord has no incentive to install energy saving retrofits in buildings where she does not pay the utility bills. In this case, the tenant, having no financial interest in the building structure or fixtures, is not to be in a position to authorize retrofits that would benefit her directly in the form of reduced utility bills.

J. *Product or service unavailability*—the adequacy of supply. Unavailability of a product is different from high search costs that make it expensive for the consumer to locate a product or service. Unavailability is a market barrier created by the manufacturers and distributors of products or service providers that inhibits consumer demand. One result may be higher prices to reflect the fact that supplies are tight. Unavailability and high prices may be the result of collusive or anticompetitive practices to hold some products (or producers) off the market in favor of others that offer higher profit or other advantages (e.g. market share). Distributors may face high search and acquisition costs in order to accurately anticipate demand or they may react in a boundedly rational way to expectations for future demand caused, for example, by the newness of a product. As a result, they may limit shelf space for or not stock energy-efficient products.

K. *Externalities*—costs that are associated with transactions, but which are not reflected in the price paid in the transaction. For example, environmental costs associated with electricity generation by fossil fuel are not incorporated into prices for electricity or fossil fuel use; these prices are too low in that they do not reflect the full cost to society of using these sources of energy. For markets to operate efficiently, transactions must incorporate full costs.

L. *Nonexternality mispricing*—other factors that move prices away from marginal cost. An example of this barrier arises when regulated utility commodity prices are set using ratemaking practices based on average (rather than marginal) costs.

M. *Inseparability of product features*—the difficulties consumers sometimes face in acquiring desirable energy-efficiency features in products without also acquiring (and paying for) additional undesirable features that increase the total cost of a product beyond what the consumer would be willing to pay for just the added energy-efficiency features alone. For example, energy-efficiency may be offered as an option on only the highest priced models in a product line, which also include a variety of other non-energy amenities. There are two aspects of this phenomenon, that need to be analyzed separately. On the one hand, if the decision to bundle product features is made at the discretion of manufacturers or distributors, then inseparability can be thought of as a market barrier that is closely related to product unavailability. On the other hand, if the inseparability is either required by law or unavoidable because it is inherent in the design of the product, then the phenomenon is not a market barrier in and of itself but is an (apparently) inescapable feature of the product. For the purpose of this study, a justification for utility energy-efficiency intervention to increase market adoption to overcome the high first cost associated with this second situation must be made based on overcoming some other market barrier (e.g., the presence of externalities or other forms of mispricing). Interventions other than conventional utility energy-efficiency programs might address this market barrier directly—e.g., changes to laws or basic research and development to change product designs.

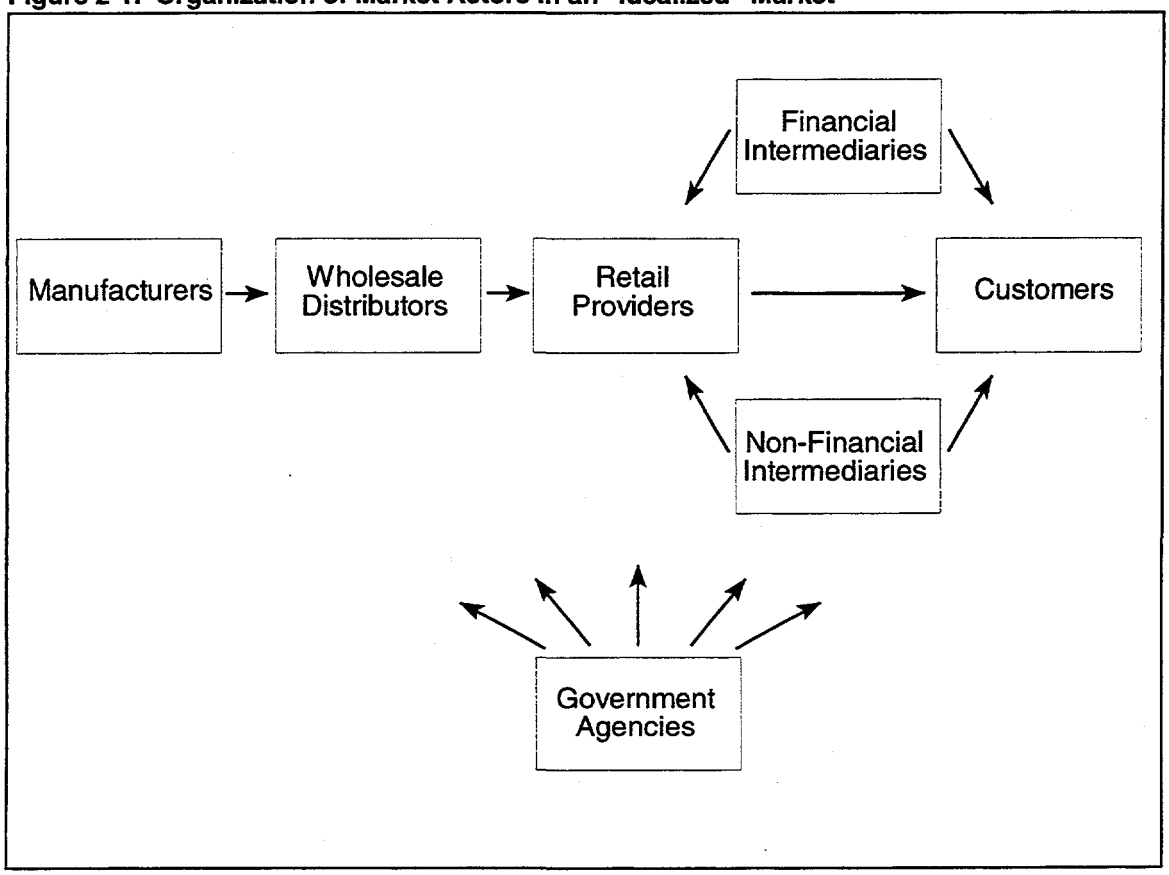
N. *Irreversibility*—once a decision to purchase an energy-efficient product or service is made, it is often difficult to revise it in light of future information because aspects of the decision are irreversible (e.g., if future energy prices go down, one cannot get "salvage" insulation that has already been blown into a wall). Irreversibility is an attribute of many energy-efficient products and closely related to performance uncertainty. Utility energy-efficiency programs to overcome irreversibility must be justified with reference to some other market barrier (e.g., externalities or mispricing). In other words, no conventional utility program intervention can change the irreversible nature of certain products although another type of intervention, such as basic research and development to change the physical characteristics of the measure could do so.

2.3 Market Effects Attributable to Utility Energy-Efficiency Programs

We begin with observations about the fundamental characteristics of market effects in general; we then assemble a framework for analyzing and illustrating the market effects of individual programs.

Market Actors versus Market Structure. As we have defined them, all market effects can ultimately be characterized as changes in the structure or market behavior of one or more sets of market actors (see Figure 2-1). Market actors can include but are not necessarily limited to the following groups: (a) consumers; (b) retail providers (such as equipment vendors, material suppliers, and new home sales staff); (c) wholesale distributors; (d) ancillary, nonfinancial intermediaries (such as design professionals and auditors); (f) financial intermediaries (such as banks and other lending institutions); (g) manufacturers (including, to some extent, builders and their subcontractors); and (h) government agencies (including both state and local building code officials). The concept of "structure" has a long tradition in the social sciences and is also an indispensable tool in understanding complex social systems such as markets. However, our methodological orientation focuses on the behavior of actors in the market.

Figure 2-1. Organization of Market Actors in an "Idealized" Market



For illustration, consider a case in which the distribution chain for a specific energy-efficiency measure initially tends to flow from manufacturers to distributors to retailers to consumers, but, as a result of a utility energy-efficiency program, distributors are partially eliminated from the chain. Some measures now flow directly from manufacturers to retailers. Clearly, this represents a change in the structure of the market. However, at a more fundamental level, the distribution chain would not have changed in this fashion unless one or more groups of market actors found it in their interests to change either selling or buying behavior.

For the purposes of this report, we attempt to characterize all market effects according to the behavior change of one or more specific sets of market actors.

A Working List of Market Effects. Because markets consist of diverse actors engaging in diverse economically motivated behaviors, there is a wide range of ways in which utility energy-efficiency programs could alter behavior, thereby leading to market effects. In Table 2-1, we have listed a number of the specific market effects that were either offered as hypotheses by our interviewees or have appeared repeatedly in the literature on the market effects of utility energy-efficiency programs. Consistent with our approach of characterizing market effects as changes in the behavior of one or more specific sets of actors, the list is organized according to the market actor whose behavior changes. For ease of presentation and to avoid duplication, we have included manufacturers and all businesses (e.g., retail providers, wholesale distributors, nonfinancial intermediaries, and financial intermediaries) under a single category labeled "other businesses."

Behavior Can Change in Three Ways. There are only a small number of mechanisms by which the behavior of market actors can be changed to lead to market effects. We classify the ways that utility energy-efficiency programs may alter the behavior of market actors based on a simple model of human behavior, which holds that, in order to make a choice, an actor must: (a) be able to make the choice; (b) be aware that the choice is available; and (c) either believe that the choice is in his or her own best interest or believe that the choice is the right thing to do. This model suggests the following ways that utility energy-efficiency programs may change the behavior of market actors:

- *Changes in options.* Utility energy-efficiency programs can create new options (for example, by accelerating the development of new technologies) or by eliminating old ones (for example, by accelerating the development or enforcement of new codes and standards.)

- *Changes in incentives.* We include not only direct financial incentives such as rebates but an entire array of incentives. For example, if dealers perceive that an appliance rebate program has increased customer demand for efficient appliances, they may find themselves facing a new incentive to stock more efficient units.

- *Changes in knowledge, awareness, attitudes, including moral suasion.* This category is largely self-explanatory. Moral suasion involves changing a market actor's values by causing the actor to believe that some energy-related behaviors are more "normal" or ethical than others.[23]

Market Effects Are Interactive. Market effects are inherently interactive; behavioral changes among one set of market actors often lead to behavioral changes for another set. Markets generally consist of a large number of individuals pursuing their self-interest in a more or less (perhaps, boundedly) rational fashion. Because systematic and large-scale changes in the behavior of one set of market actors are likely to change the manner in which other sets of market actors must behave in order to optimize their self interests, market effects are likely to beget further market effects. This iterative process continues until a new, stable pattern of market-oriented behavior is reached. Usually, when commentators discuss the market effects of utility energy-efficiency programs, they refer to the causal sequence of specific market effects that leads to a new pattern of market-oriented behavior. In relation to Table 2-1, this process can be viewed as a sequence of events in which the specific market effects listed under each category of "market actor" cause market effects listed under other categories. For example, changes in customer purchasing behavior may lead to changes in dealer pricing, promotion and stocking, which may, in turn, lead to changes in the way manufacturers design, price, or ship products. In Chapter 3, we formalize these relationships using "market influence diagrams."

Lasting Market Effects? Market effects can be transient or lasting, depending on whether the behavioral change leading to a market effect lasts after the intervention is withdrawn. Much ink has been spilled over the issue of whether and how long the market effects of utility energy-efficiency programs can be expected to last. We suggest some tentative answers to this question in Chapter 3. For now we limit ourselves to a few key observations that follow from the previous points. The first is that, if the overall process by which a utility energy-efficiency program affects the market can be described in a causal sequence of specific behavioral changes on the part of various market actors, then the behavioral changes that are posited as coming before the end of this sequence are, by definition, not lasting. Second, whether the behavioral changes that are posited as coming at the end of the sequence can be regarded as lasting is largely a matter of whether a case can be made that, once the program is withdrawn, there are no obvious incentives (i.e., unaddressed or new market barriers) present that would cause behavior to revert to the original "pre-intervention" scenario.

---

23 In theory, we believe moral suasion could be a powerful mechanism for influencing energy-efficiency markets, although one that may be difficult to employ. In recent practice, for example, utilities have largely avoided moral suasion as a marketing approach. We therefore focus in the remainder of this chapter on changes in options, changes in incentives, and changes in knowledge, awareness or attitudes.

Table 2-1. List of Market Effects Potentially Attributable to Utility Energy-Efficiency Programs

Customers
Change in purchasing energy-efficiency behavior due to change in: -- awareness -- attitudes -- knowledge -- decision-making processes
Other Businesses includes retail providers (such as equipment vendors, material suppliers, and builders/contractors), wholesale distributors, nonfinancial intermediaries (such as design professionals and auditors), and financial intermediaries (such as banks and other lending institutions)
Changes in promotional practices (all)
Changes in business strategies (all)
Changes in prices offered to customers (all)
Creation of new players (all)
Changes in stocking and distribution practices (retail providers and wholesale distributors)
Changes in design practices (design professionals)
Changes in service offerings (all)
Changes in the nature and type of employee compensation (all)
Changes in contract provisions (all)
Development of new skills (all)
Changes in underwriting practices (financial intermediaries)
Development of new financial instruments (financial intermediaries)
Development of secondary financial markets for energy efficiency (financial intermediaries)
Manufacturers
Changes in product quality
Changes in product attributes
Development of new products
Changes in promotion
Changes in business strategies
Changes in prices offered to retailers
Changes in shipping and distribution practices
Changes in retooling rates
Changes in bundling of features
Changes in production schedule and quantity (*amounts* produced)
Changes in warranties
Building of new plant
Acceleration of response to oncoming standards
Government
Changes in codes, standards, or regulations
Changes in enforcement of codes, standards, and regulations

Evidence for Market Transformation from Recent California Utility Energy-Efficiency Programs

Based on our definitions in Chapter 2, the degree to which California utility energy-efficiency programs have transformed markets depends on whether the market effects attributable to the programs are lasting and whether these effects show evidence that market barriers have been reduced. This chapter presents our findings in these two areas for selected California utility energy-efficiency programs.

The chapter is organized in seven sections. We begin by describing our overall approach to utility energy-efficiency program reviews. We then describe and give an example of the market influence diagram, a graphical tool that we have developed for our analysis. Next, we present our reviews and findings for individual utility energy-efficiency program types, including:

- Residential, Commercial, and Industrial customer incentive programs
- Residential and Nonresidential Information and Energy Management Service (EMS)programs
- Residential and Nonresidential New Construction programs
- Direct Assistance programs

We conclude by summarizing our key findings on the market effects of California utility energy-efficiency programs.

3.1 Approach to Utility Energy-Efficiency Program Reviews

The selection of programs was discussed in Chapter 1. To summarize, we examined many, but not all of California's utility energy-efficiency programs. We focused on the most recent or current program offerings (from 1994 to early 1996) and, as a result, we do not comment on the market transformation effects of programs offered prior to this period. Finally, our observations are based entirely on the information provided by the utilities and our prior work; we did not interview either customers, trade allies, manufacturers, or other interested parties. In the remainder of this section, we discuss our approach to program review.

Each review is intended to provide basic information on the potential market transforming effects of California utility energy-efficiency programs. We first describe how the programs operate, market barriers targeted, and the strategies used to overcome them. Second, we identify market effects and to what extent they can be attributed to the programs. Third, we speculate about which market effects might be lasting. If the right combination of these

market effects turn out to be lasting, this will be evidence that the programs have contributed to the transformation of the market.

Evidence documenting the market effects of California utility energy-efficiency programs has not been assembled systematically and is, in many cases, only anecdotal.[24] As we will describe in the next chapter, this is hardly surprising in view of the regulatory signals that have been given to and interpreted by the utilities. Therefore, our analysis is an initial investigation of the market transforming effects of California utility energy-efficiency programs. We believe comprehensive evidence on the degree to which the programs have transformed markets can (and should) be assembled in the future.

These sections are based largely on our independent assessment, using our knowledge, experience, and understanding of the markets and utility programs. The interviews of utility program staff contributed by providing personal observations and other information; we note explicitly whenever a statement is based on these sources rather than our independent assessment. The utilities provided a limited number of documents containing potential evidence of market effects. Even when we have received documents containing potential evidence (such as a utility program M&E study), we have not conducted a detailed review of the potential evidence in order to determine its reliability.

Available evidence for market effects is assessed in the following manner: First, can or has a change in the market been observed? Second, is there a plausible mechanism that links the market effect to the stimulus provided by the program? Third, do program managers or others agree or believe that the program has caused the market effect? Fourth, do we, the authors, believe the program has caused these or other market effects?

In organizing our findings, we have chosen to aggregate programs of similar type for convenience of presentation, rather than review individual programs. However, in the case of some larger programs (e.g., C&I EEI), we describe individual subprogram elements. We have adopted a consistent structure for the reviews, although we sometimes deviate from our strict order of topics in order to fully capture unique features of particular programs. We organize our reviews using a consistent method of graphical presentation, which we describe more fully in the next section.

Our reviews of the programs are not intended to be exhaustive. We sometimes focus only on selected sub-elements within a program. Generally, each of the major end uses addressed is covered in at least one of the programs reviewed, but we do not consider all end uses in each program. We believe we have covered most of the major markets but recognize that we have not covered every market.

---

24 We did not conduct technical reviews of the savings claims from the evaluations, but instead reviewed them only to determine the extent to which they contained evidence regarding market transformation.

We identify details of our review that are based solely on the opinions of utility staff, with which we may or may not agree. Otherwise, the views expressed represent the opinions of the authors.

3.2 A Graphical Tool for Program-Specific Analysis of Market Effects

In order to analyze the market effects of California's utility energy-efficiency programs, we developed a graphical tool designed to represent as diverse a range of market effects as possible while reflecting the fundamental characteristics of market effects discussed in the previous chapter. The objective of the tool is to graphically portray the causal relationships between program stimuli and market effects, and among market effects.

The graphic illustrates, for each major program type: (1) the causal chain of specific market effects that are hypothesized to result from the program, showing, for each link in the chain, which market actors are posited as changing their market-oriented behavior, why they do so, and in what order; (2) which market effects appear to be only temporary and which may have the potential to last after the program is withdrawn; and (3) the specific relationship between the hypothesized market effects and any lasting reductions in market barriers the program is believed to have the potential to achieve. We refer to these graphics as market influence diagrams.

Figure 3-1 is an example of a generic market influence diagram, which consists of the following elements:

- At the top of the figure, a series of vertical arrows with captions denote the initial impact of the program on various market actors.

- Below these arrows, a row of boxes indicates the major categories of market actors believed to play a role in the series of behavioral changes that constitute the overall market effect. In most cases, there are three boxes, representing manufacturers, other businesses, and customers, corresponding to the categories presented in Table 2-1. For some programs, we vary this format to represent program specifics.

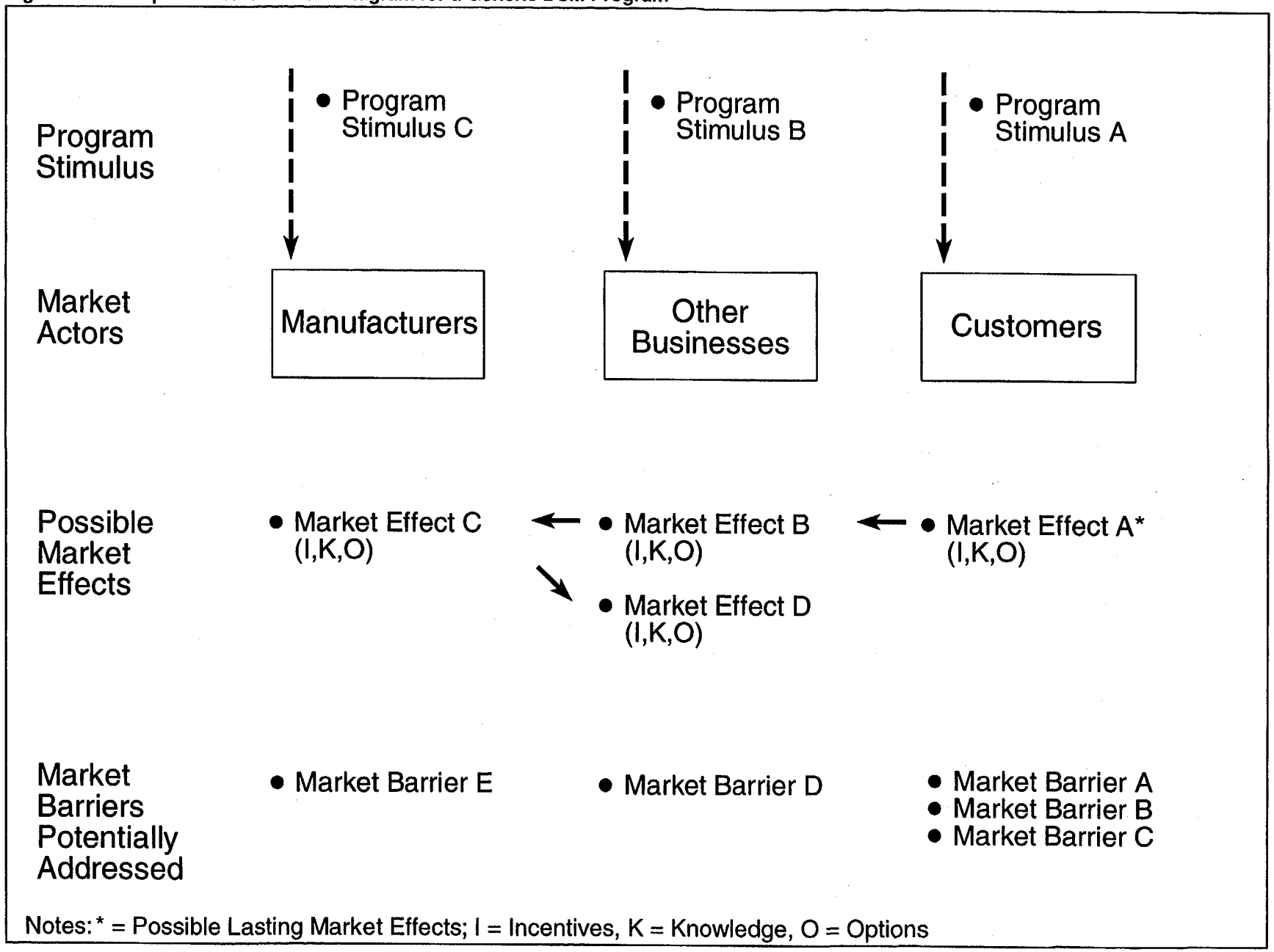
- Below the boxes indicating the major categories of market actors involved, a series of hypothesized market effects are: (1) categorized according to the set of market actors whose behavior is posited as changing; (2) linked by arrows to show the hypothesized causal sequence in which the behavioral changes occur; and (3) grouped together by brackets to show which sets of market effects act as a causal unit (e.g., cannot be disentangled from one another in illustrating the hypothesized sequence of behavioral changes). When it seems relevant, we also indicate, with an initial, I, O, or K, whether the behavioral change is believed to result from a change in the market actor's incentives, options, or knowledge.

- We identify market effects believed to be lasting, categorized according to the market actor whose behavior is posited as changing with an asterisk (*).

- Finally, we list the market barriers these effects may address, categorized according to the market actor affected.

In the remainder of this chapter, we use market influence diagrams to illustrate the market effects that our interviewees hypothesized for a range of specific programs. The reader is encouraged to return to the template shown in Figure 3-1 to place the specific market influence diagrams presented later in this chapter into their conceptual context.

Figure 3-1. Sample Market Influence Diagram for a Generic DSM Program



3.3 Residential, Commercial, and Industrial Customer Incentives Programs

California utility customer incentives programs offer financial incentives to customers, dealers, and manufacturers for the installation of energy-efficiency products and services in existing residential, commercial, industrial, and agricultural buildings or facilities. The programs also provide information and technical assistance to customers, dealers, and manufacturers (though often some information is provided through the Energy Management Services or other information programs). The incentives are intended to lead to the installation of more efficient products or systems than would have been installed in the absence of the program. The programs address both retrofit and market-driven (i.e., equipment replacement, remodeling, and renovation) opportunities.

The California DSM Policy Rules organize the customer incentives programs by customer sector: Residential Appliance Efficiency Incentives (RAEI) and Residential Weatherization Retrofit Incentives (RWRI), Commercial Energy-Efficiency Incentives (CEEI), Industrial Energy-Efficiency Incentives (IEEI), and Agricultural Energy-Efficiency Incentives (AEEI). Within these categories, the utilities offer a number of program elements organized by customer size, end use, customer characteristics, or other market characteristics.

Together, the customer incentives programs account for the largest fraction of California utility DSM expenditures, savings, net resource benefits, and shareholder incentives.

This section is based on interviews of program staff from four California utilities. Most of our effort was focused on PG&E and SDG&E because these utilities had larger and more active customer incentives programs in 1994 than did SCE or SCG.

For PG&E Commercial and Industrial EEI, we concentrated our interviews on six PG&E-defined programs including:

- Retrofit Express, which offers fixed incentive amounts for common energy-efficiency measures, including lighting, air conditioning, motor, refrigeration, and food services equipment.
- Retrofit Efficiency Options, which offers incentives or low-interest financing (through Capital Advantage) for fairly common measures not included in Retrofit Express, such as cooling towers, irrigation pump upgrades, and pumping controls.
- Advanced Performance Options, which provides flexible solutions, incentives, and custom technical assistance to customers (this is a new program in 1996 that evolved from the Customer Efficiency Options and Customized Incentives programs).
- Capital Advantage Financing Pilot, which provides financing to customers who need assistance in funding projects, i.e., customers who have capital and/or cash flow restrictions.
- Local Government Energy Advantage, which provides financing and technical support to cities, counties, and special districts.

- CFC Chiller Replacement, which offers information and technical assistance to customers, as well as incentives through the Retrofit Efficiency Options or Advanced Performance Options programs.

For SDG&E Commercial and Industrial EEI, we concentrated our interviews on three SDG&E-defined programs including:

- C&I Incentives, which offers incentives for standard mechanical and complex custom energy-efficiency measures primarily to large assigned customers.
- Power to Save, which offers audits (through the EMS program) and incentives for standard and custom lighting applications, as well as less complex standard and custom mechanical measures.
- Commercial Rebates, which provides instant rebates for refrigerator, HVAC, motor, compact fluorescent lamp, and standard lighting measures.

These PG&E and SDG&E C&I programs did not always directly follow the CPUC program classification set forth in the DSM policy rules. Instead, the utilities operated these programs as summarized above, and then, for reporting purposes, recompiled the expenditures, descriptions of activities, and program results to fit within the CPUC program categories. All of these utility-defined programs fit under the umbrellas of either Commercial EEI or Industrial EEI programs (except for some audit or information services provided under the Energy Management Services or other information programs).

For Residential Appliance Efficiency Incentives (RAEI), we concentrated our interviews on three programs:

- PG&E's Efficient Refrigerator Rebate Program;
- SDG&E's High-Efficiency Refrigerator Program; and
- SDG&E's Compact Fluorescent Lamp Program.

A large number of energy-related markets and market segments are associated with existing buildings and facilities of residential, commercial, industrial, and agricultural customers. These markets and market segments vary by customer size, customer type, business type, ownership characteristics, end use, type of market transaction (i.e.: market-driven transactions such as equipment replacement, remodeling, and renovation; and retrofit transactions), and product and/or service. For example, the market for high-efficiency lighting during remodeling of an owner-occupied commercial office building is very different from the market for replacement packaged HVAC units for leased small industrial facilities.

The utilities have developed many programs and program elements to address opportunities in different markets and market segments. Reviewing all of the utility programs and program elements designed to address the large number of markets and market segments was beyond the scope of this study. We focused the majority of our review on C&I lighting programs as

an example of C&I customer incentives programs, and on residential refrigerator and compact fluorescent lighting programs as examples of residential customer incentives programs.

In the remainder of this section we discuss:

- Market barriers in existing buildings and facilities.
- Program approaches to reducing market barriers.
- Market effects due to C&I EEI lighting programs.
- Market effects due to RAEI programs (refrigerators and compact fluorescent lighting).
- Examples of market effects for other C&I end uses.[25]
- Our conclusions for C&I and residential customer incentive programs.

3.3.1 Market Barriers to Energy Efficiency in Existing Buildings and Facilities

During our interviews, utility staff identified many market barriers to energy efficiency in existing residential buildings and commercial, industrial, and agricultural facilities. The six market barriers listed below were mentioned most frequently, and were usually thought by the interviewees to be the most important (these barriers are identified using the language of the interviewees, in the general order of importance assigned to the different barriers during the interviews):

- High first cost.
- Lack of information or knowledge, for customers and for businesses in the distribution chain.
- Getting management approval for energy-efficiency investments within the firm.
- Lack of availability of products and services.
- Uncertainty about performance and lack of trust in performance claims.
- Uncertainty of market response for manufacturers and distributors.

Below we discuss these barriers and others mentioned during the interviews. In several cases we discuss the market barriers identified by the utility interviewees and reinterpret them using our list and definitions from Chapter 2.

High first cost. In general, high first cost and the need for additional capital up-front was considered to be the most important market barrier by the interviewees. In fact, the existence of this barrier was cited as the primary reason for an incentive program, with the incentives expected to increase the adoption of energy-efficient products and services by reducing the first cost.

---

25 This subsection consists of brief summaries of hypothesized market effects associated with other C&I end uses, many of which were identified during the interviews of utility program staff. These summaries are less detailed than the C&I lighting and RAEI subsections.

As discussed in Chapter 2, high first cost results from a number of underlying market barriers. In the energy-related markets associated with existing buildings and facilities, high first cost appears to result from: (1) performance uncertainties, market and demand uncertainty, bounded rationality of manufacturers and others in the distribution chain, and high information costs for manufacturers (that lead to higher costs for customers) associated with the "newness" of the product and the uncertainty of market response in the face of investments that must be recovered; (2) poorer economies of scale for new, low-volume products and services; and (3) product or service unavailability associated with the inadequacy of supply.

Information, search, and hassle costs. Customers and businesses in the distribution chain often lack information and knowledge about energy-efficient products and services. Sometimes the customers are aware that they should do something about energy efficiency, but they don't know what to do specifically. Even if customers are interested in a particular product, they may face high search and hassle costs to acquire and install it (e.g., they may have to search for a contractor who offers a particular product or a retailer who stocks an energy-efficient appliance). The interviewees often labeled the high costs of searching and acquiring energy efficiency "lack of availability," but we include it here as high search or hassle costs.

Organization practices or customs. In the case of C&I customers, the interviewees noted that getting management approval for energy-efficiency investments within an organization was often very difficult. This is due at least partly to institutional rules, policies, and practices within organizations that have the effect of inhibiting cost-effective investments in energy efficiency. These include rules, policies, and practices for assessing and valuing investments and/or facility upgrades. For example, many customers do not look at life-cycle cost effectiveness, but instead choose to rely on payback criteria. Also, in many industrial process applications, energy-efficiency options are viable and will be considered only if other fundamental changes are being made to the process. In some businesses (most notably national chains and franchises) the decisions regarding facility changes are made centrally, while the local operator assumes the costs and implications of those central decisions.

Bounded rationality. Many individuals use rules of thumb or other boundedly rational decision-making processes when deciding about energy-efficiency products and services. Within organizations many individuals use their own boundedly rational decision-making processes, including rules of thumb, to make business and financial decisions. For example, a facilities manager may recommend against an energy-efficiency investment based on a rule of thumb instead of a thorough analysis.

Performance uncertainties, and asymmetric information and opportunism. Many customers and some businesses in the distribution chain are uncertain about the performance of energy-efficient products and services, and may not trust the performance claims made by manufacturers and vendors. Many customers also have difficulty assessing the value of energy efficiency as an investment, because the costs are paid up-front but the less certain

benefits accrue over time. In some situations, businesses in the distribution chain are unwilling to assume the risks associated with performance uncertainties. For example, an engineer specifying and sizing a new chiller is likely to oversize the chiller, because the small engineering design fee does not cover the large perceived risk of potential customer complaints due to perceptions of undersizing. Manufacturers may be uncertain about the response of customers to their new products.

Product or service unavailability. Products and services may be unavailable because manufacturers, distributors, and service providers have difficulty accurately predicting customer demand for their products/services, and may respond to this uncertainty in a risk-adverse manner, thereby limiting the availability of their products/services. Often this unavailability is associated with new products/services and the uncertainty of market response.

Hidden costs. Customers may face hidden costs related to either the operation and maintenance of energy-efficient products, or the monitoring and servicing of purchase transactions. In addition, customers may be concerned about unknown future costs associated with products that have poor quality or that fail early. Dealers and distributors may be concerned about their exposure due to unknown quality and performance. (Some readers may consider quality to be an aspect of "performance"—with the relevant market barrier being performance uncertainties. We recognize that concerns about uncertain quality could fit under either barrier.)

Misplaced or split incentives. In rental property the landlord has no incentive to install energy-efficiency measures in buildings, since the tenant generally pays the energy bills. Also, the interests of a person purchasing a product or service for an organization may not be the same as the interests of the organization itself.

Inseparability of product features. Sometimes the energy-efficiency attributes of a product or service may not be packaged with other features customers desire. For example, some energy-efficient options may only be available on high-end products, such as on high-end or large refrigerators.

Interaction of the barriers. These barriers interact with each other, often making it difficult to isolate any one cause of an efficiency gap. For example, organization practices and customs (or the bounded rationality of customers) that limit accurate assessment of energy efficiency as a cost-effective investment may introduce uncertainties and risks for manufacturers, who might respond by reducing the availability of products. One actor in the distribution chain often has difficulty acquiring accurate information on the needs, desires, and practices of others in the chain, including the ultimate end user.

3.3.2 Program Approaches to Reducing Market Barriers

Customer incentives programs use one or more of the following approaches to increase energy efficiency. Much of the focus of these approaches is on customers, but some approaches are targeted to manufacturers and/or other businesses in the distribution chain.

Financial incentives. Financial incentives provided through the utility customer incentive programs are expected to increase the adoption of energy-efficient products and services by reducing the first cost. The level of the incentives range from a small portion to the full amount of the incremental costs of increased efficiency.

Most financial incentives are paid directly to customers. Customer incentives include point-of-purchase rebates and discounts, mail-in rebates, rebates paid after utility approval of customer applications (including both prescriptive and custom rebates), and low-interest financing.

A few programs pay incentives to manufacturers to reduce wholesale prices (with the cost reduction being passed through to retail prices), as well as to help define the uncertain market size for the manufacturer (see Figure 3-4 later in this section). These manufacturer incentives are often paid as part of a planned procurement strategy. For example, programs have paid incentives to compact fluorescent lamp manufacturers and motor manufacturers in the past. Some programs pay incentives to dealers as an incentive to stock and promote efficient products, or as a fee for completing needed reports.

It was difficult to distinguish from the interviews the degree to which financial incentives were used *solely* as a marketing approach to increase the participation in a given utility program (much like a consumer rebate in a retail outlet), versus more broadly as a strategy to reduce the stated market barrier of high first cost (or the underlying causes of high first cost) in a lasting fashion. While both the simple marketing approach and the broader strategy could result in greater adoption, an explicit focus on the market barriers underlying high first cost could help to keep the program managers, designers, and implementors focused on effecting lasting changes in the market, rather than on promoting their program's particular product or service offerings.

The distinctions between marketing a program and effecting lasting changes in a market came up repeatedly during several interviews. Some interviewees had more difficultly than others in making and understanding the distinctions. For example, while we were trying to explore the barriers to market adoption of energy efficiency, some interviewees responded to our questions by discussing barriers to the adoption of their programs and ways in which they were improving the marketability of their program offerings (such as easier application forms and more effective advertising of the program). As a result of this, we have interpreted some of the interviewees' statements to be able to relate them to the reduction of market barriers.

Information and Promotion. Utility programs provide many types of information to both customers and other market actors in the distribution chain.

Often customer information is provided through another utility program (e.g., EMS or other information programs), with the other program operating as an education and marketing service for the incentive program. This is discussed in more detail in Section 3.4, on Information Programs.

Information might be provided to customers to increase general awareness of energy efficiency, assist a customer with a specific need, promote an energy-efficient product or service, or market a particular utility program. A wide variety of information is provided, anything from the costs, savings, and benefits of product and services, to where to buy a product, to how to participate in a given utility program. Some of the information is site- and customer-specific (e.g., recommendations on an industrial process in a particular plant, or the economic benefits of an installation in an office building), while other information is more general.

After reviewing documents provided by the utilities, including informational and marketing brochures, and conducting the interviews, we sometimes had difficulty making clear distinctions between information on energy efficiency used to reduce the market barrier of high information costs, information used to reduce the market barrier of high search costs, and information used mainly to promote and market a utility program with little or no emphasis on causing lasting changes in the market.

Some utility customer incentive programs also provide information to manufacturers, distributors, and retailers. Generally, the information is provided to these market actors as a secondary strategy, intended to support the primary program strategy of increasing customer participation in participant-focused programs. Often utilities and their trade allies share product and technical information. Some utilities also provide leads to vendors. Some programs provide information that helps manufacturers reduce their uncertainty about customer demand and market size. For example, some incentive and procurement programs virtually "guarantee" a minimum number of total sales, either by designing the programs to capture a set market share (and informing the manufacturers of this), or by specifying the number of products to be purchased under a set procurement. Programs also set product standards that manufacturers must meet for their products to be eligible for utility programs. In some cases manufacturers could use these standards to help describe the products and product attributes customers are likely to desire.

Technical Assistance. Some utility customer incentives programs (particularly C&I programs) provide technical assistance to customers and other market actors in the distribution chain, much like design assistance in the New Construction programs. Technical assistance is more common for large customers and complex or custom measures.

Training. Many utility customer incentives programs offer training for the trade allies participating in the programs.

Support of Trade Allies. Many of the customer incentives programs are promoted by trade allies. Trade allies may include retailers, dealers, vendors, contractors, distributors, and manufacturers. Utilities provide various forms of support for the trade allies, including information resources, technical support, telephone help desks, and advertising and joint promotion. For example, SDG&E runs a refrigerator advertising campaign to promote SDG&E-approved units within the stores of participating dealers, and retailers have supplemented SDG&E's campaign with their own advertisements which also highlight high-efficiency units.

Combinations of Approaches. Almost all the utility interviewees were careful to note that combinations of approaches were more effective than using one approach. In particular, several respondents noted that neither incentives alone, nor education alone, would be as effective as both incentives and information in reducing market barriers and increasing the adoption of energy-efficient products and services. We agree with this assertion, partly because of the existence of multiple barriers in the markets and the interaction of these barriers, and partly because it is logical that one approach would not necessarily be effective in reducing several market barriers.

3.3.3 Market Effects Due to C&I EEI Lighting Programs

There are similarities in the main utility C&I program strategies across the markets and segments, and in the types of market effects that might result from the interventions of the programs. Therefore, we use one market influence diagram summarizing the programs, program stimuli, market actors, and hypothesized market effects associated with C&I lighting (Figure 3-2) in this section to describe all of the utilities' Commercial and Industrial EEI programs. The market influence diagram for C&I lighting is an *example*, not a representation of all program activities and hypothesized market effects for all end uses. Many of the program stimuli used for C&I lighting are similar to those used by utilities for other end uses. However, as will be discussed below, it appears that more hypothesized market effects (and more potentially lasting market effects) are associated with C&I lighting than with any other end use or market.

There are several types of market actors included in the category of "other businesses" in Figure 3-2. Depending on the specific market addressed by a given program or program element, "other businesses" could include distributors, contractors, product vendors or dealers, retailers, and/or financial institutions.

Below we summarize the hypothesized market effects that appear to be due to utility C&I EEI lighting programs. We describe the market effects in groups, organized by relevant

market actors: (1) customers, and (2) manufacturers and other businesses. For each group we describe the nature of the hypothesized market effects and associated reductions in market barriers, summarize any evidence provided by the utilities or potential evidence proposed by the interviewees, and discuss whether the effects are likely to be lasting. The market effects and market barriers potentially addressed are also shown in Figure 3-2.

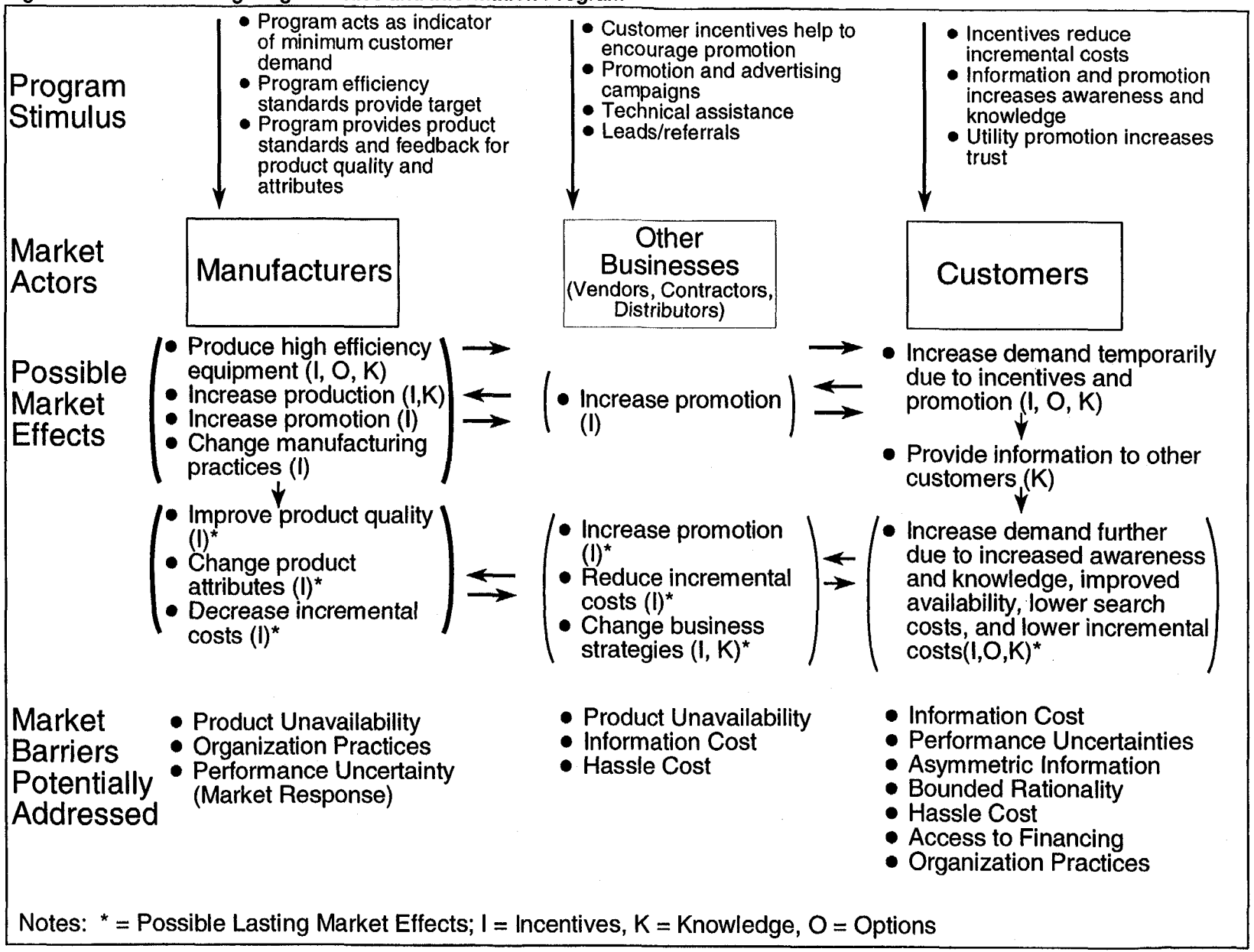
Customers: changes in purchasing behavior due to changes in awareness, knowledge, and decision-making processes.

Nature of effects: The utility programs may have increased customer awareness, knowledge, and understanding of energy efficiency, and of related products and services, leading to increases in customer demand and adoption. Increased motivation of some customers was reported by several interviewees. One interviewee reported increased interest and awareness in many industries, as evidenced by more sessions on energy efficiency at trade and business conferences. Initial increases in customer awareness and knowledge may be due to the direct stimulus of the programs; further increases could be due to changes in the behavior of manufacturers and other businesses. The majority of these hypothesized effects may be occurring in owner-occupied space, because many program participants are owners rather than tenants.

Some increases in customer awareness and knowledge may be due to the interactions of the market effects for manufacturers and other businesses in the distribution chain, and the resulting effects on customers. For example, increases in manufacturer, distributor, and vendor promotion may result in increased customer awareness and knowledge.

These hypothesized market effects appear to indicate that the utility programs are potentially addressing some of the market barriers customers face in the C&I lighting market, including: information cost, performance uncertainties, asymmetric information, bounded rationality, hassle cost, access to financing, and organization practices.

Figure 3-2. C & I EEI: Lighting Incentive and Information Program



Evidence or potential evidence of effects: Several utility lighting program M&E studies contained estimates of participant and nonparticipant spillover.[26] Customers were reported to install additional measures after participating in programs (reported as participant spillover in several utility M&E studies). More customers have heard of energy-efficiency measures (reported by one interviewee to be found in PG&E evaluation studies). Customers have demonstrated increased willingness to pay, evidenced by strong participation in programs even when incentives are lowered (also reported by interviewees to be found in some evaluation studies).

Lasting effects: We do not know whether these effects will be lasting, and if so, for how long and in what manner. We do not expect many of the observed and hypothesized changes in purchasing behavior due solely to increased information and knowledge to last much beyond the end of the specific utility interventions, at least not without other changes in the market. The utility interviewees supported this belief. Awareness is likely to erode over time. Institutional knowledge and experience within organizations may decrease without explicit support. Even if customers are willing to invest in energy efficiency now, they need regular reminders to continue to do so in the future (as one interviewee noted: "much like going to the dentist, which we all know is a good thing to do, but many of us may let slip without regular reminders"). Several interviewees stated that clear, consistent messages repeated several times had more impact than one message, and questioned who would provide these messages in the future if utilities did not. In addition, the level of customer knowledge and understanding will not increase *above* current levels without additional efforts by the customers, efforts of others (such as lighting vendors and manufacturers), or continued interventions in markets. Customers now understand what they did (after completing their participation in a utility program), but most would not know what to do next time.

The observed and hypothesized changes in purchasing behavior due to changes in decision-making practices within organizations may be more lasting. For example, once an organization has gone through the process of assessing, deciding on, and installing/implementing energy-efficiency products/services, the process should be easier with fewer institutional hurdles for future energy-efficiency investments. In particular, chains or organizations with multiple sites have the greatest opportunities, both for investments at other sites, and for additional investments within sites that made initial investments. Several interviewees stated that this was occurring in some multi-site organizations, though they were unable to distinguish how many of the subsequent installations were within utility programs versus outside of them. These changes in decision-making practices may be true for other end uses as well as for lighting.

---

26 We did not conduct detailed technical reviews of these M&E studies, and therefore were not able to assess or determine the reliability of any evaluation findings or estimates.

Manufacturers and other businesses: changes in products, product attributes and features, product quality, distribution practices, promotional practices, design practices, prices, and business strategies; and acceleration of response to oncoming standards.

Nature of effects: There are a large number of hypothesized market effects in the market for energy-efficient lighting (see Figure 3-2). Interviewees identified many of these potential effects, including: development of new products; increased production of energy-efficient products (supported by increased manufacturing capabilities); improvements in product quality (e.g., electronic ballasts and CFLs); changes in product attributes (e.g., CFLs with higher power factors and lower total harmonic distortion, and smaller sizes and shapes that fit better); lower prices for energy-efficient lighting fixtures, lamps, and ballasts (e.g., electronic ballasts and T-8 fixtures); lower prices for LED exit signs (SDG&E reported that prices were reduced by $60 or $70 when first introduced by the utilities); increased promotion by designers, specifiers, and vendors, to the point where some technologies either are, or are approaching, standard practice; more appropriate promotion of energy-efficient products that better meet lighting needs and requirements (e.g., higher wattage CFLs to better meet lumen requirements); changes in design practices leading to both greater use of energy-efficient products (e.g., increased use of CFLs for task lighting), and more appropriate (often lower) lighting intensities; energy-efficient products getting to market more quickly (e.g., the fairly rapid introduction of 8' T-8 fixtures and lamps); increased availability of products (e.g., currently there is no shortage of electronic ballasts as in prior years); and acceleration of manufacturers' responses to standards.

The hypothesized market effects outlined above appear to indicate that the utility programs are potentially addressing some of the market barriers associated with manufacturers and other businesses in the C&I lighting market, including: product unavailability, organization practices, performance uncertainties related to the uncertainty of market response and the associated information costs for manufacturers and other businesses in the distribution chain, and hassle cost.

Evidence or potential evidence of effects: In the majority of M&E studies that estimated spillover, the spillover was associated with energy-efficient lighting. One interviewee suggested that price reductions over time could be assessed using the Statewide measure cost studies, or internal utility databases that track the invoice cost of measures (the interviewee suggested that the PG&E internal measure cost tracking system could be useful, but it has not been analyzed in this manner). Others suggested that electronic ballast shipments could be analyzed.

Lasting effects: It appears that many of the market effects associated with at least some lighting products (most notably, T-8 fixtures) will last. For example, improvements in product quality, changes in product attributes, increases in promotion, decreases in incremental costs, and changes in business strategies appear to be likely to last. Some of these lighting technologies are, or are close to becoming, standard practice in many markets

(e.g., in owner-occupied buildings), with the technologies being supported and promoted both by manufacturers and vendors. We do not know whether the market effects associated with other lighting products will be lasting, and if so, for how long or in what manner.

The market effects associated with C&I lighting do not account for a majority of the *number* of hypothesized market effects summarized in this study. However, the hypotheses appear to be well-founded, many of the effects appear to be lasting, and the utilities have focused much of their program efforts and expenditures on lighting. Therefore the effects, while small in total number, may result in a large amount of benefits.

3.3.4 Market Effects Due to the Residential Appliance Efficiency Incentives (RAEI) Programs

RAEI programs provide incentives to customers, dealers, or manufacturers for the replacement of existing appliances or the installation of new appliances in existing residential structures. The programs also provide information to customers, dealers, and manufacturers (though often information is provided to customers through the EMS or other information programs). The incentives are intended to lead to the installation of more efficient appliances than would have been installed in the absence of the program. Appliances covered by the programs include refrigerators, freezers, and compact fluorescent lighting products.

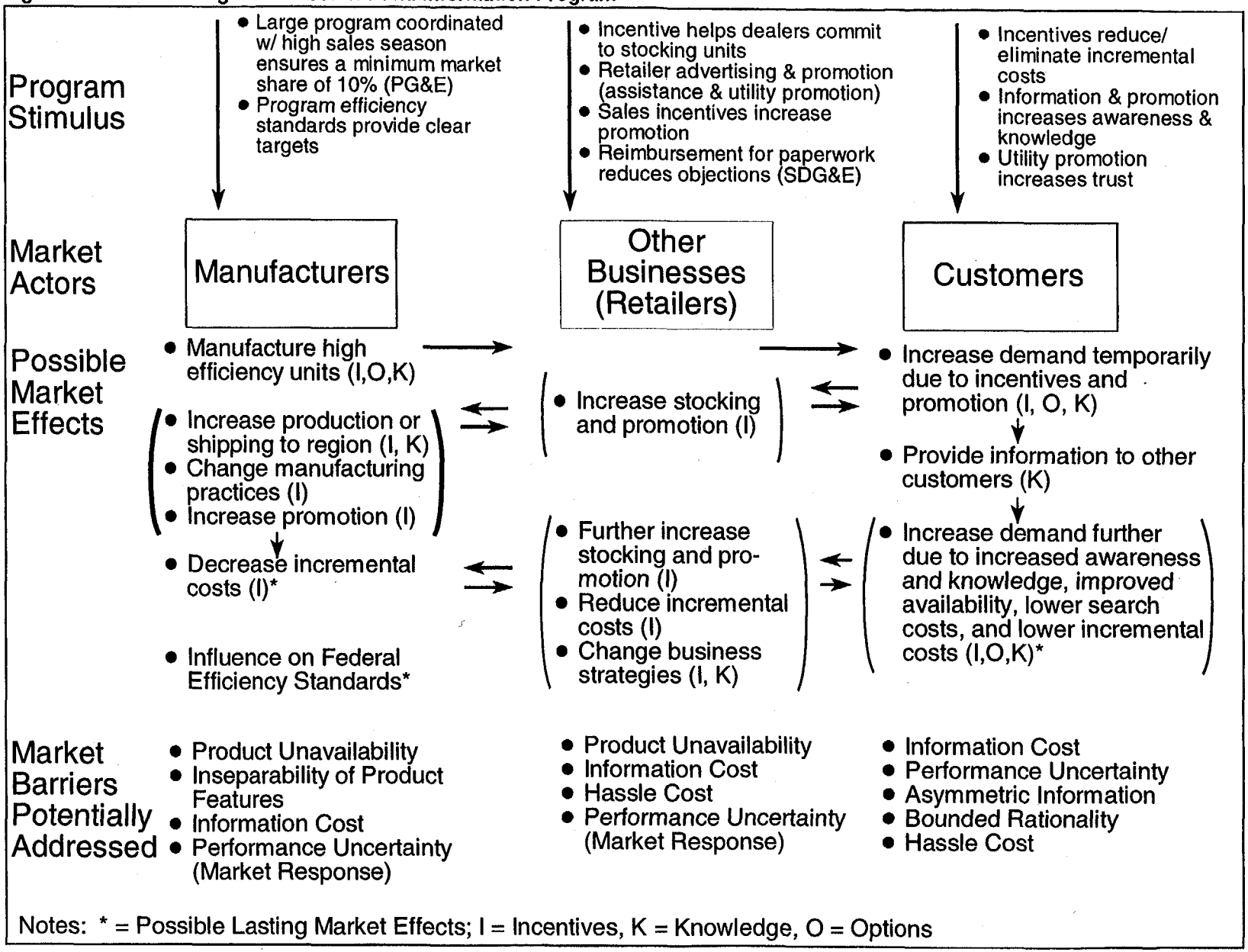
This subsection is based on interviews of program staff from PG&E and SDG&E. For PG&E, we concentrated our review on the Efficient Refrigerator Rebate program. For SDG&E, we concentrated our review on the High-Efficiency Refrigerator Program and the Compact Fluorescent Lamp Program.

We use a market influence diagram summarizing the programs, program stimuli, market actors, and hypothesized market effects associated with refrigerators (Figure 3-3) in this section as an example of all of the utilities' RAEI programs. Many of the program stimuli used for refrigerators and hypothesized market effects resulting from the utility refrigerator programs are similar to those associated with compact fluorescent lighting programs.

There are several types of market actors included in the category of "other businesses" in Figure 3-3. "Other businesses" could include distributors, dealers, retailers, or contractors.

Below we summarize hypothesized market effects that appear to be due to utility RAEI programs. We also list these hypothesized market effects on Figure 3-3. We describe the market effects in two groups, organized by relevant market actors: (1) manufacturers and other businesses, and (2) customers. For each group we describe the nature of the hypothesized market effects and associated reductions in market barriers, and summarize any evidence provided by the utilities or potential evidence proposed by the interviewees. Finally, we discuss whether any of the hypothesized market effects are likely to be lasting.

Figure 3-3. RAEI: Refrigerator Incentive and Information Program



Manufacturers and other businesses (distributors and retailers): Changes in products, production levels and schedules, product attributes and features, product quality, awareness and knowledge, distribution practices, promotional practices, stocking practices, prices, and business strategies; acceleration of response to oncoming standards; and influence on standards.

Nature of effects: There are a large number of hypothesized market effects associated with the refrigerator programs (see Figure 3-3), including: changes in products and product attributes (e.g., refrigerators that exceed federal efficiency standards by 10 to 25%, many of which were not available before utility programs according to the interviewees); increased production of energy-efficient products (generally in response to planned utility programs); increased awareness and knowledge among manufacturers and retailers; lower prices for energy-efficient refrigerators; increased promotion by manufacturers and retailers (including advertising campaigns run by the utilities, and supplemental campaigns run by manufacturers and dealers); increased stocking and availability of products; and acceleration of manufacturers' responses to efficiency standards. Some of these effects (i.e., increased promotion and increased availability) may have led to further increases in customer awareness and knowledge.

Utility energy-efficiency efforts may have influenced federal efficiency standards for appliances. The interviewees asserted that earlier generations of refrigerator programs were very important in setting higher federal standards in 1993, and stated that the programs are also influencing the new proposed federal standards.

The hypothesized market effects outlined above appear to indicate that the utility programs are potentially addressing some of the market barriers associated with manufacturers and other businesses in the residential refrigerator market, including: product unavailability, performance uncertainties related to the uncertainty of market response, information cost, inseparability of product features, and hassle cost.

We also identified a large number of hypothesized market effects associated with compact fluorescent lighting, including: development of new products (CFLs and fixtures); increased production of energy-efficient products (supported by increased manufacturing capabilities); improvements in product quality; changes in product attributes (e.g., CFLs with higher power factors and lower total harmonic distortion, modular components, and smaller sizes and shapes that fit better); increased awareness and knowledge; lower prices for energy-efficient lighting products (reported for both lamps and fixtures by the interviewees); increased promotion by manufacturers and retailers; and increased stocking and availability of products.

Evidence or potential evidence of effects: SDG&E and SCE provided M&E reports of refrigerator and CFL programs in which the net savings estimates included participant and

nonparticipant spillover, estimated by using comparison service territories.[27] SDG&E provided a refrigerator floor stock study which found the average floor stock efficiency rating increased from 7% above the standards in 1990 to 15.5% above the standards in 1992. Interviewees agreed with the suggestion that price reductions over time could be assessed using the Statewide measure cost studies, or internal utility databases that track the invoice cost of measures.

Lasting effects: Lasting effects for manufacturers and other businesses in the distribution chain are discussed below.

Customers: changes in purchasing behavior due to changes in awareness, attitudes, knowledge, and decision making processes.

Nature of effects: The programs may have increased customer awareness, knowledge, and understanding of energy efficiency, and of related products and services, leading to increases in customer demand and adoption. Customer demand has increased due to incentives and promotion within the program (at least temporarily)—some of this increased demand may lead to longer term or lasting effects (i.e., increases in the demand of these or other customers).

These hypothesized market effects appear to indicate that the utility programs are potentially addressing some of the market barriers customers face in the residential refrigerator market, including: information cost, performance uncertainties, asymmetric information, bounded rationality, and hassle cost.

Evidence or potential evidence of effects: SDG&E and SCE provided M&E reports in which the net savings estimates included participant and nonparticipant spillover. The interviewees reported increased willingness to pay for energy efficiency, demonstrated by strong participation in programs even when incentives are lowered (also reported by the interviewees to be found in some evaluation studies).

Are these hypothesized market effects lasting? We do not know whether these effects will be lasting, and if so, for how long and in what manner. A couple may last beyond the utility programs, but it appears that the majority will not.

Manufactures of refrigerators have substituted components on the assembly line to increase energy efficiency rather than retooled or made substantial changes to the manufacturing process. Therefore, if utility programs are discontinued, and customer demand drops, the manufacturers could (and most likely will) revert to manufacturing less efficient refrigerators.

---

27 As noted earlier, we did not conduct detailed technical reviews of these studies, and therefore were not able to assess or determine the reliability of any evaluation findings or estimates.

CFL manufacturers have made investments in manufacturing plants and processes that cannot be changed easily to less efficient products. Therefore they are very likely to continue manufacturing and promoting their products. However, product attributes may change, which may result in lower product quality, fewer modular product offerings, or products with lower power factors and higher harmonic distortion.

We do not know whether the increased promotion of energy-efficiency products by manufacturers and retailers will be lasting. We suggest that these market actors will promote energy-efficiency measures as long as such promotion is in their self-interest. If utility programs are discontinued, and customer demand drops, manufacturers and retailers most likely will go back to promoting less costly (and less efficient) units and products. CFL manufactures will probably continue, and may even increase their promotion efforts because of their sunk investment in CFL manufacturing plants and processes.

We do not believe that the increases in stocking will be lasting unless customer demand for energy-efficient products remains stable or grows. Utilities in other states and regions have reported lasting increases in stocking driven partly by higher customer demand, and partly by changes in vendor business strategies, but most of these reported increases have been associated with C&I programs.

The majority of observed and hypothesized changes in customer purchasing behavior due to increased information and knowledge are not expected to last much beyond the end of the specific utility interventions. The utility interviewees supported this belief. Awareness is likely to erode over time. Even if customers are willing to invest in energy efficiency now, they need regular reminders to continue to do so in the future. Several interviewees stated that clear, consistent messages repeated several times had more impact than one message, and questioned who would provide these messages in the future if utilities did not. Some aspects of the increased knowledge of customers may last, being used later for purchasing other products, or for recommending products to others. However, the level of customer knowledge and understanding will not increase above current levels without additional efforts by the customers, efforts of others, or continued interventions in markets.

We generally consider codes and standards to be lasting. However, currently there are questions about the near- and long-term support for federal standards, thereby adding uncertainty regarding their long-term effectiveness.

3.3.5 Examples of Market Effects Associated with Other C&I End Uses

Below we summarize the hypothesized market effects associated with other C&I end uses (nonlighting) that appear to be due to utility C&I EEI programs. We describe the market effects in groups, organized either by (1) relevant market actor(s), (2) end use or technology, (3) type of market effect, or (4) a combination of these. For each group we describe the nature of the hypothesized market effects and any reductions in market barriers, summarize any evidence provided by the utilities or potential evidence proposed by the interviewees, and discuss whether the effects are likely to be lasting.

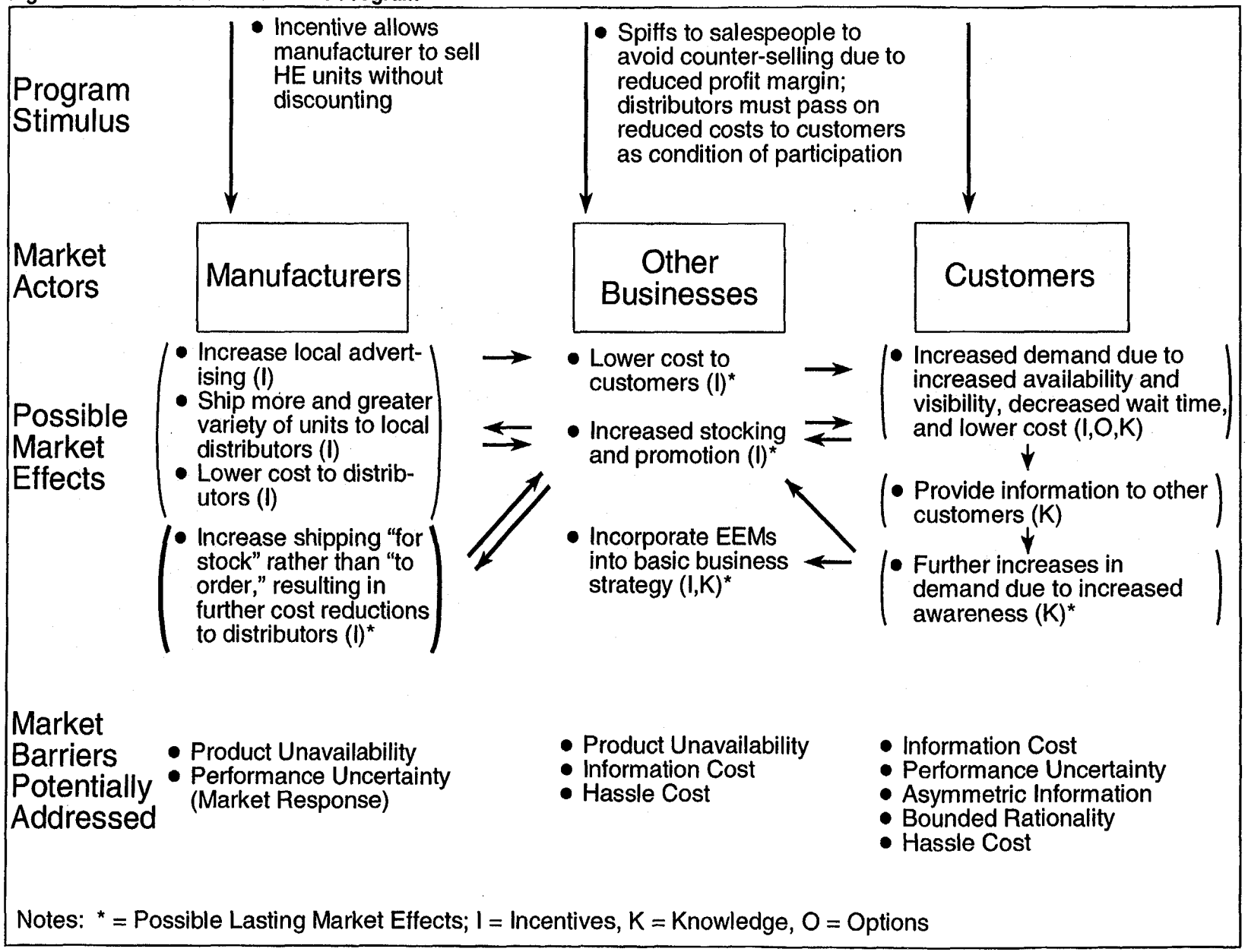
Other businesses and manufacturers, chillers: changes in products, product attributes and features, distribution practices, promotional practices, design practices, prices, and business strategies.

Nature of effects: There have been substantial changes in the product design, manufacturing, system design, use, and promotion of energy-efficient chillers in recent years. Chillers have undergone large technological improvements, with designs focusing on reducing cooling water temperature through greater use of cooling towers and more effective controls (i.e., condensed water relief). Manufacturers have also made improvements in equipment efficiency, and in reduced horsepower cooling towers. More manufacturers are building and actively marketing these improved systems, and more vendors are promoting and specifying them. Increased competition among vendors has led to lower prices. Some of the increased interest in chillers in general is driven by CFC refrigerant regulations. PG&E reports that the utility programs have been a very large influence in this market.

Evidence or potential evidence of effects: Interviewees reported increased efficiency in the standard practice or baseline estimate developed using the M&E protocols (with some interviewees claiming that the higher baseline was really due at least partly to the utility programs). According to utility interviewees, self-reports of manufacturers and vendors described substantial changes in standard practice, and the large role the utility programs played in causing this change.

Lasting effects: It appears that some of the design and technology improvements will last, especially manufacturer commitments to using techniques that will reduce cooling water temperature, and probably some portion of the equipment efficiency improvements. Operation-oriented improvements (i.e., operation of controls) may be temporary without continued intervention. The degree to which larger cooling towers will continue to be used will be determined by concerns about first cost, with vendors likely to decrease their promotion of larger cooling towers if the vendors become more concerned about losing bids. PG&E believes that the next efficiency innovation will not be promoted or even developed without continued intervention.

Figure 3-4. Manufacturer Incentive Program



Other businesses and manufacturers, motors: changes in stocking and distribution practices, promotional practices, prices, and business strategies.

Nature of effects: Vendors are distributing and stocking more energy-efficiency measures as a result of utility programs. One example of this is energy-efficient (premium efficiency) motors. The increased stocking of energy-efficient motors appears to be due at least partly to utility programs, which have attempted to increase customer demand (thereby encouraging vendors to increase stocking), and to encourage more stocking of energy-efficient motors directly (often using vendor, dealer, or manufacturer incentives; see Figure 3-4 summarizing the program stimuli and market effects associated with manufacturer incentives programs). For example, SCE has offered manufacturer incentives in the past, and SDG&E has a small handling fee for motor dealers and contractors. The programs appear to have increased availability and reduced search costs for customers. In addition, the utilities report that the prices for motors have decreased.

Evidence or potential evidence of effects: One interviewee hypothesized that information may be available in M&E studies regarding the change in availability and stocking of motors.

Lasting effects: We do not know whether these effects will be lasting, and if so, for how long and in what manner. Utilities in other states and regions have reported lasting increases in stocking driven partly by higher customer demand, and partly by changes in vendor business strategies.

Other businesses, contractor and vendor promotion of measures, including VSDs: changes in promotional practices and business strategies.

Nature of effects: The utility programs have increased vendor promotion of energy-efficiency products/services. In some cases, the increased promotion appears to be beyond that required by the utility program activity itself. For example, VSDs on air handlers, which are occasionally being installed based on customers' requests, are now being recommended and promoted regularly by vendors.

Evidence or potential evidence of effects: None provided or suggested by interviewees.

Lasting effects: We do not know whether the increased promotion of energy-efficiency products/services by vendors will be lasting, and if so, for how long and in what manner. We suggest that vendors will promote energy-efficiency measures as long as such promotion is in their self-interest. In the case of VSDs, vendors appear to be able to make sales that otherwise would not be made without the vendor's promotion efforts.

Other businesses and manufacturers, HVAC systems: changes in product attributes, changes in design practices, promotional practices, and business strategies.

Nature of effects: Some HVAC designers are promoting and specifying more efficient HVAC systems. Common efficiency standards in utility programs have provided a consistent efficiency target for manufacturers, thereby reducing their uncertainty and risk.

Evidence or potential evidence of effects: None provided or suggested by interviewees.

Lasting effects: We do not know whether these effects will be lasting, and if so, for how long and in what manner. Packaged HVAC designers may or may not repeat the energy-efficient design in the next building. HVAC contractors may not recommend efficient systems because they may be concerned that the higher costs could result in them losing the bid. Customers are unlikely to take the next incremental step on their own. For this market and end use, the interviewees believed that the next efficiency innovation would not be promoted or even developed without intervention.

Other businesses, industrial process and compressed air: changes in design practices, promotional practices, and service offerings, as well as development of new skills.

Nature of effects: There is greater interest in industrial process applications of energy efficiency, partly driven by increased experience in using energy efficiency to help meet other customer needs (such as regulatory compliance or process improvements), and partly by utility desires to provide high-quality service to these customers. Some vendors have increased their promotion of energy efficiency, and are offering design, engineering, and installation services to meet customers' need. In some cases, vendors are developing new skills and offering new services, often targeted to specific industries. To be effective, many of these new services require systematic approaches that can be costly. For example, compressed air systems have very large energy-efficiency opportunities, but capturing the opportunities requires a planned, systematic approach.

Evidence or potential evidence of effects: None provided or suggested by interviewees.

Lasting effects: We do not know whether these market effects will be lasting, and if so, for how long and in what manner. It is not clear whether vendors will continue to offer such services if utilities discontinued their promotion, or whether customers would pay the costs for systematic approaches. One interviewee noted that there is less opportunity to transfer information between customers in the industrial sector, because opportunities are site-specific and competitive considerations.

Government: changes in codes or standards.

Nature of effects: Utility energy-efficiency efforts may have influenced federal efficiency standards. There have also been changes in city and county codes and regulations (e.g., the Berkeley energy-efficiency codes, which were predicated on using the PG&E program to comply) that may have been influenced by utility programs.

Evidence or potential evidence of effects: None provided or suggested by interviewees.

Lasting effects: We generally consider state codes and federal standards to be lasting. However, currently there are questions about the near- and long-term support for state codes and federal standards. Local codes that rely on utility programs for assistance in complying are less likely to last if the programs are discontinued. Also, codes and standards can lose value if they are not enforced fully.

3.3.6 Conclusions

The main strategies of utility customer incentives programs (providing financial incentives, information, and technical assistance to customers, dealers, and manufacturers) attempt to address the two market barriers most frequently reported by the utilities during the interviews: high first cost (which we have noted is due to underlying market barriers) and lack of information. In this sense it appears that the program strategies may be properly focused. A closer look, however, raises questions about whether the programs will lead to transformed markets.

We identified many additional market barriers beside high first cost and lack of information, including some that are underlying contributors to high first cost. The more recent customer incentives programs (1995 and 1996) appear to address a longer list and wider variety of these market barriers than did the earlier programs. However, it is not clear whether the programs are addressing enough of the important market barriers, or the right ones, to lead to lasting market effects (and transformed markets) in the most effective and efficient manner.

It appears that not all programs try to identify or reduce the market barriers underlying high first cost. There are explicit attempts in some programs to reduce the underlying barriers, e.g., by reducing the uncertainty of market size for manufacturers, guaranteeing a minimum market share for efficient equipment by informing manufacturers of the size of the utility programs in advance, providing clearer messages about the products and attributes likely to be desired by customers, and providing manufacturer incentives that manufacturers could choose to invest in new facilities or improvements. However, the majority of the emphasis of the programs is on financial incentives to customers.

The emphasis on identifying and addressing market barriers seems to be well developed in many programs. However, in some interviews, the emphasis on market barriers appeared to be a very recent shift from previous priorities—sometimes the right words were used, but the interviewees did not seem to fully comprehend the meanings or the implications. For example, in a few cases interviewees had a difficult time distinguishing between lasting barriers to the market adoption of energy efficiency and current barriers to participation in their programs.

Using our knowledge and understanding of the relevant markets and the California utility programs, we identified many potential market effects of the customer incentives programs. During the interviews the utilities suggested market effects that were identical or similar to many of the hypotheses we developed independently. The interviewees also identified additional hypothesized market effects. We consider the following hypotheses of market effects to be the strongest (meaning that the market effects are well-founded in theory, the observed changes in the market are consistent with the market changes that were expected to be caused by the programs, and the market effects are believed to be true by many in the industry, including us and the interviewees):

- Changes in products and product attributes (including improvements in product quality),
- Changes in production levels and schedules,
- Changes in promotional practices among dealers and manufacturers,
- Changes in stocking practices among dealers and distributors,
- Increases in product and service availability,
- Reductions in the incremental costs of energy-efficiency products and services,
- Changes in design and specification practices,
- Changes in awareness and knowledge of energy efficiency among customers, manufacturers, and other businesses in the distribution chain, and
- Changes in decision-making practices among organizations (especially those with multiple sites).

We consider the majority of these hypothesized market effects to be plausible, but largely unsubstantiated. Many of the hypothesized market effects sound logical and reasonable, and are consistent with market changes that have been observed and would be expected to be caused by the programs. However, there is almost no empirical evidence available at this time to estimate the nature and size of the market effects.

It appears that the hypothesized market effects could result from both market-driven (equipment replacement, remodeling, and renovation) and retrofit transactions. Some hypothetical effects seem to be closely linked to financial incentives, while others appear to be due to other program activities or services.

The utilities provided little or no evidence or documentation to support most of the hypotheses of market effects. Several interviewees gave suggestions for how the information needed to support the hypotheses could be provided or developed.

The only documentation of hypothesized market effects provided by the utilities was M&E reports that included participant and nonparticipant spillover in the estimates of net savings. We have not completed a thorough review of these studies, and therefore cannot confirm the reliability of the net savings estimates that include spillover; however, the *existence* of spillover appears to be irrefutable.

We do not know whether the hypothesized market effects will last, and if so, for how long and in what manner. The utilities provided no empirical evidence of lasting effects. It appears that many of the hypothesized market effects we summarized probably will not last if the utility programs are discontinued. The ones that appear to be more likely to last are those associated with energy-efficient C&I lighting, compact fluorescent lighting (because of the commitment of manufacturers to the products and to dedicated manufacturing facilities, meaning that manufacturers are unable to substitute less efficient components on the assembly line), changes in decision making practices within some organizations, changes made to manufactured equipment (e.g., technological improvements to chillers), and some aspects of changes in customer awareness and knowledge (i.e., knowledge that can be used later for purchasing other products, or for recommending products to others). While these effects may be a minority of the *number* of effects summarized in this report, they would result in a large *amount* of savings and benefits for customers and society.

Utility staff supported our belief that many of the hypothesized market effects are not lasting. When utility staff were asked whether they thought the potential market effects identified during the interviews were temporary or lasting, the utilities considered the majority of the hypothesized market effects to be temporary—though they also suggested that the relatively small number of lasting market effects associated with C&I lighting and some other end uses should provide a large amount of benefits.

The success of utility customer incentives programs in *completely* transforming markets seems limited to date, because: (1) it appears that many of the hypothesized market effects may not be lasting effects, and (2) barriers to energy efficiency remain in most markets. Even in markets where some barriers have been reduced, there are other barriers that remain. Again, one area of success may be C&I lighting; it appears that at least some markets for C&I lighting either have been transformed, or are in the process of being transformed.

We believe that well-designed utility programs will find some markets easier to transform than others. For example, transformation of some equipment and end-use technology markets (e.g., lighting and chillers), where accelerated commercialization of new products is the main objective, seems more straightforward and more likely to succeed than transformation of other markets, particularly those with more difficult market barriers such as misplaced or split incentives associated with rental property and leased space.

3.4 Information Programs

3.4.1 Overview

Formally, the information programs offered by California's utilities are classified in two ways: residential vs. nonresidential, and Energy Management Services (EMS) vs. other information programs. While the EMS category always includes energy audits, the other programs categorized under this heading vary somewhat among the utilities.[28]

In practice, the specific information programs being offered by the utilities, as well as the strategies underlying these programs, vary widely. They run the gamut from several types of audits, to design assistance and other technical assistance efforts, to telephone hotlines, to mass advertising efforts.

On the surface, the primary market barrier addressed by most information programs is obviously lack of information or awareness regarding specific energy-efficiency measures and practices on the part of the market actor being targeted. However, in interviews, information program managers emphasized that what customers are generally lacking is not so much information about measures and practices per se, as information that is credible and readily accessible (i.e., a practical way of reducing search costs). Most managers also emphasized the need for a neutral third party to help customers sort through the competing claims of different vendors (i.e., a way of overcoming the problem of asymmetric information). In addition, several interviewees emphasized that the C&I sector does not lack basic knowledge about what measures are available, so much as detailed technical understanding of the financial performance of these measures (i.e., a way of reducing performance uncertainties). Interviewees reported that their programs directly addressed lack of customer knowledge by providing customer-specific combinations of technical, financial, and market-related information.

In assessing the potential market effects of California's information programs, we focused much of our attention on the information programs offered by Southern California Edison Company (SCE). Because of uncertainties about the tax treatment of its energy-efficiency program costs, SCE in 1995 eliminated most of its incentive programs and refocused its marketing efforts on information programs. Based on information contained in SCE's annual reports and evaluations, we concluded that these programs—particularly SCE's C&I audit program— appear to have generated substantial savings. We thus selected this program as a case study of the market effects of information programs.

---

28 The DSM policy rules appear to define Energy Management Services as those which offer site- and measure-specific recommendations, as opposed to more generic recommendations. However, in practice, it is unclear whether this distinction is being closely followed in the way the utilities categorize their programs for reporting purposes. For example, in some documents, SCE classified direct load control, time-of-use rates, and Home Energy Loan Program under Residential Energy Management Services (REMS).

We also interviewed program managers for PG&E's nonresidential EMS program and SDG&E's nonresidential other information programs. Finally, we gathered data on information programs in the course of our interviews with the managers of several new construction and rebate programs, both of which feature information components.

We draw a primary distinction between information programs focused on encouraging the adoption of specific measures (for example, audit programs) and programs intended to generate broader changes in customer awareness of or attitudes regarding energy efficiency (for example, mass advertising.)[29] Our initial intent was to analyze the market effects of these two categories of programs separately, based on the premise that there were likely to be fundamental differences between the market effects of programs targeting specific measures and those focusing on broader issues of energy-efficiency awareness. However, in the course of the study, we made two discoveries that led us to reconsider this strategy.

First, it appears that the great majority of the resources dedicated to information programs in California have gone to programs focusing on specific measures—specifically, to audit programs. This appears to be changing, as utilities face both regulatory and business pressures to influence customer behavior more cost-effectively. For example, as discussed later in this chapter, several utilities have recently converted their residential new construction programs into general information programs intended to increase customer demand for energy-efficient housing. In addition, in 1995 and 1996, several of the utilities have introduced innovative informational efforts such as multipurpose World-Wide Web sites focusing on energy efficiency, mass advertising campaigns targeting specific ethnic groups, and increased use of technical seminars for C&I customers. However, most of these marketing efforts are new enough that they that they can not yet plausibly be expected to have resulted in substantial market effects.

Second, our interviews with utility employees and our review of annual DSM reports for the past several years both suggest that the utilities have tended to view their general information programs primarily as the means of promoting and generating participants for their other programs.[30] It would therefore be difficult to isolate the market effects of these programs in

---

29 Programs targeting broad changes in customer awareness of energy-efficiency options can be further subdivided into two categories: mass information programs, which attempt to change the awareness or attitudes of the general public, and targeted information programs, which attempt to change the awareness or attitudes of specific utility customers or groups of customers. Examples of the latter category include workshops, electronic bulletin boards, and display booths.

30 This tendency appears to be so strong that even some programs initially designed for other purposes are being used in this manner. For example, SCE's Commercial Technology Applications Center (CTAC) was initially intended primarily for general education of customers and company employees. However, when asked how CTAC was currently being used, SCE interviewees emphasized how helpful it was to be able to send customers wavering about accepting a specific energy-efficiency recommendation for which a financial incentive is being offered to see the measure in operation at CTAC.

and of themselves. (As discussed below, this proved difficult even in the case of more measure-specific programs.)

For both of these reasons, we focused most of our attention on those programs, such as audit and technical assistance programs, which target customer adoption of specific measures.

3.4.2 The Current Role of Information Programs in the DSM Portfolio

In attempting to assess the market effects of measure-specific information programs, we soon discovered that most utilities view even these programs as integrally connected to their incentive programs. In some cases this connection takes the form of using information programs to generate leads for rebate programs, while in others, it takes the form of viewing both information programs and incentive programs as two components of an integrated marketing approach to influencing customer behavior. For example, PG&E uses its C&I audit program largely to generate leads for its rebate programs, and also features extensive technical assistance services as part of the rebate programs themselves. Similarly, SCE is moving in 1996 to a marketing approach that integrates audits and rebates and focuses these services on those customers who most need information.

This tendency to view incentive and information programs as part of one overall marketing approach appears to work both ways, for if information programs are often viewed as a vehicle for generating leads for incentive programs, incentive programs are also often viewed as a vehicle not just for encouraging the adoption of specific measures, but also for educating the customer about energy efficiency. In fact, several rebate program managers told us they believed the most important lasting market effect of their programs was to increase customer awareness and understanding of the benefits of energy-efficiency measures. In addition, as discussed elsewhere in this chapter, several utilities believe that the main vehicle by which the market effects induced by their rebate programs may persist after the programs are withdrawn is the education of local trade allies about the role that energy efficiency can play in their business strategy.

The integration of information and incentive programs reflects the belief of many program managers that lack of information, high first costs, performance uncertainties, and risk averseness are all closely intertwined as market barriers, that must be addressed simultaneously in order to effectively encourage customers to adopt energy-efficiency measures. The sole exception to the rule that the utilities view their information and incentive programs as an integrated whole appears to be Southern California Gas Company (SCG). [31]

---

[31] While SCE's sharp focus in 1995 on audits and other information services might initially be viewed as another exception to the rule, SCE made clear in interviews that it regarded its elimination of customer incentives in 1995 solely as a business necessity to reduce its exposure to tax losses, and not as a repudiation of the usefulness of incentives as part of its DSM portfolio.

In interviews, SCG employees repeatedly emphasized three claims: (1) that lack of customer information on available energy-efficiency options was the number one market barrier; (2) that information was what SCG believed its customers wanted and were willing to pay for; and (3) that SCG believed focusing on offering customers information on energy efficiency was both in the company's interest and the right thing to do. This exclusive focus on lack of customer information about available options as the sole market barrier needing to be addressed is difficult to reconcile with most available theory and evidence regarding the functioning of energy-efficiency markets. Most theorists appear to accept that other market barriers beyond lack of customer information, such as those discussed in Chapter 2 of this report, do contribute to the gap between the actual level of investment in energy efficiency and the level that appears to be cost-beneficial. (Of course, the overall size of this energy-efficiency gap, and the desirability of public intervention to help close the gap, continue to be hotly debated.) In addition, the last time utilities relied solely on offering customers information to achieve savings was in the late 1970s and early 1980s. The results of these early programs were not particularly encouraging regarding the potential for information-only efforts to lead to significant increases in the adoption of energy-efficiency measures.

A key implication of the utilities tending to view their information and incentive programs as components of an integrated marketing effort is that in many cases it is extremely difficult to disentangle the potential market effects of the two types of programs. Below, we attempt to untangle them. However, in our conclusions, we return to the issue of interwoven market effects from incentives and information programs.

3.4.3 The Market Effects of California's Information Programs

In many cases, information program managers offered no hypotheses about any long-term market effects that information programs, separate from other programs, might be having. In several cases, interviewees told us straightforwardly that they regarded their program's main objective to be encouraging the adoption of specific measures, and that any broader market effects were incidental.

In almost all cases where program managers did offer hypothesized market effects for their programs, these revolved around lasting increases in the level of customer awareness or understanding of energy efficiency.[32] Most often, these hypothesized effects revolved around customers being contacted so repetitively with measure-specific recommendations that there

---

32 Because on-site audits are a skilled and labor-intensive activity, we hypothesized that one potential market effect of REMS and NREMS programs might be the development of the energy-efficiency labor market—particularly in cases where these programs are outsourced, thus leading to the training of new energy-efficiency professionals beyond the boundaries of the utility. However, program managers generally responded negatively to this hypothesis, with one saying that the number of auditors involved was too small to make a substantial difference.

ensued a generalized, transferable increase in their level of understanding of energy efficiency, leading in turn to long-term changes in purchasing behavior. For example:

- The manager of one utility's C&I customer seminars and internet Web site believes that these programs have made a lasting increase in customers' access to information about energy efficiency by increasing their networking opportunities. This manager reports that many of the facility and energy managers attending the utility's seminars have begun interacting by phone and e-mail on issues of common interest. In addition, on the Web site, hot-links to other energy-efficiency resources have exposed customers to other sources of information beyond those offered directly by the utility.

- A manager of agricultural sector programs offering both incentives and information credits primarily the information for catalyzing a lasting shift toward adoption of drip irrigation.

- In discussing market changes induced by utility C&I heating, ventilation, and air conditioning (HVAC) programs, (see Section 3.3) one program manager credited the program's information component for convincing customers that high-efficiency chillers could perform reliably. This manager also pointed to breakfast meetings held with trade allies as convincing vendors that customers would purchase this measure if convinced of its reliability.

- SCE's manager of nonresidential audits and services offered the opinion that, because each of her company's 5,000 largest C&I customers receive some type of measure-specific information from the utility many times each year, there has been a cumulative increase in their general awareness of energy efficiency as a business resource.

Despite these hypotheses, none of our interviewees was able to point to any evidence of these longer-term behavioral changes in the form of market research or program evaluation data. As discussed elsewhere in this report, this lack of market evaluation appears to be the direct result of the M&E protocols focusing on the measurement of the load impacts associated with rebated measures. Several interviewees told us directly that they believed their company had little reason or opportunity to measure the longer term behavioral effects of information programs.

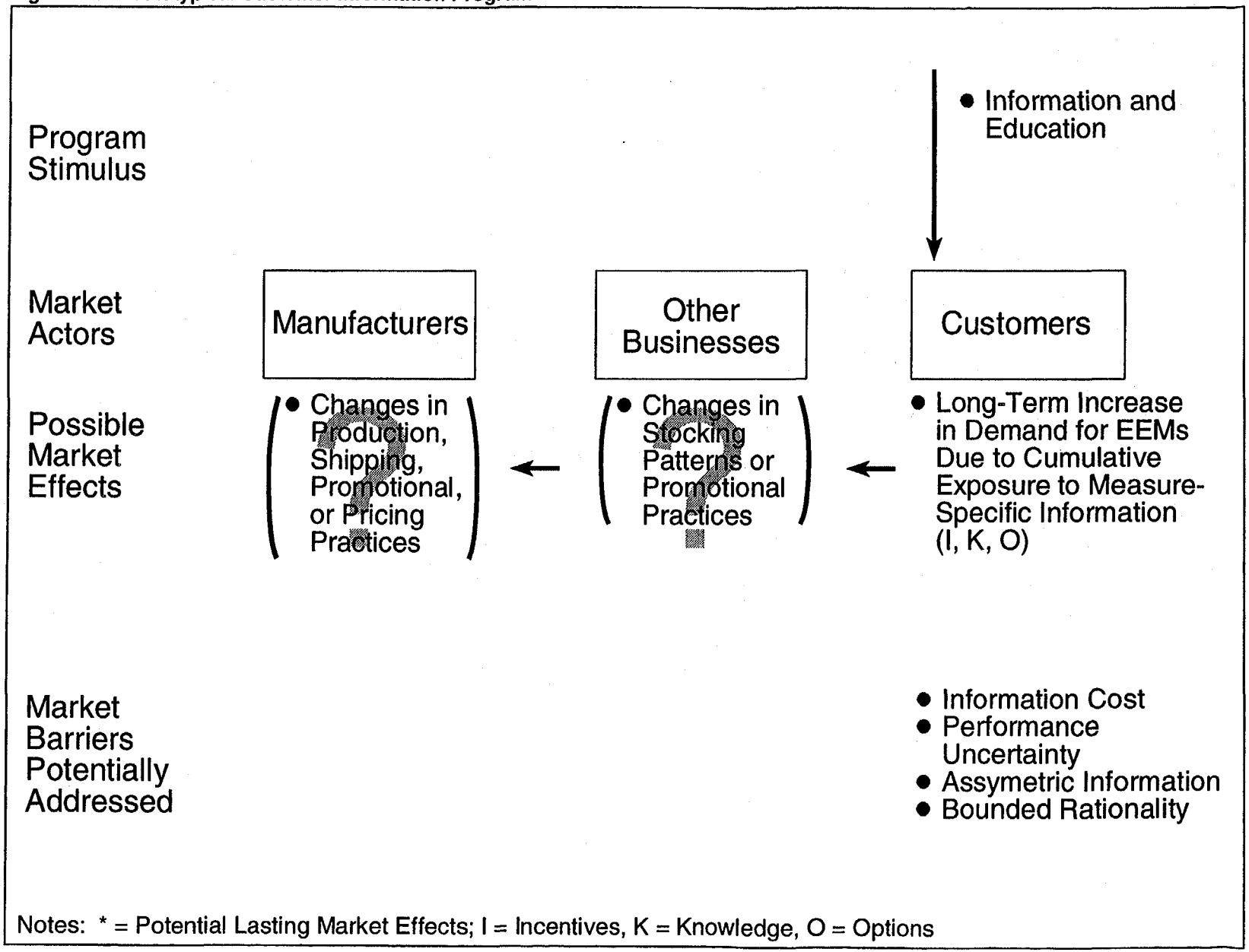
While we do not question the possibility or even likelihood of such longer-term educational effects occurring, as illustrated in Figure 3-5, we believe it is an open question whether such effects alone are sufficient to produce lasting changes in the structure and functioning of energy-efficiency markets. There is a long tradition of research in the behavioral sciences showing that even fundamental changes in attitudes or knowledge do not guarantee changes in behavior, which is often dictated by custom, habit, exigency, or bounded rationality. In addition, the review of market barriers presented in Chapter 2 of this report suggests that many energy-efficiency measures face multiple market barriers, including those that involve

customers but not limited information, and those that do not involve consumers at all. As suggested by the case studies in the preceding section on resource programs, the most convincing examples of lasting market effects stemming from utility energy-efficiency programs tend to revolve around chain reactions in which barrier-reducing changes in the behavior of one set of market actors lead to further barrier-reducing behavioral changes involving other market actors. The prototypical example involves changes in consumer behavior sending an audible signal up the distribution chain, thereby influencing dealer, distributor and even manufacturer behavior. However, thus far, there has been little discussion in the DSM industry of the possibility that such chain reactions may occur as a result of information programs rather than incentive programs. Without such a chain reaction, increases in the demand for energy-efficiency measures induced by customer education could eventually run up against the brick wall of limited availability, due to market barriers that customer enthusiasm alone cannot ameliorate.

Have California's information programs produced long-term increases in measure adoption sufficient to influence the practices of regional vendors? We asked a number of program managers this question. Most had no opinion, but those who did were generally skeptical. To establish crudely whether such market effects might be plausible, we looked for information on the long-term penetration of several residential and nonresidential audit programs. The results do not rule out the possibility of market effects. For example, SCE reported that it had 3.5 million customers, and had conducted a cumulative total of about 1 million audits, suggesting that about 30% of customers had received a home audit.[33] In addition, as noted above, SCE reports that its 5,000 largest customers, which it is targeting for audits and other information-related services, are all being contacted by account representatives numerous times each year. Such numbers suggest that, if these programs do in fact have significant long-term behavioral effects, the sheer numbers of customers manifesting these effects could be sufficient to induce changes in the functioning of energy-efficiency markets.

[33] This should be viewed as a very rough estimate, given the facts that: (1) different customers can receive an audit on the same house, if it changes hands; and (2) the same customer may receive an audit on different houses.

Figure 3-5. Prototypical Customer Information Program



However, in the absence of longer-term behavioral impacts beyond the specific measures initially recommended, the potential for information programs alone to have generated significant volume-based changes in vendor practices appears to be more limited. One crude measure of the likelihood of such volume-based effects is the raw savings of the measures adopted because of these programs. In 1995, an unusual year in which audits were its primary marketing approach in the C&I sector, SCE achieved an estimated 222,283 MWh of savings from this approach. However, in the preceding year, when SCE used a more traditional approach integrating audits and rebates, these approaches together achieved an estimated 704,701 MWh of savings. There is no way of knowing how many energy-efficiency measures must be adopted as a result of a utility energy-efficiency program in order to send a perceptible signal to local vendors. However, it seems likely that measures representing 704,701 MWh of savings are significantly more likely to do so than measures totaling 222,283 MWh. Thus, at least at the level at which such programs have been historically funded, the potential for volume-based market effects resulting from audit programs appears to pale in comparison to that for programs integrating audits and rebates.

3.4.4 Conclusions

The tendency of utilities to integrate their information and incentive offerings makes it difficult to reach firm conclusions about the market effects of information programs. We believe it is likely that information efforts have contributed significantly to many of the market effects of resource programs discussed earlier in this chapter. However, there appears to be insufficient evidence at this point to attribute many clear market effects to information programs in and of themselves. Factors contributing to this conclusion include: (1) the tightly interwoven nature of California's incentive and information programs; (2) the fact that program managers were generally quicker to attribute market effects to specific incentive offerings than to specific information offerings; (3) the uncertainty regarding whether the specific measures induced by audit programs have been sufficient to generate market effects reflective of changes in vendor practices; and (4) the uncertainty regarding whether short-term changes in purchasing behavior are accompanied by longer-term behavioral changes.

The difficulty of extricating the market effects of information and incentive programs has two primary implications. First, more research is needed to assess the role of information in generating lasting changes in customer purchasing behavior. Second, categorization of programs according to whether they offer incentives or information makes it difficult to evaluate market effects by program. If an incentive mechanism is created that is focused to encourage the utilities to change the way energy-efficiency markets work, what constitutes a program will have to be redefined, and programs will have to be recategorized. We return to this theme in the final chapter of this report.

3.5 New Construction Programs

This section is based on interviews conducted with the program staff for two residential new construction programs (offered by SCG and SDG&E) and two nonresidential new construction programs (offered by PG&E and SCG). The SDG&E residential program was discontinued in 1995; the remaining programs are continuing to operate in 1996. In 1996, SCG eliminated financial incentives to builders in the residential new construction program. SCG's nonresidential new construction program has been changed into an alternative marketing channel for rebates on new gas cooking equipment offered in their commercial energy-efficiency incentive (CEEI) program. Therefore, we de-emphasize our findings from that program in this section and cover the program in our review of CEEI programs. PG&E's nonresidential new construction program retains its basic design but has been modified to reflect that shareholder earnings for this program are now based on the shared-savings incentive rather than the performance adder.[34]

California utility energy-efficiency programs for new construction attempt to improve the energy efficiency of buildings during their design and construction phase.[35] New construction is often viewed as a strategic target for utility energy-efficiency programs because the costs of improving energy efficiency at this stage in the building life cycle are low compared to the cost of retrofit after a building has been built. Because this stage of the building life cycle is comparatively short compared to the total life of the building and in view of the substantially higher cost of retrofit, failure to improve energy efficiency at the time of design and construction is often referred to as a "lost opportunity."

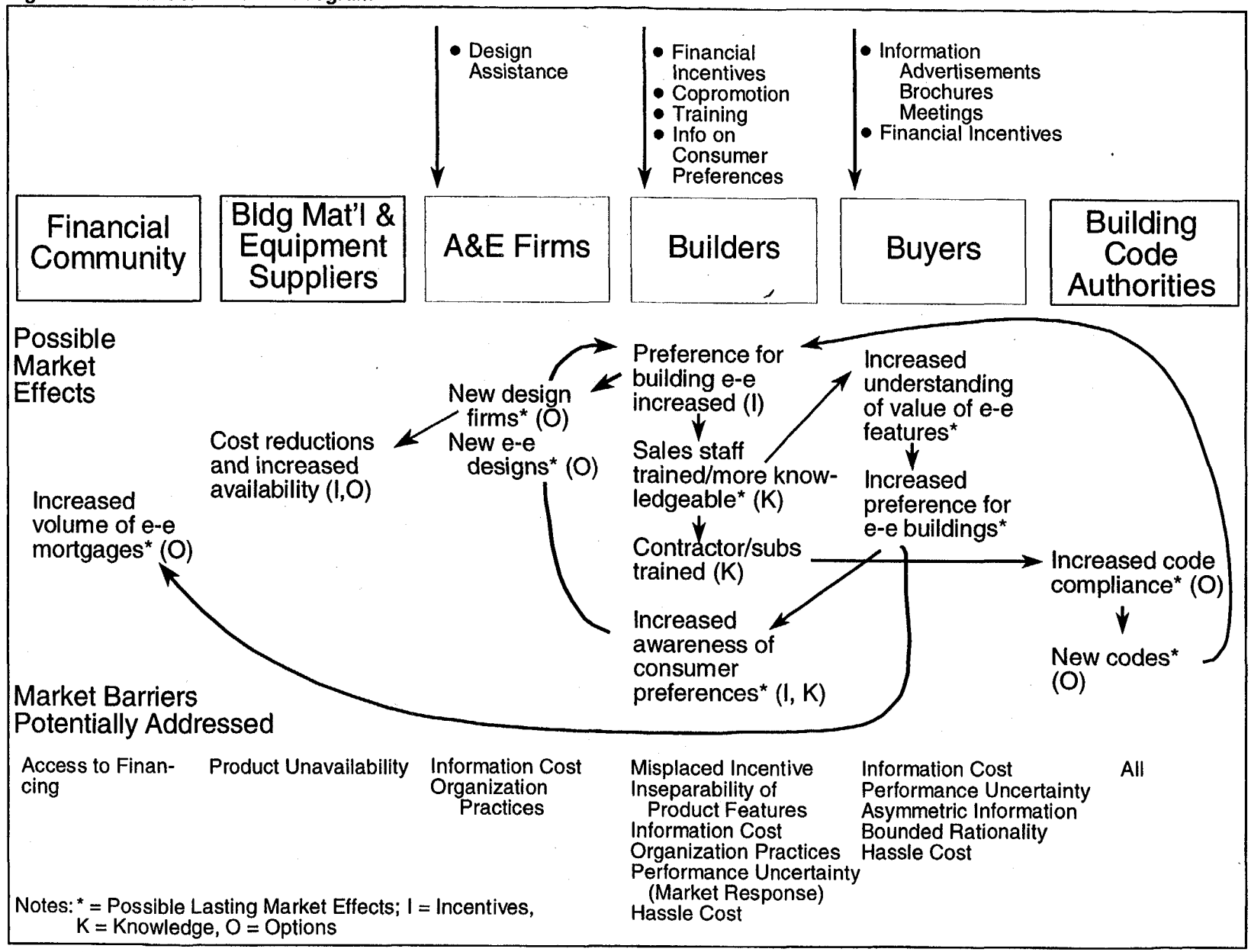
New construction programs are somewhat different from traditional rebate programs in that financial incentives are generally paid to the builder or developer of a new building rather than (or in addition to) the ultimate owner of a building. To the extent that the builder is the target of a new construction program's marketing efforts and incentive offerings, the builder is acting as an intermediary, much the same role that trade allies play in appliance rebate programs that provide incentives to appliance dealers. Nevertheless, builders can also be thought of as manufacturers in the sense that they create consumer products from raw materials. As a result, the market influence diagram for new construction programs differs somewhat from those for rebate programs (see Figure 3-6).

---

34 See Chapter 4 for a discussion of the shareholder incentive mechanisms.

35 PG&E's nonresidential new construction program also includes major renovations to existing nonresidential building that require compliance with Title 24.

Figure 3-6. New Construction Program



New construction refers to a broad class of economic activities. The split between residential and nonresidential is formally recognized in the organization of utility energy-efficiency programs. We will be careful to distinguish aspects of utility new construction programs that apply uniquely to residential or nonresidential new construction.

From the standpoint of utility energy-efficiency programs, the most important distinction between residential and nonresidential construction has to do with the development process. For residential construction, most (but not all) builders develop (i.e., acquire the land, finance construction, and sell finished homes) in addition to building homes. Residential builders are sometimes distinguished by the volume of construction they represent. Some develop and build large tracts of homes based on a small number of plans. Some develop and build less than 20 homes annually, often based on custom designs. The majority of new home buyers occupy the residence unless it is a multifamily building (which resembles a nonresidential building in this regard). However, the identity of the ultimate owner (and thus the owner's interest in energy efficiency) is usually not known during the initial phases of construction.

For nonresidential construction, the development process is more complex. Many developers do not occupy the finished building but instead build to resell (also true of multifamily residential buildings). Nevertheless, a significant percentage of nonresidential construction is developed by the ultimate owner for occupancy or rental. Owners may own individual buildings or of chains of buildings, among other arrangements.

In addition, nonresidential new construction also tends to involve coordination among more than one firm. The most important are the design/build firm, which manages the design and construction process on behalf of both owner-occupiers and speculative builders, and architectural and engineering (A&E) firms, which supply designs. In residential new construction, these activities are typically different departments within a single developer's firm.

Both residential and nonresidential builders rely extensively on subcontractors for selected aspects of construction process, such as HVAC, plumbing, wiring, etc. These subcontractors, in turn, rely on a highly mobile workforce, which is subject to rapid turnover.

In addition to builders and owners, other firms involved in the new construction process may be affected by utility new construction programs, including equipment vendors, material suppliers, and the lending community, which finances the construction and purchase of new buildings.

A final observation on the building industry is that it is cyclic or subject to periods of boom and bust. Entry into and exit from the business is relatively easy. Competition among builders is, not surprisingly, fierce. In residential new construction, for example, competition is reflected primarily in price, as influenced by a variety of different amenities (total floor area, three car garages, large window areas, central air conditioning, etc.). Participation in utility

energy-efficiency programs is keenly affected by new construction cycles; small numbers of housing starts generally mean low participation in utility residential energy-efficiency programs.

3.5.1 Market Barriers in New Construction

New construction is often identified as the archetypal *misplaced or split incentive* market barrier. Builders are said to want to minimize first cost, and therefore to have little or no interest in energy-efficiency measures that increase first cost because they cannot benefit directly from these measures—they will not pay the energy bill for the occupied building. Similarly, owners who will pay the building's energy bills, have limited or no opportunity to have their interest in energy efficiency influence the design and construction process, especially if they come into the picture after the building is constructed.

A more precise statement of the situation is that builders do not believe it will be profitable to raise the first cost of a building to cover the added expense of making it more energy efficient because they do not believe purchasers value energy efficiency. Characterized in this fashion, the split incentives market barrier can be seen as manifestation of a variety of underlying market barriers. In order to understand the approaches adopted by utility new construction programs, it useful to identify these underlying market barriers:

Buyers, developers, designers, and builders often lack information on the availability of energy-efficiency measures for new construction. Acquiring reliable information is costly; there are *search costs, performance uncertainties, and asymmetric information.* In addition, developers may not have adequate information on the value that buyers might place on energy-efficiency measures; in other words, developers face *performance uncertainties* about the market response to their product.

Buyers, developers, designers, and builders may therefore, misjudge how their self interest is affected by energy efficiency because they rely on imperfect decision-making processes. Buyers may think of energy efficiency as a binary feature (either a home is energy efficient or not) or may not fully understand a home energy rating system, which are examples of *bounded rationality*. Developers, designers, and builders may rely on rules of thumb (*organization practices or custom*) for building orientation, construction details, and equipment sizing decisions.

Energy-efficiency measures, by themselves, typically cost more than standard measures.[36] Higher costs may be attributable to supply constraints or simply the current low level of demand for the measures i.e., *product unavailability.*

---

36 Although a comprehensive energy-efficient design may result in a lower total cost for construction.

Buildings are a bundled product of attributes of which energy efficiency is only one. This *inseparability of product features* is exacerbated by the absence of financial instruments that account for the unique characteristics of energy-efficiency measures (*access to financing*). This situation, in part, arises from the lack of reliable information on the absolute and comparative energy performance of buildings.

The building construction process is sequential, involving coordination among a host of firms, contractors, and subcontractors. The *hassle costs*, for example, of tightly coupling energy-efficiency measures that interact (e.g., better building shell allows HVAC equipment to be downsized) may be deemed too high. The cost of enforcement between principals and their agents (master contractor and subcontractor, or subcontractor and employees) weakens accountability for failure to meet specifications (*organization practices*).

3.5.2 New Construction Program Approaches to Overcoming Market Barriers

To overcome market barriers, California utility new construction programs employ (or have employed) one or more of the following approaches in varying combinations:

1. Financial incentives have been provided to developers, builders or design/build firms, intended to offset some or all of the incremental cost of energy-efficiency features, in both residential and nonresidential new construction.

2. Financial and technical assistance has been given to design firms to reduce the extra design costs associated with energy-efficiency features, primarily in nonresidential new construction.

3. Economic analysis and hands-on demonstrations have been provided for buyers and developers, to improve their understanding of the value of energy efficiency, primarily in nonresidential new construction.

4. Training has been offered to sales staff to improve their ability to communicate the technical/economic aspects of energy efficiency to buyers, primarily in residential new construction programs.

5. Company-sponsored information and logos have been provided for use in developers' advertising, sales offices, and model homes, along with independent mass-media advertising to indicate to customers that the company has endorsed the energy-efficiency aspects of the builder's product; this occurs in residential new construction programs.

6. Company-sponsored trade advertising has been used to recruit builders and other company-provided information has been offered on customer perceptions of the importance

of the energy-related features of new buildings; these approaches have been used primarily in residential new construction programs.

7. Companies have participated in residential home energy rating systems and acted as intermediaries for energy-efficient mortgage programs to improve access to capital, which acknowledges the unique characteristics of energy-saving measures in homes.

3.5.3 Market Effects Due to the Programs

Government: Changes in building codes, including frequency and process of adoption. Changes in enforcement of or compliance with codes.

The single most important market effect of the new construction programs has been change in California's building code for energy efficiency, Title 24. The market effects of these revisions include changes in the products available, as reflected by changes in building practices and equipment selection (see below). All three program managers that we interviewed indicated that they believed their programs had helped pave the way for revisions to Title 24 by promoting practices and technologies that were later mandated by the code revisions. We do not dispute this claim, nor did we expect the program managers to suggest otherwise because the DSM policy rules (discussed at length in the next chapter) state explicitly that such revisions are the guiding principle for these programs. The programs have not accelerated the schedule for revisions; however, they are believed to have made the revision process much smoother. We believe it is safe to conclude that in the absence of these programs code revisions would be less dramatic and more contentious.

We also believe that current code revisions are permanent and provide evidence of a lasting transformation in new construction. There is mixed evidence on the need for additional market transformation. Program managers for SDG&E's residential program indicated that, as a result of Title 24 revisions, there are few remaining cost-effective opportunities for residential new construction, given the climate in areas serviced by SDG&E. If substantiated, the need for additional market transformation is clearly less than that for areas where there remain cost-effective opportunities. We can deduce that these opportunities remain in other parts of California, since the utility programs continue to be cost effective.

At least one utility energy-efficiency program evaluation has suggested that the utility's new construction program increased the level of compliance with Title 24. This finding suggests that even with code revisions, noncompliance is evidence of the need for additional intervention to transform new construction markets.[37]

---

[37] Chapter 4 discusses the disincentive to utilities to pursue compliance activities as part of their new construction programs, which emerges from the current M&E protocols.

Developers, Builders, Design Firms: Changes in design practices/fees, including entry by new firms specializing in energy efficiency. Changes in marketing practices. Changes in construction practices.

Although, marketing, and construction practices have clearly been affected by utility new construction programs, the lasting impacts of the utilities' programs on these practices, outside of changes to Title 24, have not been subject to much scrutiny. New design firms have entered the market, but it is difficult to tell whether they entered the market because of the programs or the Title 24 building codes.

Among residential builders, the SDG&E and SCG programs appear to have had a noticeable impact on marketing practices. Participating builders rely on copromotional activities with the utilities in order to differentiate themselves from the competing builders. Without support from the utility, we believe builders would be less successful. Among nonresidential builders, PG&E's program has not targeted, nor resulted in changes in marketing practices.

For residential and especially nonresidential builders, we believe that lasting changes in construction practices have so far been limited primarily to those now mandated by Title 24. That is, we believe builders' actions are largely if not entirely dictated by the preferences of their ultimate customers. For example, PG&E indicated that the design/build firms, which account for a majority of their nonresidential program, are motivated almost entirely by the financial incentive paid by the utility. PG&E believes that, if the incentive removed, construction practices will revert to code compliance.

Based on our interviews, we believe lasting effects on builders other than compliance with Title 24 are limited to those resulting from increases in consumers' awareness of energy-efficient measures and their willingness to pay for these measures. As indicated below, these market effects appear to be modest; nevertheless, they have not been evaluated systematically. The two possible exceptions to this general finding may be residential duct testing and sealing and use of energy-efficient residential windows (in part to increase glazing area while still meeting the prescriptive requirements for overall thermal transfer value of the building shell), both of which SCG and SDG&E indicate to be growing in use.

Buyers: Changes in awareness of energy-efficiency features. Changes in preferences (willingness to pay) for energy-efficiency features.

There is limited, but growing evidence to support claims for the existence of these market effects in both the residential new construction market and in aspects of the nonresidential new construction market. In the residential new construction market, one example is an SCG-sponsored survey (provided to participating new home builders) on buyer preferences, developed from exit interviews of new home buyers. The survey documents growing consumer awareness of and interest in paying for energy efficiency (in particular, for gas appliances in new homes). SCG has also conducted market research and found that

awareness is high among potential new home buyers in their residential new construction program. SDG&E and SCG report that co-advertising, in which newspaper ads identify participating builders and logos on new homes indicate participation in the utilities' program have been found by residential builders to be an important marketing tool. Neither form of evidence for market effects has been examined to determine to what extent the utilities' program has caused the increase in awareness versus the extent to which the program has simply capitalized on growing awareness due to other influences.

In the nonresidential new construction market, PG&E notes that the primary contact for the majority of projects is the design/build firm. The ultimate owner is often not directly involved in PG&E's program. Among projects in which the owner is involved, PG&E indicates that its program has increased awareness of energy efficiency. Specifically, PG&E cited an example of a prospective owner who, when reviewing a variety of energy-efficient measures, made a decision based on availability of a rebate from PG&E for a particular measure. Although some of element of this decision no doubt reflects the owner's interest in obtaining PG&E's rebate, PG&E maintains that part of the decision reflects the importance the owner placed on PG&E's endorsement of certain energy-efficiency measures. In addition, PG&E reports that presentations to project review committees for institutional owners, which consist of various institutional staff, have been very successful in persuading this type of building owner to participate in PG&E's program.

It is difficult to assess the lasting effects of these new construction programs on customers' awareness of energy efficiency. In the residential market, both SCG and SDG&E indicate that their programs have created some degree of awareness of energy efficiency (although, as mentioned, is it difficult to distinguish awareness of energy efficiency from awareness of their programs). The same can also be said of PG&E's nonresidential program, at least for the even smaller percentage of their program that directly involves owners (as opposed to design/build firms). No studies have examined the permanence of whatever awareness has been created.

It is even more difficult to assess the effects of the programs on buyers' willingness to pay. First of all, most of the programs offer financial incentives, either to the residential developer or to the nonresidential design/build firm, not to the ultimate owner. In these cases, the buyer is generally unaware of what is being paid for the energy-efficiency features in the building. In both this case and in the case where the buyer receives the incentive, the design of the program makes it difficult to determine willingness to pay because the incentive offsets some or even all of the incremental cost of the energy-efficiency measures. Willingness to pay, consequently, can only be established for the fraction of the true cost not covered by the incentive. This situation may change in the future; PG&E has reduced the fraction of incremental cost covered by its rebates, and SCG has completely eliminated financial incentives to residential developer.

Equipment Vendors and Material Suppliers: Changes in stocking practices (product availability). Changes in equipment or material prices.

In the majority of cases, participation in utility new construction programs primarily involves installing more efficient equipment (and, in residential construction, more materials) than that called for by code or conventionally installed. New construction programs offer both prescriptive- and performance-based financial incentives, consistent with the compliance paths for Title 24. As is the case with Title 24 compliance, many new buildings comply through the prescriptive path. For new construction programs, this means participation tends to involve around rebates for specific types of equipment or materials. In residential new construction, the equipment most frequently targeted includes high-efficiency central air conditioners (SDG&E, not SCG), gas water heaters, and gas furnaces. In residential new construction, energy-efficient windows and additional insulation are also targeted. In nonresidential new construction, the equipment most frequently targeted by PG&E includes high-efficiency lighting systems, chillers, pumps, refrigeration, and, for SCG, gas cooking. In this regard, the programs can be thought of simply as rebate programs targeted to new construction. SCG's nonresidential new construction program and SDG&E's current approach to residential new construction are both explicit examples of this approach.

As with the demand for energy-efficient construction, Title 24 also influences the product offerings of vendors and suppliers of high-efficiency equipment and materials. With this market effect as a backdrop, we focus our remaining comments on market effects other than those resulting from minimum compliance with Title 24.

As a result of the equipment/material-based orientation of new construction programs, it is difficult to isolate their market effects from those of the utilities' other energy-efficiency programs. The differences depend on their size relative to one another and on the size of the programs relative to the total market. Generally speaking, the new construction programs have all been much smaller in size than the EEI programs. Within the new construction portion of the market, no utility was able to provide information on the percentage of new construction activity influenced directly by its programs.

In residential new construction, SCG indicated that its program has not significantly altered the stocking patterns of retail vendors of high efficiency gas furnaces or water heaters, nor had the program resulted in lower prices. As evidence, the SCG program manager indicated frustration that, when high-efficiency equipment installed in new construction fails, it is almost always replaced on an emergency basis with less expensive, more readily available, standard equipment.

Similarly, SDG&E indicated that the cost differentials for high-efficiency central air conditioning units remain too high to justify by energy savings, in large part because the

modest cooling requirements in coastal and inland regions.[38] SDG&E indicated that the price differential for energy-efficient windows is currently only about $1-3/square foot, which is indicative of a mature market for these windows. However, the role of SDG&E's program in influencing the size of the market is unknown.

SCG indicated that the market for high-efficiency commercial gas cooking equipment is quite competitive but did not indicate whether its program had affected either pricing or stock practices. SCG indicated that its older program had no measurable effect on the shipment lead-times required for double-effect chillers.

PG&E said that it believed its new construction program had influenced several equipment markets to varying degrees: (1) for T-8 lamps, statewide adoption somewhat independent of Title 24; (2) for packaged HVAC systems, slow increases in the efficiency (3) for industrial refrigeration, significant and identifiable changes (3) for high-efficiency motors, little or no change and (4) for energy management systems, near complete saturation

A common theme in our interviews with program managers was the lack of information to verify their speculations regarding changes in new construction equipment and material selection. PG&E currently has a study under way that is expected to provide some documentation for claims about its programs.

Financial Intermediaries: Creation and use of new financial instruments.

The use of the CHEERS home rating system and energy-efficient mortgages for new residential homes has not been widespread in California. Utility new construction programs have likely played some role in accelerating the limited market acceptance of these two ideas. SCG's program offers an incentive to home buyers in the form of a credit to reduce closing costs for energy-efficient mortgages. However, neither SCG nor SDG&E mentioned energy-efficient financing as a major element of their programs. As a result, we conclude that these programs are not likely to have contributed strongly to the creation and use of new financial instruments.

38 Although we did not review PG&E's residential new construction program, PG&E indicated that it was aware of a consultant to the residential building industry that had documented price reductions in the cost of high-efficiency central air conditioners; the extent to which these reductions could be attributed to PG&E's program was unknown.

3.5.4 Conclusions

California utility energy-efficiency programs have played an important role in facilitating the revision of Title 24. These revisions are the most important and lasting market effect of utility new construction programs. As a result of code revisions, builders have changed their practices, new firms specializing in compliance issues have entered the market, and equipment vendors and material suppliers have seen increases in the demand for energy-efficient products. However, many program managers regard their programs' financial incentives to builders as no more than bribes. Many felt that builders would immediately revert to no more than code compliance, if financial incentives were discontinued. Further reversion is precluded in many cases because Title 24 changed and it is unlikely that code provisions will be rolled back at some future date. Thus, compliance with the revisions is an important part of the evidence that must be examined to assess market transformation in new construction.

Some program managers believed that the key to stimulating long-term builder interest lies in stimulating long-term buyer interest in energy-efficient buildings. We agree with this assessment. Recent pressures on utilities to reduce the overall budgets for the programs have unintentionally provided utilities with an opportunity to redesign their programs to emphasize buyer awareness. That is, pressure to reduce the level of financial incentives paid have led at least one utility to focus attention on stimulating customer demand and assisting builders in capitalizing on this demand. Internal notes circulated among new construction program staff at another utility indicate that they, too, are beginning to pursue this strategy more aggressively.

We believe this subtle shift in program emphasis could be consistent with improving the ability of new construction programs to overcome the split incentive market barrier in new construction in a lasting fashion. That is, buyers' interests in energy efficiency must be established first; builders can then recognize how their financial self-interest is affected by building energy-efficient buildings. Technical and marketing assistance allows builders to act upon and further stimulate buyer demand. The increased availability of design expertise and creation of new financial instruments lowers the asymmetric information, hassle costs and lack of access to financing associated with designing and acquiring energy-efficient buildings.

3.6 Direct Assistance Programs

This section is based on an interview conducted with the program staff of SCG's low-income weatherization assistance program, which SCG has run since 1983.

Direct assistance programs are not subject to cost-effectiveness tests used to evaluate other utility energy-efficiency program offerings because enhancing economic efficiency is not the primary motivation for these programs. For example, SCG reports that the $11 million spent in 1995 is expected to produce only $4 million in savings.

Funding levels, negotiated annually between the CPUC and SCG, have declined steadily from a high of over $30 million to a projected $12 million in 1997. SCG funding was once a major source of funding for the community based organizations (CBOs) that implement the program; SCG funding for CBO weatherization activities is decreasing, as is funding from all other sources, including state Department of Economic Opportunity, Federal LIHEAP, and DOE weatherization funding.

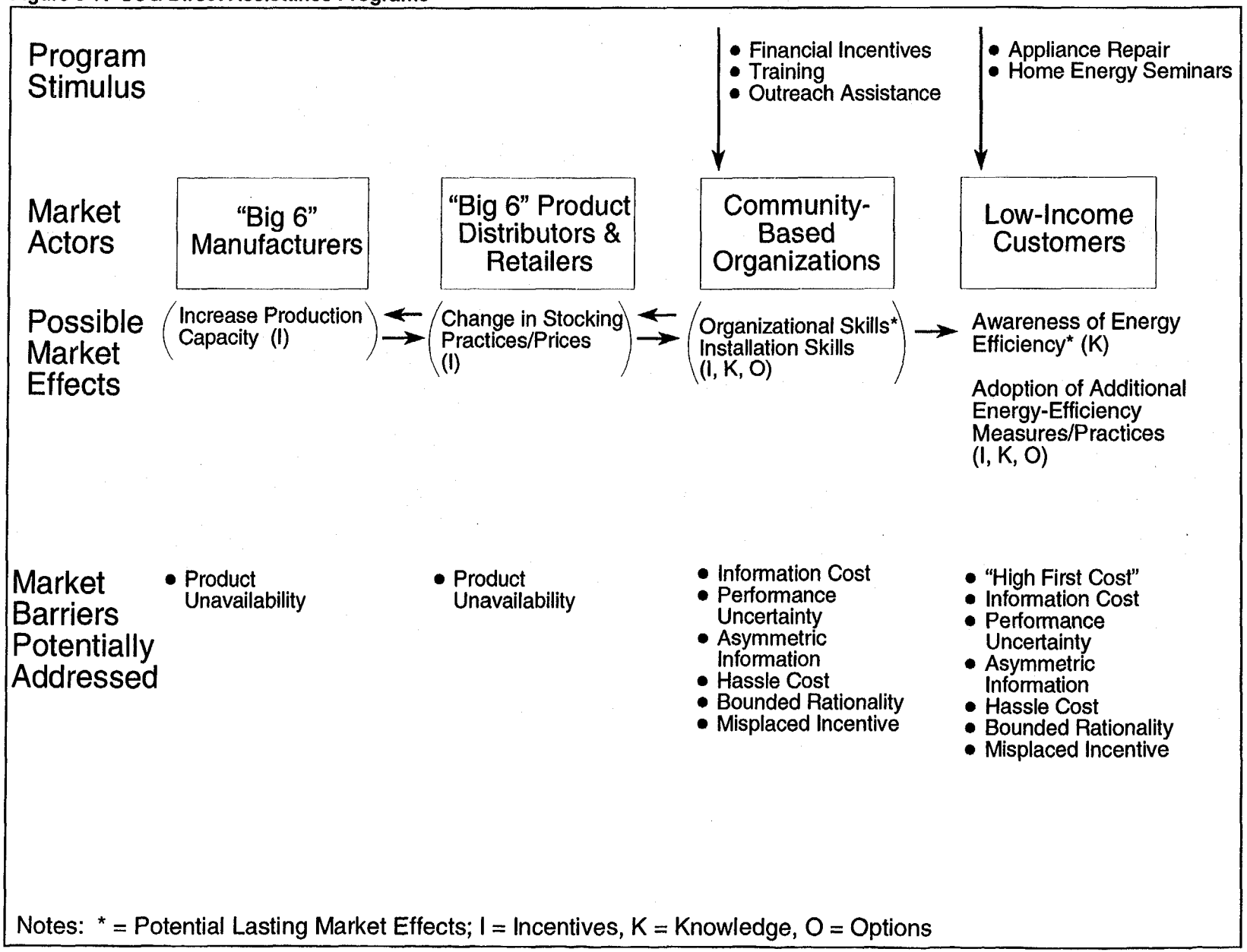
SCG believes that some CBOs are poorly administered. This year, SCG is conducting a pay-for-performance pilot in which only 60% is paid out in advance; the remaining 40% is paid only after a billing analysis conducted following the first heating season after the weatherization. In 1995, SCG also began a pilot to allocate 25% of funds through a competitive solicitation.

SCG believes that a primary constraint on the cost effectiveness of the program has been the requirement to install the "Big Six" measures when, according to SCG, many are clearly not cost effective. SCG says it is trying to increase the cost effectiveness of measures installed by tightening some requirements (e.g., attic insulation only for bare attics). SCG also reports that it has also reduced some internal administration costs.

3.6.1 Market Barriers Targeted

The target market for SCG's weatherization program is qualifying, low-income customers. The market barriers these customers face are similar to those faced by all consumers, but in many cases the degree to which they are affected is far greater. Many are transient and do not own their residence, and thus are subject to the *split incentives* market barrier. They also face high *search costs, performance uncertainties, asymmetric information, and hassle cost* market barriers. Many lack the skills needed to evaluate energy efficiency (*bounded rationality*). Moreover, in many cases, the individuals and firms they have dealt with in the past may have exploited these attributes opportunistically and created substantial mistrust regarding claims made about unfamiliar topics (such as energy efficiency). At the same time, because they are poor, low-income customers have fewer means (i.e., disposable income) for overcoming these barriers, or for bearing the consequences of bad decisions.

Figure 3-7. SCG Direct Assistance Programs



3.6.2 Program Approaches for Overcoming Market Barriers

The program operates through CBOs that are compensated on a per-household basis for installing a mandatory set of "Big 6" measures at no charge to the customer (see Figure 3-7). SCG pays a maximum of $400 per household envelope weatherized. SCG provides training to CBO staff at a central training facility. Outreach, largely door-to-door, is conducted by CBO to a populace that SCG reports is increasingly wary of giving out the information needed to qualify. The high cost of outreach was cited by SCG as a leading cause of poor performance in 1995. SCG indicated that poor performance by the CBOs in 1995 led to SCG spending of only $18 million out of its authorized budget of $25 million.

SCG reports that a particularly successful element of their program has been an appliance repair and replacement program, which they indicate has been extremely well received and is now increasingly accompanied with some direct consumer education on proper use. In our opinion, this is an extreme, and instructive example of takeback. In many cases, the program is not simply increasing energy efficiency of poorly operating equipment, it is providing previously foregone energy service amenities by fixing broken (i.e., non-operating) appliances.

SCG's program and training center contribute to overcoming market barriers by providing funding and training to assist a community-based infrastructure deliver weatherization services. The center also ends up teaching basic reading and math skills to CBO staff.

3.6.3 Market Effects

To the extent that consumers receive information, they are more aware of proper use of appliances, experience greater indoor comfort, and often gain working appliances. SCG believes that the appliance program has had an intangible yet generally acknowledged effect of increasing good will toward SCG. We believe good will toward SCG may lead to increased awareness and trust in information provided by SCG on energy efficiency. SCG also believes its consumer workshops have imparted lasting consumer education benefits.

SCG indicates that CBO staff members have acquired job skills from what is often their first job. SCG has historically operated the only training facility in its service territory for weatherization training. It believes it has thus provided training that is being leveraged by the other low-income weatherization programs, which do not provide training. (PG&E now has a center in Bakersfield, and SCG now has one in Compton.)

SCG indicates CBOs have gained administrative and outreach skills, which some are now attempting to apply to other business enterprises.

SCG reports that stricter insulation requirements now required in order to qualify for the program have reduced purchases of insulation, although it is not clear what percent of total

insulation sales are a result of these programs. SCG also reports that some local suppliers are selling more doors as a result of the program; SCG had no information whether these increases have led to changes in stocking practices or prices.

SCG reports that CBOs tell them that, after 13 years of operating these programs, it is getting harder to find qualified customers willing to participate, which suggests that the cumulative market penetration of the program has been significant.

SCG is not required to conduct formal evaluations of its direct assistance program and has not done so, therefore there is not documented evidence of post-program savings or the extent and lastingness of market effects. A post-program savings evaluation is being conducted this year as part of SCG's pay-for-performance pilot.

3.6.4 Conclusions

The product-related market effects of direct assistance programs have not been documented and would be difficult to distinguish from effects of other utility programs offering similar measures to the residential sector or from nonutility activities to implement these measures. The institutional effects are more tangible. SCG reports that its direct assistance programs have accounted for the lion's share of funding for CBOs, facilitating both their creation and continued existence. According to SCG, lack of accountability in these programs have led to mixed performance on the part of CBO's. In our opinion, the lack of accountability stems, in part, from the non-economic efficiency rationales for promoting them. The notable successes of the program include repairing broken appliances and providing supplementary education as well as developing community-based organizing skills in lower income communities. It is difficult to justify these successes on grounds other than social equity although we do not dispute the political legitimacy of doing so.

3.7 Summary

Using our knowledge and understanding of the relevant markets and the California utility programs, we identified many potential market effects of the recent programs, including:

- Changes in products and product attributes (including improvements in product quality),
- Changes in production levels and schedules,
- Changes in promotional practices among dealers and manufacturers,
- Changes in stocking practices among dealers and distributors,
- Increases in product and service availability,
- Reductions in the incremental costs of energy-efficiency products and services,
- Changes in design and specification practices,

- Changes in new construction codes and in enforcement of existing codes,
- Changes in awareness and knowledge of energy efficiency among customers, manufacturers, and other businesses in the distribution chain, and
- Changes in decision-making practices among organizations (especially those with multiple sites).

During the interviews, the utility representatives suggested market effects that either were consistent with the hypotheses we developed, or were additions to our list of hypothesized market effects. We consider the majority of these hypothesized market effects to be *plausible* and *likely*. Many of the hypothesized market effects sound logical and reasonable, and some observed market changes are consistent with expectations of how the programs would impact those markets.

The vast majority of the hypothesized market effects we identified are associated with customer incentives programs (C&I EEI and RAEI) and new construction programs. Information programs may have contributed to these effects because they are very closely linked to the incentives programs.

Unfortunately, there is almost no empirical evidence available at this time to support most of the hypotheses of market effects, or to assess the nature and estimate the size of the effects. The only documentation that the utilities provided were several M&E reports that included estimates of participant and nonparticipant spillover. The remainder of the hypothesized market effects were not supported by documentation. Many utility interviewees suggested that it would be valuable to study market effects, but they said they had no directions or incentives to do so, and that it was a low priority compared to other M&E tasks required by regulators and utility management.

Some of the hypothesized market effects listed above have the *potential* to lead to lasting reductions in market barriers. However, we do not know whether the market effects will last, and if so, for how long and in what manner. The utilities provided no empirical evidence of lasting effects. It appears that many of the hypothesized market effects probably will not last if utility programs are discontinued.

The market effects that appear to be most likely to last are those associated with energy-efficient lighting, changes in decision-making practices within some organizations (especially those with multiple sites), changes made to manufactured equipment (e.g., technological improvements to chillers), changes in design and specification practices, and changes in codes and standards. Although these are only a portion of the market effects identified in this report, they would result in large savings and benefits for customers and society.

The market effects of earlier utility programs, including the influence of the programs on codes and standards, may have been lasting and very beneficial. We did not assess these effects because the focus of our review was on 1994 and later programs.

The success of recent utility programs in *completely* transforming markets seems limited to date; it appears that many of the hypothesized market effects may not be lasting effects, and barriers to energy efficiency remain in most markets. One potential area of success may be C&I lighting; it appears that as least some markets for C&I lighting have either been transformed, or are in the process of being transformed.

Some markets are likely to be easier to transform, using well-designed utility programs, than other markets. For example, transformation of some equipment and technology markets (e.g., lighting and chillers), where accelerated commercialization of new products is the main objective, seems more straightforward and more likely to succeed than transformation of other markets, particularly those with more difficult market barriers such as misplaced or split incentives associated with rental property and leased space.

Does California's Current DSM Policy Framework Support the Objective of Market Transformation?

In this chapter, we assess the consistency of California's DSM policy rules, shareholder incentive mechanisms, and M&E protocols with the objective of market transformation. Our primary approach is to analyze in theoretical terms the structure of the incentives[39] and disincentives posed to utilities by these three components of California's DSM policies. However, we also draw on the results of Chapters 2 and 3, as well as on our interviews and review of program documents.

In theory, the policy rules, shareholder incentive mechanisms, and M&E protocols each play a unique role in the state's DSM policies. The DSM policy rules enunciate the state's objectives for utility energy-efficiency programs and the means by which these policies are to be carried out; the shareholder incentive mechanisms are designed to encourage the utilities to pursue these objectives; and the M&E protocols are designed to assess the extent to which the objectives have been met, and to establish the compensation paid to utilities for their efforts.

In practice, however, the three components appear to blend together to form an integrated policy framework. The DSM policy rules lay out program objectives and cost-effectiveness criteria, but also establish the broad outlines of the shareholder incentive mechanisms and measurement and evaluation activities. The protocols focus primarily on the technical requirements for M&E studies, but also establish schedules for the payment of shareholder incentives and an institutional setting for the handling of evaluation-related issues. In view of these overlaps, it is perhaps not surprising that when we asked interviewees about the effects of the DSM policy rules, the shareholder incentive mechanisms, and M&E protocols on their decision-making, most told us they did not draw clear distinctions between the three, but thought instead in terms of the overall DSM regulatory environment that has evolved in California.

Because these three components of California's DSM policy framework have evolved in such an integrated fashion, it is difficult to isolate the individual effects of any one of the components. Therefore, this chapter presents a series of general findings regarding the compatibility of the current policy framework with the objective of market transformation,

---

39 Throughout this chapter, we use the word "incentives" to refer to the full array of factors, including both regulatory policies and business forces, that influence the course of action a utility finds to be in its shareholders' best interests to pursue. This use of the word should not be confused with shareholder incentive mechanisms, which we call by that name.

with substantiation of many of these findings drawn from all three components of the policy framework.

4.1 California's DSM Policy Framework Promotes Resource Acquisition

California's DSM policy framework has largely been shaped by a single overriding policy objective: resource acquisition, or the achievement of reliable, measurable energy and demand savings that can replace supply-side options.

If there is a single concept that explains why California's DSM policy framework has evolved in the way it has, it is that of resource acquisition.[40] By way of illustration, the following is a series of passages taken from the most recent version of the DSM policy rules (Decision 95-06-016, June 8, 1995):

> The utilities should treat energy-efficiency improvements and energy conservation as viable alternatives to supply-side resource options... Resource value refers to the ability of a DSM program to reliably reduce utilities' fuel and/or capacity needs.... The stable development of DSM programs that deliver reliable energy savings for California's ratepayers depends on well-designed methods of program measurement and evaluation... It is important that forecasts of DSM savings be reliable in meeting California's energy needs. Rigorous measurement and evaluation enhances the reliability of these forecasts...

Underlying each of these statements is the concept that the energy and demand savings produced by utility energy-efficiency programs can replace supply-side options, but only if the programs are designed, implemented, and evaluated in a manner that yields predictable, reliable and measurable savings results.

This emphasis on reliability as the determinant of resource value is carried through to the shareholder incentive mechanisms. The basic form of the shared savings incentive

40 We recognize that policy objectives other than resource acquisition have been incorporated into California's policy framework over the years. These other policy objectives are the subject of a later section (4.4) in this chapter.

mechanisms[41] appears to have been motivated by a desire to align the interests of the utilities with the policy goal of resource acquisition, by allowing utilities to retain a share of whatever resource value they produce. Furthermore, many of the historical debates about the specifics of shared savings incentive mechanisms have been framed in terms of what type of mechanism is most consistent with the goal of resource acquisition.

The emphasis on resource acquisition carries through to the M&E protocols, in the form of:

- Strict requirements for accurate measurement and reporting of the load impacts of utility energy-efficiency programs, as well as the persistence of these impacts.
- Different measurement treatment for programs that are considered resource programs and those that are not.
- Reporting requirements established at the end-use level.
- The development of specific protocols for activities such as metering, monitoring, and regression analysis, to ensure the reliability of the results.

There is a good deal of evidence that this sharp focus on acquisition of reliable demand-side resources has been fruitful. At a time when utilities in other states have been vigorously campaigning to reduce or eliminate their DSM budgets, most of the major California utilities have continued to aggressively pursue demand-side resources.[42] Each year, the resulting programs of PG&E, SDG&E, SCE and SCG combined have yielded hundreds of millions of dollars in net resource benefits to society. Furthermore, rigorous impact evaluation continues to demonstrate that the energy and demand savings produced by California's utility energy-efficiency programs are both real and reasonably reliable.

---

41 The shared savings mechanisms applied to resource programs are only one of the two main categories of incentive mechanisms in place in California, the other category being performance adder mechanisms. However, performance adder mechanisms appear to have been responsible for only a small portion of the total savings claimed for utility energy-efficiency programs in California to date. Furthermore, we found in Chapter 3 that performance adder mechanisms are being used primarily to promote resource programs, and the existence of the performance adder incentives appears to be having little marginal effect on the behavior of the utilities above and beyond the combined effect of the shared savings mechanisms and other business forces. For these reasons, we focus primarily in this chapter on the shared savings mechanisms. However, the performance adder mechanisms are discussed at the end of the chapter.

42 A possible exception to this finding are gas utility energy-efficiency programs, which tend to have lower benefit-cost ratios than electricity programs, and for which shareholder incentive mechanisms based on sharing of net benefits are thus less attractive to utilities. In interviews, SCG told us that after the recent establishment of a requirement that utilities guarantee the cost-effectiveness of their programs, it no longer found the risk associated with the shareholder incentive mechanisms to be worth the reward. Accordingly, it eliminated all rebates with an estimated cost-effectiveness ratio below 1.5, leaving only a small number of commercial and industrial measures eligible.

4.2 The DSM Policy Framework Provides Mixed Incentives for Market Transformation

The emphasis of the current policy framework on resource acquisition as commonly defined provides the utilities with mixed incentives for achieving market transformation, or even market effects.

Clearly, then, California's policy framework is well adapted to the existing goal of resource acquisition. But how compatible is this policy framework with the new policy objective of market transformation, first expressed explicitly in the CPUC's December, 1995 electric industry restructuring decision?[43] We attempt to answer this question, by: (1) assessing the rewards and penalties utilities can receive for causing market effects under the existing policy framework;[44] and (2) analyzing the effect of the resource acquisition paradigm on the marketing strategies chosen by the utilities. We observe the following:

4.2.1. *The rewards to utilities for causing market effects are mixed, with some types of market effects increasing shareholder incentives, and other types decreasing them. However, the latter effect seems to dominate.*

On the positive side, certain types of beneficial utility-induced market effects can result in increased net benefits from resource programs, and therefore higher earnings under the shareholder incentive mechanisms for which these programs are eligible. For example, increasing the availability of energy-efficiency measures may increase customer participation in resource programs, while reducing the incremental cost of energy-efficiency measures may increase the net benefits for each unit claimed by the program.

On the negative side, however, California's M&E protocols contain two fundamental features which tend to penalize the utilities for any market effects manifesting themselves in reductions in average consumption among nonparticipants. The first of these is a strong emphasis on the use of comparisons of changes in energy consumption among participants and nonparticipants to establish net program impacts. As discussed later in this chapter, this research approach has an established role in the behavioral sciences. However, in the context of the energy-efficiency programs implemented by California's utilities, its use means that any reductions in consumption among nonparticipants caused by the program are likely to simply be subtracted from the reductions among participants, reducing the apparent net savings.

---

43 For a more general discussion of the compatibility of resource acquisition and market transformation as policy objectives, see (Prahl and Schlegel, 1994.)

44 A threshold question for policymakers is whether or not utilities are appropriate agents for pursuing the objective of market transformation. We discuss this issue briefly in the final chapter, but it is largely beyond the scope of this report.

An example of how this can happen can be found in C&I lighting. In Chapter 3, we found that C&I lighting rebate programs are likely to have had a number of significant market effects, including increased dealer promotion, reduced incremental costs, and improvements in product quality. All of these effects are at least as likely to increase the adoption of efficient lighting by nonparticipants as by participants. However, under the protocols, C&I lighting programs are commonly evaluated using multiple regression models which compare changes in consumption among participants and nonparticipants. Therefore, utilities are likely to be penalized for the market effects of their lighting programs.

Manufacturer rebate programs offer a second example. When asked why his company had not re-established its highly successful 1994 manufacturer rebate program targeting compact fluorescent lamps and motors in the C&I sector, one interviewee noted that the protocols provided a disincentive for such programs in the form of leakage—the purchase of eligible units by customers in the same region as the utility but not in the utility's service territory. He explained that his company's service territory was riddled with pockets where such leakage could occur, such as areas served by municipal utilities. Savings associated with leakage cannot easily be claimed by the sponsoring utility, and may even reduce savings credited to the utility if the areas where leakage occurs must be included in the nonparticipant group.

The second feature of the M&E protocols which tends to penalize the utilities for reductions in consumption among nonparticipants is the emphasis on treating the most commonly used measures and practices as a baseline, by which the energy savings associated with energy-efficiency measures are estimated. If a utility program leads to the adoption of energy-efficiency measures by nonparticipants, it is virtually certain to increase the efficiency of this baseline, thereby decreasing the apparent savings associated with each measure adopted by program participants.

An example of the manner in which the handling of baseline issues can penalize utilities for market effects can be found in the protocol requirement for new construction programs that utilities receive savings credit only for energy savings above and beyond the efficiency level mandated by codes. While this requirement ensures that utilities do not receive credit for code-induced savings for which they are not responsible, it also bars utilities from receiving credit for any enhancements to codes or code enforcement that were caused by the utility's programs. The results of the new construction analysis in Chapter 3 indicate that the historical effects of utility programs on codes and standards in California may have been substantial, suggesting that this is an important limitation of the current protocols.

To assess the overall compatibility of California's shareholder incentive mechanisms with the policy objective of market transformation, we would need to know the relative magnitude of the various rewards and penalties for market effects discussed above. While this is not an easy question to answer, the following facts lead us to conclude tentatively that the penalties for utility-induced market effects are likely to exceed the rewards:

- None of the utility program managers we interviewed cited the potential rewards for market effects such as reduced incremental prices and increased measure availability as a major influence on their actual programming decisions; however, numerous interviewees said potential penalties for inducing savings among nonparticipants did affect their decisions.[45]

- The linkage between increased measure availability and increased participation in utility energy-efficiency programs is far from automatic. Increasing the availability of a measure is likely to lead to increased participation only if limited availability has posed a significant market barrier for that measure.

- At the levels of participation historically observed for many (though not all) measures, the level of effort required for a utility to successfully increase its shareholder incentives by increasing measure availability or decreasing marginal prices appears to be disproportionately large relative to the potential rewards. Consider a hypothetical case in which the adoptions of a particular measure rebated under a resource program constitute 25% of the overall size of the market for that measure and its less efficient alternatives. In this case, in order to increase its shareholder incentives by generating market effects, the utility must try to influence a total number of transactions four times as large as its participant population, simply to enhance the savings attributable to the participant population. While it is conceivable that a utility might try to do this, it would probably be much easier to simply optimize net savings among participants by shaping the types of measures or participants targeted. In fact, when asked how the shareholder incentive mechanisms shaped their day-to-day programming decisions, program managers most often cited these types of decisions.

- Under the current M&E protocols, it is unclear whether a utility would in fact receive credit for increased participation resulting from increased measure availability. Like most market effects, such changes are likely to affect nonparticipants as much as participants. Thus, any increase in participation resulting from increased measure availability may be offset by decreases in the estimated net-to-gross ratio.

Thus, although market effects may result either in rewards or penalties to the utilities, we conclude that the latter effect predominates, and that, on balance, the current policy framework provides little encouragement for utilities to attempt to achieve lasting market effects.

---

45 We note that the fact that the utilities did not cite the rewards for market effects as a significant influence on their actions does *not* necessarily imply that they have not in fact been rewarded for such effects. As discussed elsewhere in this report, very little evaluation research appears to have been conducted on the market effects of California's utility energy-efficiency programs to date—much less on the influence of these effects on shareholder incentives earnings. It is possible that the utilities have been rewarded for market effects that they did not consciously attempt to achieve.

4.2.2. *The emphasis on achieving reliable, measurable savings results gives utilities a strong incentive to focus their programming efforts on a few select marketing approaches that tend to limit the range of market barriers that can be effectively addressed.* This effect appears to be occurring in at least three areas: in the choice of which market actors to target; in the decision to target individual purchase decisions rather than broader behavioral patterns; and in the selection of mechanisms for changing the behavior of targeted market actors.

At the most general level, the emphasis on reliability provides a strong disincentive for utilities to develop marketing approaches targeting market actors other than customers, because the results of such strategies tend to be both less certain and harder to measure. In essence, instead of only having to predict and measure the behavioral choices of one market actor (the consumer) a marketing strategy targeting regional resellers has to consider the program's effect on the behavior of the reseller, and then the effect of changes in reseller behavior on the behavior of customers. Programs targeting manufacturers add still another set of causal relationships to consider.[46] This may be a secondary reason (in addition to leakage, discussed earlier) why there have been only a handful of manufacturer rebate programs in California, even though these programs have generally been highly effective when implemented.[47]

Furthermore, beyond simply focusing on marketing to customers, state policy emphasis on reliability appears to encourage utilities to focus on *specific customer purchasing decisions* rather than on customers' broader behavioral patterns. From the perspective of reliability, focusing marketing efforts on specific purchasing decisions has the advantage that it yields a time, place, energy-efficiency measure, and set of participants to the transaction that are all relatively easily identifiable. Being able to identify all of these parameters facilitates both making predictions about the resulting savings, and measuring actual savings once the transaction has been completed.[48]

Finally, in focusing on influencing specific customer purchasing decisions, the emphasis California's DSM policy framework places on reliability also encourages utilities to emphasize financial incentives as the primary mechanism for altering customer purchasing behavior. Compared to other marketing approaches (such as training, technical information, or moral suasion) financial incentives affect purchasing behavior in a relatively predictable manner.

---

46 In the current environment, when utilities do target market actors upstream of the customer, it is usually in an attempt to optimize resource acquisition objectives. For example, interviewees from both SDG&E and PG&E stated that they were attempting to use existing market mechanisms such as trade allies specifically to reduce administrative costs.

47 For example, one PG&E employee said in an interview that she had a CFL manufacturer rebate program vetoed by management because of uncertainty over whether it would be possible to obtain from manufacturers the names of specific customers purchasing eligible units in order to document sales.

48 A related issue is that focusing on specific purchasing decisions may make it easier for the utility to document program participation to the satisfaction of regulators—e.g., by ensuring that a signed rebate form is on file for each customer for whom the tracking system claims savings.

Thus, if it is at all risk-averse, a utility whose compensation is based on the degree of change in purchasing behavior is likely to be strongly motivated to focus on this marketing approach.[49] Consistent with this finding, the results of Chapter 3 suggest that, while the utilities are offering numerous information programs, most of these in practice are viewed as supporting the incentive-based resource programs that are the bread and butter of the overall marketing effort.

Each of the above limitations on the scope of the marketing strategies utilities are encouraged to pursue has the potential to limit the range of market barriers utility energy-efficiency programs can effectively address. For example, avoiding targeting market actors upstream of the customer is likely to limit the potential for programs to directly address market barriers which do not involve customers. Examples of such barriers include asymmetric information, product or service unavailability, and high search costs on the part of contractors, dealers or distributors.

Similarly, focusing exclusively on attempts to influence individual purchase decisions tends to limit the potential for utility programs to address those market barriers which cannot easily be influenced within the setting of a specific purchase decision. Examples of such barriers include split incentives (where the fundamental problem is not the characteristics of the purchase decision but the fact that the person making the purchase will not be responsible for operating costs) and lack of access to capital (where the problem is again not in the characteristics of the purchase decision but in the lack of independent sources of capital, secondary markets, or risk-hedging instruments.)[50] The results of Chapter 3 suggested that

---

49 Some people might argue that utilities are purely profit-maximizing entities, and are therefore most likely to pursue whichever marketing strategy maximizes the expected value of shareholder incentives, regardless of the spread around this value. However, such an argument, even if true, would ignore the fact that there may be differences between the interests of the utility as a whole and the interests of those utility employees responsible for crafting energy-efficiency program marketing strategies. The latter may be most concerned with ensuring that a minimum level of shareholder incentives is reached, thereby demonstrating that utility energy-efficiency programs represent a legitimate business function.

50 Utilities can and do address lack of access to capital in individual purchase decisions, by implementing financing programs. However, these do not necessarily generate lasting increases in the availability of financing beyond the specific purchase financed.

these are two of the market barriers that have been least mitigated by California's utility energy-efficiency programs.[51]

Lastly, focusing exclusively on financial incentives as the mechanism for changing customers' purchasing behavior will tend to limit the degree to which it is possible to directly reduce market barriers that are nonfinancial in nature.[52] Examples of such barriers include asymmetric information, inseparability of product features, and bounded rationality.

In short, while the strong focus of California's DSM policy framework on reliable savings results has undoubtedly enhanced the resource value of program savings, it appears to have done so at the cost of encouraging the utilities to adopt marketing strategies that significantly limit the range of market barriers that can be directly addressed. Counterbalancing this trend is the fact that the main marketing strategy that *is* encouraged, using financial incentives to target individual customer purchasing decisions, tends to have ripple effects that can ultimately influence a wider range of market barriers than those initially targeted. As discussed in Chapter 3, many of California's rebate programs appear to have led to changes in stocking and promotional behavior on the part of dealers and distributors, and some even appear to have helped to cause manufacturers to bring new products to market or improve the attributes of existing products.

Are the ripple effects of customer incentive programs sufficient to offset limitations on the range of marketing strategies employed by the utilities? We believe the answer is unclear. However, Chapter 3 shows that many market effects of incentive programs to date are likely to be temporary, suggesting that these programs have not lastingly reduced at least some market barriers. This suggests that the ripple effects of the programs have probably not been sufficient to overcome the limitations on the scope of marketing efforts caused by the policy focus on reliable, measurable savings.

---

51 As discussed in Chapter 3, an exception to this generalization is new construction programs, where design incentives and rebates have helped to overcome the consequences of builders and other design professionals often being responsible for selecting equipment while customers are responsible for paying utility bills. In this case, it appears that utilities were motivated to deal successfully with split incentives because it was possible to identify a relatively small group of individuals with purchasing responsibility, whose behavior could be altered relatively easily. However, even in new construction programs, the need to make savings as reliable as possible can limit the extent to which split incentives are addressed. For example, in an interview, an SCG employee noted that his company's nonresidential new construction program was targeting cooking measures in newly constructed restaurants. He explained that this was because restaurant owners are particularly receptive to cooking measures, as this is one piece of equipment they can retain possession of if they enter bankruptcy. In this case, the measures *not* being targeted are exactly those for which there is a potential split incentives problem.

52 As discussed in Chapter 2, we draw a clear distinction here between *circumventing* and *reducing* market barriers. A financial incentive can circumvent many market barriers simply by paying a market actor to take a specified action regardless of the existence of the barrier. However, circumventing a market barrier does not necessarily, in and of itself, reduce the market barrier in any lasting way.

4.2.3. *In their current form, shared savings shareholder incentives strongly encourage utilities to focus on only the most cost-effective measures, thereby limiting the potential for programs to address certain types of market barriers.*[53] Consistent with the overall focus on resource acquisition, the shared savings incentives that form the core of California's DSM policy framework are designed to allow the utilities to retain a share of the estimated net resource benefits of their programs. If there is one thing that was made clear by our interviews, it is that most of the utilities take this opportunity seriously, giving substantial thought to how program design can be optimized to maximize the resulting incentive payments. Unfortunately, such attempts to optimize shared savings incentive payments appear to be shaping utility marketing efforts in a manner that further limits the range of market barriers utility energy-efficiency programs are designed to address.

First, an obvious way to optimize net resource benefits is to focus on those measures which are highly cost-effective, but which face extra-financial market barriers that can be circumvented through incentives and information.[54] One virtually inevitable result of such a strategy is that the utility will tend to avoid promoting measures which are only marginally cost-effective because their incremental cost relative to the standard measure is high.[55]

From a societal perspective, the desirability of this outcome depends on why the incremental costs for a given energy-efficiency measure are so high. We can distinguish at least two possible reasons: because the measure's energy-efficiency features are inherently expensive to manufacture, or because the measure is not yet produced on a sufficiently large scale to enjoy the same economies of scale as the standard measure. In the former case, because the measure offers only limited net benefits to society, utility avoidance of the measure would appear to be desirable. In the latter case, however, avoidance of the measure is likely to result

---

53 Currently, California's shared savings incentive mechanisms allow utilities to retain a constant, uniform percentage (30%) of estimated net benefits across all programs. One can envision a system allowing utilities to retain a larger portion of estimated net benefits for measures with a relatively low benefit-cost ratio. Such a system would probably help to overcome some of the perverse incentives discussed below. However, the focus of this analysis is on California's DSM policy framework in its current form.

54 The incentive to resort to this strategy appears to have been heightened by the recent establishment of a requirement that utilities guarantee the cost-effectiveness of both their residential and nonresidential program portfolios. Several utilities stated that they had responded to this requirement by increasing the predicted cost-benefit ratio that a measure must meet to well over 1.0. An extreme example is SCG, which, as noted earlier, stated that it had responded to the requirement by eliminating rebates for all measures with a benefit-cost ratio below 1.5, leaving only a few C&I measures still eligible.

55 Given unlimited resources, and in the absence of performance risks, a utility's best strategy might be to pursue all measures with a cost-benefit ratio above 1.0, since all such measures would provide the utility with a profit. However, because resource constraints do apply, and because marginally cost-effective measures present greater performance risks (i.e., the risk that actual savings will fall sufficiently below expectations to yield a cost-benefit ratio below 1.0), in practice the optimal strategy is likely to be to pursue only the most cost-effective measures.

in the neglect of a promising new technology which requires only commercialization efforts in order to increase its level of production, and thus reduce its incremental costs.[56]

Not surprisingly, even though a good deal of attention has been paid to the need for commercialization programs in recent years —including the development of collaboratively produced guidelines for designing and funding such programs—relatively few such programs have been developed. In addition, based on our interviews, it appears that the support of the California utilities for national commercialization-focused initiatives such as the Consortium for Energy Efficiency (CEE) is slipping.[57]

In essence, the disincentive to the utilities to implement commercialization programs under the current policy framework appears to stem from a problem in the way benefits are measured. Both for highly cost-effective measures and for marginally cost-effective ones in need of commercialization efforts, estimated net benefits (and thus shareholder incentive payments) are currently based on the immediate savings produced by each rebated unit. However, in reality, the majority of the true social benefits produced by commercialization programs occur only later, when the incremental costs of the measure have been reduced. Timing problems associated with California's current measurement and evaluation framework are discussed in more detail later in this chapter.

In addition to focusing on the most cost-effective measures facing nonfinancial market barriers, a second obvious way to optimize net resource benefits is to focus on those customer sectors which offer the most cost-effective opportunities. In the current environment, this means focusing mainly on the C&I sector, and limiting attention to the residential sector. Consistent with this outcome, the level of funding dedicated to C&I programs relative to residential programs does appear to have been increasing in recent years.

An excessive focus on C&I customers to the exclusion of residential customers raises equity issues, because residential customers may end up paying for services that they do not receive. Moreover, and more centrally for the purposes of this analysis, it is likely to limit the potential for utility energy-efficiency programs to transform markets for residential measures.

---

56 While we focus here on the role of the pursuit of cost-effectiveness in discouraging utilities from pursuing commercialization efforts, we note that the current policy framework appears to offer other disincentives as well. For example, a closely related issue is that the emphasis on reliable savings results tends to discourage the promotion of measures for which impact evaluation methods are ill-developed. In many cases these are the same new, promising, but not fully mature technologies for which commercialization efforts are needed. At least one utility interviewee stated that California's DSM policy framework has led his company to avoid such measures. Finally, measures in need of commercialization tend to have limited market availability, consumer awareness and consumer confidence, all of which tend to limit the near-term prospects for customer participation, and thus the likelihood of large shareholder incentives under a shared-savings mechanism.

57 Several interviewees stated that this was a result of disappointing benefit-cost ratios and poor performance on the part of the manufacturer in tracking rebated units in the Super Efficient Refrigerator Program, CEE's first major initiative.

Furthermore, it may lead the utilities to underemphasize in their marketing efforts those market barriers that are either unique to residential customers or affect residential customers more pervasively than C&I customers. Examples of market barriers that may fall into this category include bounded rationality (residential customers are often depicted, rightly or wrongly, as being less rational in their purchasing behavior than C&I customers) and asymmetric information (residential customers are often depicted as being less informed about energy-efficiency opportunities than C&I customers, and therefore more at the mercy of vendors.) As discussed in Chapter 3, the tendency of the California utilities to use their information programs primarily to promote specific measures, rather than to attempt to change general awareness and attitudes regarding energy efficiency, seems to be consistent with the avoidance of these market barriers.

4.2.4. *The short time-frame allowed for initial program impacts to appear, and for the documentation of those impacts, is inconsistent with the gradual nature of many market transformation initiatives and many market effects.* Some market transformation initiatives can be more like long-term investments, with significant resources invested up-front (sometimes with a net loss in the first year or two) leading to long-term benefits, rather than year-by-year, kWh-by-kWh acquisitions. Under the current policy framework, however, utilities are held financially accountable for the results of their programs after only one year, which provides a strong disincentive for embarking on marketing efforts explicitly intended to generate gradually accumulating market effects.

Technically, the seven- and 10-year measurement periods specified by the M&E protocols[58] give utilities an opportunity to link their overall compensation to longer-term program results. Practically, however, a utility must take the risk that a program that is not cost-effective in the first year will ultimately be cost-effective—a risk that utilities are unlikely to take under the existing circumstances. In addition, the protocols for persistence studies currently focus on the retention and continuing performance of measures initially installed under the program rather than on the persistence or accumulation of market effects. The protocols thus give the utilities little incentive to consider the potential for long-term market effects in designing and implementing their programs.

4.2.5. *Utilities are unlikely to aggressively pursue market transformation in the absence of regulatory policies encouraging them to do so.* There has been some debate in the DSM industry regarding whether, in a restructured electric industry environment, business forces

---

58 California's current DSM policy framework raises several issues involving the timing of program benefits, evaluation studies, and utility rewards for market effects. Most of these issues are best viewed as measurement challenges, and are thus discussed later in this chapter in the section on the measurement and evaluation protocols. However, as noted in the chapter introduction, the M&E protocols, incentive mechanisms and DSM policy rules tend to form an integrated policy environment. As a result, it is sometimes difficult to unambiguously assign an issue to one or another specific policy document. Although it is the protocols that spell out the short schedule on which utilities must initially report the benefits of their programs, this appears to be broader than simply an evaluation issue. Thus we discuss the issue here rather than in the protocols section.

alone will lead utilities or their successors to pursue market transformation as a source of profit, thereby eliminating the need for regulatory policies to encourage this end.

It is difficult to speculate about this issue without knowing specifics of the new industry structure, such as the degree to which the generation, transmission and distribution functions are ultimately separated, the degree to which electricity becomes a commodity versus a value-added service, or the manner in which transmission and distribution utilities are regulated. However, under most scenarios, it appears that market transformation will not necessarily be in the best interest of profit-seeking utilities. Generation companies, freed from the obligation to serve, seem unlikely to have much incentive to pursue demand-side energy efficiency of any kind. Distribution utilities may have some positive motivations for supporting market transformation, including the opportunity to increase or maintain customer satisfaction or loyalty by providing quality service, the opportunity for earnings from providing products or services directly to customers, and the possibility that market transformation investments could reduce or defer distribution system investments (though market transformation savings are likely to be too diffuse over time and across space for them to be of much value for targeted distribution system savings). However, supporting market transformation initiatives will often conflict with other key objectives of the distribution utility, such as keeping costs low under performance-based ratemaking, recovering costs and making profits on all investments, focusing on short-term profits, avoiding or reducing risks, securing reliable information about changes in loads, controlling key customer and market information in a competitive environment, maintaining market share of existing energy-efficiency markets, and increasing energy sales (if functional separation or divestiture are incomplete or ineffective).

In addition, we note that the types of market transformation initiatives that business considerations encourage distribution utilities to support are not necessarily the type that society wants them to support. For example, one can envision a utility that foresees a large potential market for building commissioning services, if only new construction practices in the commercial sector can be altered so that commissioning is standard practice. However, the utility is unlikely to undertake the major efforts needed to change the new construction market in this fashion unless it believes it will end up with a lasting and substantial share of the resulting market for commissioning services. Thus, no sooner has the utility transformed the market, than it may become a monopoly power with an incentive to stifle the further development of a fully competitive market.

For these reasons, we conclude that, in the absence of appropriate regulatory policies, utilities or their successors will be unlikely to aggressively pursue socially constructive market transformation activities in a restructured electric industry.

4.2.6. Summary. Although the current DSM policy framework does not *forbid* utilities from focusing on reducing market barriers and achieving lasting market effects, it provides little positive support for market transformation—and the interpretation of the policy framework and resulting standard practice have led to significant disincentives. These disincentives

include: (1) beneficial market effects are more likely to lead to decreases than increases in shareholder incentive payments; (2) the emphasis of current policies on achieving reliable, measurable savings tends to limit the range of market barriers that utility energy-efficiency programs are designed to effectively address; (3) shared savings-type shareholder incentives, in their current form, encourage the utilities to focus on only the most cost-effective opportunities, further limiting the range of market barriers addressed; and (4) the short time-frame allowed for initial program impacts to appear is inconsistent with the gradual nature of many market transformation initiatives and many market effects. Furthermore, it appears that under most future industry restructuring scenarios, business considerations alone will not provide utilities with much of an incentive to pursue desirable market transformation activities.

4.3 California's M&E Protocols Do Not Encourage Measurement of Market Effects

The M&E protocols are designed in a way that effectively encourages the utilities to accurately measure the resource benefits of their programs, but for the most part discourages them from making serious efforts to measure market effects. However, the protocols do appear to have resulted in an institutional process[59] *that is adaptable to the successful measurement of market effects,* **if** *the involved parties are presented with appropriate incentives to encourage them to use the process in this manner.*

The challenges of evaluating market effects stem, for the most part, from the characteristics of markets themselves. One such characteristic, as discussed earlier in this report, is that markets are *interactive* in the sense that significant changes in the behavior of one group of market actors (e.g., customers) can and do lead to changes in the behavior of other groups (e.g., dealers and distributors). From an evaluation perspective, this interactivity makes it difficult to isolate the effects of successful efforts at market transformation, by making it difficult to establish a comprehensive understanding of all the indirect effects of the intervention.

A second characteristic of markets is that they are *dynamic*—that is, they are constantly changing and evolving. This dynamism is a corollary of interactivity. If each group of market actors is always responding to changes in the behavior of other groups, the overall nature of a market system will continue to change as long as the behavior of one or more groups of market actors is changing—probably indefinitely. This creates additional difficulties for evaluation because it complicates our understanding of the status of the market both before and after intervention. If the natural state of the market is flux, how can we establish a clear

[59] The specifics of this institutional process are discussed in more detail below.

baseline from which to measure the net effect of an intervention? And how can we establish the point at which the indirect effects of the intervention have ceased?

A third characteristic of markets, as suggested earlier in this chapter, is that *fundamental changes in their structure and functioning may occur only slowly*. For example, studies in the diffusion of innovations have shown that many new technologies take decades to gain market acceptance and reach their ultimate level of market penetration. This may raise methodological difficulties (as well as obvious policy challenges). The longer we must wait to observe anticipated program effects, the more likely it becomes that what we observe will be a result of changes in nonprogram factors such as laws, macroeconomic conditions, or technological innovations. However, the less time we wait, the less sure we can be about whether any observed changes in the structure or functioning of energy-efficiency markets are lasting.

Finally, markets are, for the most part, *regional and national in nature*, rather than being organized to correspond to utility service territories. Although an individual utility customer may purchase energy-efficiency measures primarily from providers within a given utility service territory, those providers are likely to be purchasing from at least some distributors located in other service territories. Distributors, in turn, purchase from manufacturers who are seldom located in the sponsoring utility's service territory. All of these market actors are influenced in their behavior by macroeconomic trends, which are regional and national in nature; by laws, which are made at both the state and national levels; and by exposure to advertising and other mass media effects, which are produced largely at the national level. Clearly, it will be difficult in most cases to isolate the effects of an attempt to transform energy-efficiency markets in a single service territory. This has obvious implications for evaluation. It means that in many cases, it will be difficult or impossible to evaluate program effects by studying market changes only within a sponsoring utility's service territory.

How well do California's measurement and evaluation protocols deal with these methodological challenges? In order to answer this question we need to understand the philosophical underpinnings of the requirements established by the protocols. These underpinnings are best summed up in Table 5, *Protocols for the General Approach to Load Impact Measurement:*

"Net Load Impacts = Participant Group Load Impacts
minus
Comparison Group Load Impacts
plus or minus
Effects of Uncontrolled Differences between Participant and Comparison Groups"

The research philosophy underlying this approach is that of quasi-experimental design, under which changes in the behavior of a sample of subjects affected by a treatment are contrasted with those of a sample who are unaffected. Here the behavior of interest is energy

consumption, the treatment is participation in a utility energy-efficiency program, and there is an explicit recognition that statistically based adjustments may need to be made in order for the results to accurately represent the net load impacts of the program.

There is some variation in the methods prescribed for individual programs, and over the years the basic concepts underlying the protocols have been supplemented by more specific directives regarding data quality, reporting standards, and implementation schedules. However, the general philosophy reflected in the preceding quote pervades the protocols, influencing most of the specific requirements. For this reason, in critiquing the compatibility of the protocols with the policy objective of market transformation, we focus primarily on this philosophy and the manner in which it has influenced the development of the protocols, rather than on the requirements established for specific programs. However, we note where requirements for individual programs may pose exceptions to our general findings.

We believe the quasi-experimental orientation reflected by the protocols is generally appropriate for the measurement of the direct, immediate load impacts of utility energy-efficiency programs. In practice, there have often been significant challenges involved in implementing this approach, involving issues such as self-selection effects, data attrition, and other sampling problems. However, the DSM evaluation community has accumulated a great deal of experience in dealing with these challenges, much of which has made its way into the protocols.

In addition, the results of Chapter 3 suggest that the direct load impacts of utility energy-efficiency programs are likely to be positively correlated with some types of market effects, such as volume-based changes in dealer stocking patterns and promotional behavior. Thus, by encouraging the utilities to accurately measure the load impacts of their programs, the protocols may incidentally be leading to some indication of the potential magnitude of these types of market effects.

Furthermore, there appears to be no inherent reason why the quasi-experimental orientation adopted by the protocols could not be adapted to measurement of other types of market effects. One can envision a framework in which a participant is defined as someone who has been potentially exposed to the influence of a market effect and a nonparticipant as someone who has not. For example, in the case of a mass media advertising campaign, the population of participants could be defined as all residents of a targeted media market, and a comparison group could be developed using residents of an untargeted media market. By agreement among CADMAC members, some evaluations have already been conducted using this type of broadened definition of participation.[60]

---

60 Examples include multi-utility studies of rebate programs for refrigerators and compact fluorescent lamps.

However, despite these fundamental compatibilities, we believe the protocols in their current form contain substantial disincentives for the utilities to make serious efforts to measure market effects. We explore these disincentives below.[61]

4.3.1. *Many of the concepts in the protocols, although they may not explicitly disallow measurement of market effects, are more ambiguous under a market transformation framework than under a direct resource savings framework. The utility thus has an incentive, if not a requirement, to follow the safest and best-understood path, and focus on the measurement of direct impacts.* Much debate in California has revolved around how much flexibility the protocols offer utilities to include the market effects of utility energy-efficiency programs in their savings claims. However, we believe such debate tends to be misleading, for the key issue is not type of measurement activities the protocols *allow*, but the type of measurement activities they *incent*.

Consider the definitions of a participant and nonparticipant. These two concepts lie at the core of the quasi-experimental framework represented by the protocols. According to the protocols, a participant is:

> An individual household, business, or other utility customer that received the service or financial assistance offered through a particular utility energy-efficiency program, set of utility programs, or particular aspect of a utility program in a given program year. Participation is determined in the same way as reported by a utility in its Annual DSM Summary.

While a nonparticipant is defined as:

> Any customer who was eligible but did not participate in the utility program under consideration in a given program year.

Theoretically, a utility could conceivably interpret these terms liberally enough to facilitate a focus on measuring market effects, by defining the "service" that a participant receives from a program as the benefits of whatever market effect is being claimed, and a nonparticipant as someone who could have been influenced by the market effect but was not. Such an interpretation would allow comparison of changes in the behavior of customers in one service territory with those in another, which could be a wide enough net to capture some types of market effects.

But how likely is it that a utility will risk adopting these nonstandard definitions of these key terms in the current environment, in which savings claims face significant auditing and potential litigation? If the evaluation conducted using this approach produces substantial

---

61 As discussed below, we draw a clear distinction between what the protocols *require* and what they *incentivize*. Much of the following discussion focuses on the latter issue.

savings results, the utility's opponents will easily be able to argue that the utility took too many liberties in adopting definitions that facilitated these results. It is far safer to define participation and nonparticipation in the traditional manner, and claim savings for direct program impacts.[62]

In short, the protocols communicate more information to the utilities than simply what measurement activities are and are not allowed. They also signal which measurement approaches should be avoided, not because they are explicitly disallowed, but because they are ambiguous, and therefore likely to provoke attacks in an adversarial auditing process.

4.3.2. *The sharp focus of the protocols on the measurement of load impacts, to the exclusion of other market indicators, strongly discourages measurement of market effects.* At first glance, it may seem strange to suggest that protocols encouraging the utilities to measure the energy and demand saved by their programs are discouraging the documentation of market effects. After all, whether utility energy-efficiency programs are implemented under a resource acquisition or a market transformation framework, most have improvements to energy efficiency as their ultimate objective, and what better way to document improvements to energy efficiency than to measure the energy saved?

Unfortunately, however, an emphasis on load impacts as the primary outcome variable of interest has a number of undesirable consequences under a market transformation framework. First, and most importantly, it makes even more daunting the already serious challenges of effectively documenting market effects. Evaluations of the load impacts of rebate programs have been facilitated by the fact that such programs usually allow the utility to establish with a fair amount of certainty: (1) who participated, allowing researchers to establish reliable and representative samples of participants and nonparticipants; (2) what specific measures they adopted, allowing for the estimation of reasonable ex-ante estimates of savings, to which ex-post results can be compared; and (3) when each participant adopted the measure or measures, allowing for the selection of appropriate pre- and post-treatment periods. Even with these advantages, isolating energy-efficiency program load impacts from other sources of variation in energy consumption has often proved difficult. With market effects, which may range from increased market availability to the development of new financial instruments to changes in manufacturing practices, it may be much more difficult to identify affected customers or the specific measures they adopt. Thus, the challenges of isolating load impacts

62 An exception to this rule can be found in the protocols for residential refrigerator retrofit programs, which explicitly allow for estimation of net savings using comparisons of sales and shipping data across geographic regions.

are simply piled on top of other, more basic challenges such as establishing which customers were affected, how, and when.[63]

Second, by focusing solely on changes in the behavior of customers, and ignoring those of other market actors, an exclusive focus on the measurement of load impacts sacrifices a good deal of potentially useful information which could help to illuminate the market effects of utility energy-efficiency programs. Has the range of efficient appliances stocked by the average dealer changed? Has the time it takes the average customer to locate a compact fluorescent bulb decreased? Has the use of energy-efficient mortgages by lenders increased? In a load impact measurement framework, none of the answers to these obviously relevant questions matter if they cannot be directly and reliably correlated to changes in energy consumption on the part of a specific set of customers.

Third, in several ways, an exclusive focus on measuring load impacts impoverishes the power of evaluation to isolate the causal impacts of utility energy-efficiency programs and to inform future programming efforts. Because load measurement does not provide any direct indication of the specific nature of the market effects generating savings, it provides little or no feedback regarding whether or how programs should be changed to improve their effectiveness. And because it involves measuring only one key outcome (changes in energy consumption), it tends to discourage the use of research approaches revolving around the measurement and integration of multiple outcome variables. Such approaches have an established role in the behavioral sciences and in the evaluation of marketing campaigns.[64]

4.3.3. *The M&E protocols' focus on programs, calendar years, and end-uses as the units of analysis is not conducive to the accurate measurement of market effects.* Under the protocols, a program is regarded as the primary unit of analysis in the sense that it is at this level at which impacts are measured, required methods established, and shareholder incentives credit claimed. A calendar year is regarded as a unit of analysis in the sense that savings claims must generally be made for annual periods. Finally, an end-use is regarded as a secondary unit of analysis, in the sense that for many types of programs the scope of the protocol requirements, additional methodological requirements, and the level at which reported results must be disaggregated, are all driven largely by end-uses.

Unfortunately, the results of Chapter 3 suggest that most of the likely market effects that have occurred to date have probably been the result of combinations of several programs, rather than of individual programs. Therefore, attributing market effects to individual programs—at

---

63 It is always possible to simply compare changes in consumption for an entire service territory or region with changes in consumption in a comparison area, assuming that the subset of customers who have been affected by the program will be represented in the test sample in proportion to their representation in the population. However, the problem with this approach is that it is likely to make load impacts more difficult to isolate, by decreasing their magnitude relative to the average consumption of the average sample member.

64 Feldman (1995) discusses the use of indicators of market effects with examples from marketing campaigns.

least the way programs are currently defined—will be difficult. In addition, as suggested earlier, many market effects do not occur quickly enough to be captured within a single calendar year. Finally, many energy-efficiency related markets are not structured by end use, suggesting that disaggregating most market effects by end-use may prove difficult. For example, consider the case of a home energy rating system which, by facilitating objective comparisons of the overall energy efficiency of different homes, has the market effect of encouraging lenders to increase the availability of energy-efficient mortgages. Greater availability of energy-efficient mortgages would probably help to make energy efficiency a more salable commodity in the real estate market, thus increasing the demand for energy-efficient measures. But how could this type of market effect, involving overall dwelling energy-efficiency, be disaggregated to the level of individual end-uses?

4.3.4. *The protocol requirement that measures mandated by codes and standards be excluded from the savings credited to the utilities explicitly bars any credit for program-induced changes in codes and standards.* As discussed earlier, this provision guards against the utilities receiving credit for the effects of codes that they did not cause, but also bars them from receiving credit for any changes to codes or enforcement of existing codes that they *did* cause.[65]

4.3.5. *Because of resource constraints, the specific obligations imposed on the utilities by the protocols are diverting utility attention away from other studies that would probably be more useful in illuminating market effects.* A skeptic might argue that, despite the above disincentives to the measurement of market effects posed by the protocols, utilities could still perform such studies on the side, and simply not use the results to substantiate earnings claims. However, the demands that the protocols place on the utilities are substantial, and in an age of increasing competition resources are sharply and increasingly constrained. Thus, even if it were in the utilities' interests to perform market effects studies without being able to receive credit for the results, it is questionable whether the utilities could find sufficient left-over resources to perform such studies once they have met their protocol obligations. [66]

4.3.6. *Although the protocols establish a <u>process</u> and an <u>institutional setting</u> (i.e., CADMAC itself, the annual CPUC review of the protocols, the retroactive waiver and modifications process, and the DRA study review process) which could facilitate the*

---

65 In its comments on the initial draft of this report, DRA noted that several years ago it proposed a performance adder mechanism that would have provided a substantial bonus to utilities for any beneficial code changes that occurred. Such a mechanism could have helped significantly to mitigate the disincentives introduced by the use of current code as a baseline. However, the proposed mechanism was reportedly rejected by the utilities, who preferred that new construction programs be eligible for shared savings treatment.

66 In comments on the initial draft of this report, several reviewers noted that the utilities have been consistently underspending their evaluation budgets in recent years, suggesting that the primary constraint is not the availability of funds, but the willingness of the utilities either to expend the available funds, or to hire additional staff to manage the implementation of additional research projects.

development of methods to measure market effects, participants in the process currently have little incentive to pursue this outcome. In theory, many of the institutional features first established by the protocols are conducive to the development of new methods to measure market effects. For example, CADMAC itself appears to be well adapted to the kind of informal negotiation among stakeholders that is needed to develop effective market evaluations. In addition, the retroactive waiver and modifications process could theoretically mitigate many of the above disincentives to the measurement of market effects, by allowing stakeholders to strategically trade waivers from the existing protocol requirements for specific desired market evaluations.

Unfortunately, however, it appears that CADMAC participants currently have little real incentive to use the process in this manner. Because the rewards for the documentation of direct load impacts are both substantial and much more dependable than those that could result from the documentation of market effects, utilities have little incentive to switch the basis of their compensation away from the results of direct load impact studies to the results of market effects studies. Their motivation to do so is weakened still further by the awareness that, unless methods are established collaboratively and in detail before the study is conducted, market effects studies are more vulnerable to being challenged in the DRA verification process.

Nor does it appear that DRA, in pursuing its mandate to protect ratepayers, has much incentive to agree to such up-front negotiation to replace load impact studies with market effects studies. Such studies would surely yield less precise savings estimates, and could conceivably yield estimates much higher than those resulting from traditional load impact studies. Furthermore, in negotiating the methods up front, DRA would have largely surrendered its prerogative to challenge the results once the study was completed.

4.3.7. Summary. In summary, while the protocols are based on a research philosophy which is theoretically applicable to the measurement of market effects, in their current form, they contain substantial disincentives to the utilities using them in this manner. These disincentives include: (1) the requirement that measurement activities focus solely on load impacts rather than other market indicators; (2) the required use of concepts that, if not explicitly disallowing the measurement of market effects, at least make such measurement fundamentally risky; (3) a focus on programs, calendar years, and end-uses as the units of analysis, which is incompatible with the nature of market effects; and (4) the explicit requirement that savings associated with codes and standards be excluded from savings credited to utilities. Although the institutional setting established by the protocols could conceivably be used to overcome these disincentives, the participants in the process currently have little incentive to pursue this outcome. Nor do utilities have much incentive or opportunity to conduct market effects studies voluntarily, above and beyond the load impact studies mandated by the protocols.

4.4 There Are Modest Compensations for Market Transformation in the Existing Policy Framework

Over time, policymakers have designed into the system various "fixes" intended, among other things, to compensate for the ways that existing policies limit the ability of utility energy-efficiency programs to transform the market. However, these fixes appear to have generally been insufficient to significantly alter the overall structure of incentives facing the utilities.

Thus far in this chapter we have focused on the structure of incentives and disincentives to utilities caused by the strong focus of California's DSM policy framework on resource acquisition. Although resource acquisition appears to be the most central concept underlying the policy framework, it is not the *only* concept. Some other concepts, such as equity between customer classes, capturing of lost opportunities, and the use of specified cost-effectiveness tests, have been incorporated into the policy framework from the beginning. Other concepts have been introduced over time, specifically to mitigate undesirable side-effects that were perceived as resulting from the heavy focus on resource acquisition.

In this section, we assess the extent to which some of these attempts to "fix" the undesirable side-effects of the resource acquisition paradigm have succeeded in overcoming the disincentives to market transformation discussed thus far. We review three major regulatory policies: (1) the use of performance adder mechanisms to give utilities an incentive to operate programs that cannot be justified on the basis of resource acquisition objectives; (2) efforts to encourage the utilities to implement commercialization programs; and (3) the recent establishment by the CPUC of a $5 million PG&E market transformation fund.

4.4.1. Performance Adder Mechanisms. These mechanisms, which offer the utility recovery of the costs of certain programs plus or minus a small performance-related component, were initially established because policymakers recognized that certain types of programs were unlikely to be implemented in a policy framework focused primarily on resource acquisition. In the words of the DSM policy rules:

> The usefulness of the TRC [Total Resource Cost] test as a primary indicator of cost-effectiveness is limited for certain programs which do not necessarily focus on the timing or type of resource needs of the utility. Direct Assistance programs address equity concerns... For Information Programs and Energy Management Services, the link between programs and savings is difficult to discern. Strict adherence to the TRC should not be required for these programs... Shareholder incentive mechanisms should be based on a shared-savings approach *for programs whose savings can be reasonably estimated.* (Italics added.)

Although the policy rules do not say so explicitly, policymakers appear to have concluded that information and direct assistance programs were worth encouraging regardless of their lack

of easily documented resource value, and that an alternative shareholder incentive mechanism was thus required for these programs.

Have performance adder mechanisms been successful in encouraging utilities to offer effective information and direct assistance programs? In the case of direct assistance, this is a difficult question to answer, because state law requires the utilities to implement these programs whether they want to or not. At this point some utilities do appear to be going beyond the minimum legal requirements for direct assistance programming; others appear to be doing no more than they have to. However, in the case of information programs, we have already concluded: (1) that most of the dollars currently being spent on information programs are going toward programs being used to support, promote, or provide leads to the more lucrative resource programs; and (2) that performance adder mechanisms are having little effect on the utilities' desire to implement information programs, above and beyond the effects of shared savings shareholder incentive mechanisms and of other business considerations.[67] Thus it appears that the performance adder mechanisms are doing little to mitigate the limiting effects of the resource acquisition paradigm on market transformation.

4.4.2. Commercialization Initiatives. Periodically, policymakers have made decisions intended to encourage the utilities to implement programs targeting the commercialization of promising new technologies. One example of such efforts is the attention paid to commercialization initiatives in the 1994 market transformation workshops, which led to a set of collaboratively designed guidelines for the development of commercialization programs.

Have such initiatives helped to counteract the undesirable side-effects of the overall focus on resource acquisition? What limited evidence is available suggests that while they may have helped, they have not been sufficient. For example, although much attention was paid to the manner in which commercialization initiatives should be conducted, few actual programs have emerged since the initial surge of support for the Consortium for Energy Efficiency (CEE). At this point, based on our interview results, it appears that even support for CEE may be slipping, as industry pressures force the California utilities to concentrate their available funds on those programs that are most certain to produce large shareholder incentives.

4.4.3. PG&E Market Transformation Fund. In 1995, the CPUC directed PG&E to establish a $5 million fund specifically for market transformation initiatives. It is too early to reliably assess the effects of this decision, for as this report was being written, PG&E and its DSM Advisory Committee were still reviewing possible program initiatives to be initiated under the fund. However, it is revealing that the first specific program initiative PG&E decided to implement under the fund was an increase in refrigerator rebates, to a level that was believed

---

67 Together, these two findings suggest that one incentive offered by the current system may be for utilities to move as much as possible of the cost of the overall marketing effort for each measure into the performance adder category, where it increases the performance adder bonus, while decreasing the costs that reduce shareholder incentives from resource programs.

capable of continuing to influence dealer behavior.[68] In Chapter 3 we found that residential appliance rebates were one of the most likely sources of beneficial market effects in California to date, suggesting that this was not an unsupportable decision. However, it suggests that, at least at this early stage, establishment of the market transformation fund has yet to result in any qualitative change in the focus of PG&E's marketing efforts.

4.4.4. Summary. In summary, it appears that most of the policy initiatives intended to counteract the undesirable side effects of the resource acquisition paradigm, while theoretically sound, have had minimal effects on the overall focus of utility marketing efforts. Given the potential magnitude of shareholder incentives associated with resource programs, this is not a surprising outcome. In essence, it appears that none of the mitigating policy measures introduced to date has sufficiently altered the overall structure of incentives and disincentives facing the utilities to distract them from the primary goal of maximizing shared savings incentive payments.

Furthermore, there is every reason to believe it will be even more difficult to do so in the future. Increasing downward budget pressure resulting from industry competition is likely to focus the utilities even more sharply on maximizing shareholder earnings from resource programs, making it increasingly difficult to encourage them to undertake other major initiatives.

4.5 Conclusions

The results of our analysis of California's DSM policy framework have suggested the following:

- California's DSM policy rules, shareholder incentive mechanisms, and M&E protocols form an integrated policy framework, that is strongly focused on the objective of resource acquisition. As it is most commonly defined in California, resource acquisition is the generation of energy-efficiency program savings that are sufficiently reliable, predictable, and measurable to replace supply-side options.

- California's DSM policy framework has been very successful in its objective of encouraging the utilities to pursue effective resource acquisition programs. Rigorous impact evaluation has documented that California's utility energy-efficiency programs have generated hundreds of millions of dollars of resource benefits each year.

---

68 In comments on the initial draft of this report, several non-utility members of PG&E's Advisory Committee stated that they had opposed this decision.

- However, on balance, the focus on resource acquisition provides significant disincentives for the utilities to actively attempt to achieve market effects—particularly lasting market effects, or effects that take a long time to manifest themselves. These disincentives stem primarily from the types of programs, measures, customers, and market barriers that utilities are encouraged to target. Furthermore, it appears that under most industry restructuring scenarios, business considerations alone will not provide utilities with much of an incentive to pursue socially desirable market transformation activities.

- Although the M&E protocols are based on a research philosophy that is theoretically applicable to the measurement of market effects, in their current form, the protocols in their current form provide substantial disincentives for the utilities to measure market effects. These disincentives include: (1) the requirement that measurement activities focus solely on load impacts, rather than other market indicators; (2) the required use of concepts that, if not explicitly disallowing the measurement of market effects, at least make such measurement fundamentally risky; and (3) reporting requirements that are not easily adaptable to the measurement of market effects.

- Over time, various "fixes" have been introduced to counteract some of the undesirable side-effects of the policy focus on resource acquisition. Examples include performance adder mechanisms for nonresource programs, commercialization initiatives, and the PG&E market transformation fund. However, while these fixes have been logically sound, they do not appear to have sufficiently altered the structure of incentives facing the utilities to cause them to adopt additional corporate objectives beyond the primary one of maximizing shareholder earnings from resource programs.

In the next and final chapter of this report, we use these findings to develop recommendations on how the CPUC could better encourage the utilities to pursue market transformation as a policy objective.

Conclusions and Recommendations

In this chapter we summarize our conclusions, and provide some recommendations for how California might revise its policies, incentive mechanisms, and evaluation protocols to better support the objective of market transformation.

5.1 Summary of Conclusions

Under the definitions adopted for this report, market transformation means a reduction in market barriers due to a market intervention, as evidenced by a set of market effects, that lasts after the intervention has been withdrawn, reduced or changed.

This definition of market transformation is based on the need to have a standard by which to judge market interventions in a regulatory environment. Under this definition, if an energy-efficiency program yields no lasting market effects, then the market has not been transformed because the reduction in market barriers has been only temporary. If a program does yield lasting market effects but further intervention is still warranted, then the market has only been partially transformed. Finally, if there are lasting market effects and the most important and relevant market barriers have been reduced to the point where further intervention is no longer deemed appropriate, then the market has been completely transformed.

Given this broad definition of market transformation, all utility energy-efficiency programs have the potential to transform markets. Therefore, *a priori* exclusions of any program types from the category of "potentially causing market transformation" appear unwarranted. Market transformation is not a label that uniquely identifies certain utility energy-efficiency program designs to the exclusion of others. It is instead an objective that all utility energy-efficiency programs have at least a theoretical potential to achieve to varying degrees. However, a program's success in achieving market transformation cannot be settled in the abstract. It must instead be established by a review of the program's design intent and execution, and of the market effects attributable to the program.

How successful, then, have California's recent utility energy-efficiency programs been in transforming markets? Our review of a selection of these programs shows mixed results. Many programs, particularly those offering financial incentives to customers or trade allies, do appear to have produced significant market effects. Some of the more common effects suggested by our review include the following:

- Changes in products and product attributes (including improvements in product quality);
- Changes in production levels and schedules;
- Changes in promotional practices among dealers and manufacturers;

- Changes in stocking practices among dealers and distributors;
- Increases in product and service availability;
- Reductions in the incremental costs of energy-efficiency products and services;
- Changes in design and specification practices;
- Changes in new construction codes and in enforcement of existing codes;
- Changes in awareness and knowledge of energy efficiency among customers, manufacturers, and other businesses in the distribution chain; and
- Changes in decision-making practices among organizations (especially those with multiple sites).

However, there is little evidence documenting the existence or extent of these market effects. This lack of evidence appears to be due in part to the strong emphasis that California's M&E protocols place on the measurement of direct load impacts, which has had the effect of diverting utility attention away from other types of evaluation research that would shed more light on the market effects of utility energy-efficiency programs. Recent underspending by the utilities of their evaluation budgets suggests that funds for additional evaluation (including market evaluation) are available. However, staffing limitations, combined with a desire to contain costs, appear to have limited utility interest in performing any studies, including evaluations of market effects, that are not directly required for purposes of shareholder incentives or for other explicit commitments.

If they have in fact occurred, the market effects listed above have the potential to lead to reductions in many of the market barriers discussed in Chapter 2 of this report, including information cost, hassle and search costs, performance uncertainty, product unavailability, organization practices and custom, and asymmetric information. However, both economic reasoning and the results of our program manager interviews suggest that many of these reductions in market barriers may be temporary in nature.

The market effects that appear to be most likely to last are those associated with energy-efficient lighting, changes in decision-making practices within some organizations (especially those with multiple sites), changes made to manufactured equipment (e.g., technological improvements to chillers), changes in design and specification practices, and changes in codes and standards. Although these are only a portion of the market effects identified in this report, they would result in large savings and benefits for customers and society.

An analysis of California's current DSM policy framework—the DSM policy rules, shareholder incentive mechanisms, and M&E protocols—suggests that whatever market effects have occurred are likely to be less significant than those that could occur under a framework explicitly designed to promote market transformation as a policy objective. The existing policy framework was developed to promote resource acquisition, or the generation of energy savings which are sufficiently reliable, predictable, and measurable to replace supply-side options in the planning process. Existing policies have been very successful in achieving this objective. However, some of the same policies that have been so effective in

promoting resource acquisition are likely to discourage the utilities from attempting to transform energy-efficiency markets. We outline four reasons for this:

First, under the current DSM policy framework, utilities are more likely to be punished than rewarded for causing beneficial market effects, because of the emphasis placed by the M&E protocols on comparisons between customers who actively participate in energy-efficiency programs and those who do not. Because most market effects tend to reduce consumption among nonparticipants, such comparisons tend to understate the savings attributable to the program being evaluated. The effects of this penalty appear to outweigh any potential rewards for market effects, such as increased measure availability leading to increased participation in resource programs, or reductions in incremental costs leading to increases in the net benefits attributable to each measure claimed under an energy-efficiency program.

Second, the emphasis on reliable and predictable savings encourages the utilities to focus their programming efforts on a few select marketing approaches which tend to limit the range of market barriers that can be effectively addressed. For example, the utilities have an incentive to target customers rather than other market actors, which limits the potential for programs to address market barriers that do not directly involve customers. The utilities also have an incentive to focus on specific customer purchasing decisions rather than on broader behavioral patterns, which tends to limit the potential for addressing market barriers which cannot easily be influenced by changing an individual purchase decision. Finally, the utilities have an incentive to emphasize financial incentives over other marketing methods, which may be less effective in addressing market barriers that are not financial in nature.

Third, the current shared savings incentive mechanisms, which offer utilities a fixed, uniform percentage of the net benefits their programs achieve, strongly encourage a focus on promoting only the most cost-effective measures. This tends to discourage the utilities from promoting promising new technologies which require commercialization efforts in order to increase production volumes and thus reduce incremental costs over standard technologies. It also tends to discourage the utilities from marketing to the residential sector, which simultaneously raises equity issues and limits the potential for energy-efficiency programs to transform markets for residential energy-efficiency products and services.

Fourth, while the current evaluation protocols have been very successful in encouraging the utilities to accurately measure the resource benefits of their programs, they tend to discourage the utilities from trying to use market effects studies to meet filing requirements. Although both the basic research philosophy and some of the key definitions underlying the protocols are theoretically adaptable to the measurement of market effects, the utilities face substantial disincentives to trying to apply them in this manner. These disincentives include: (1) the requirement that measurement activities focus solely on load impacts, rather than on indicators of market effects; (2) the required use of concepts that, if not explicitly disallowing the measurement of market effects, at least make such measurement fundamentally risky; (3) the lack of agreed-upon methods for estimating market effects which are enshrined in the

protocols; and (4) reporting requirements that are not easily adaptable to the measurement of market effects.

Although various attempts have been made in recent years to adjust California's policy environment to make it more conducive to market transformation, these adjustments have not been sufficient to significantly alter the fundamental structure of incentives and disincentives that discourage the utilities from actively pursuing market transformation as a program objective. Furthermore, it appears that under most future industry restructuring scenarios, business considerations alone will not provide utilities with much incentive to pursue socially desirable market transformation activities.

For all of these reasons, we conclude that, if the CPUC wishes to pursue market transformation as a policy objective, as set forth in D.95-12-063, some changes in California's DSM policy framework will be needed. In the remainder of this chapter, we provide a number of specific recommendations toward this end.

5.2 Recommendations

Our recommendations are organized in four sections. We begin by discussing needed *policy* changes in the overall strategic orientation of California's energy-efficiency efforts. Next, we outline a broad *evaluation and research* agenda that encompasses but also extends beyond the current role of evaluation solely as a means for verifying performance incentive claims. We then present recommendations on *performance incentives* for market transformation. Finally, we address *transition issues*.

5.2.1 Overall Regulatory Policies

1. *Given that market transformation is a strategic objective of the California Public Utilities Commission (Decision 95-12-063), and that the recent increase in emphasis on this objective represents a shift in public policy, we recommend that the energy-efficiency policy framework be revised to align it more with the strategic objective of market transformation.* All energy-efficiency and DSM policies—policy rules, incentive mechanisms, and measurement and evaluation protocols—need to be reconsidered with the strategic objective of market transformation consciously in mind. As we discussed in Chapter 4, there are important inconsistencies between the past policy objective of resource acquisition and the objective of market transformation. The current policy framework, which was developed to support primarily the objective of resource acquisition, does not provide adequate support for market transformation.

2. *As a first step toward revising and realigning the policy framework to provide support for market transformation, we recommend that the CPUC clarify the strategic objective of*

market transformation. Working through the details of aligning the policy framework with the strategic objective of market transformation will require further clarification of what the CPUC and others mean by "market transformation." We understand that the Energy Services Working Group is working on clarifying the definition of market transformation, and may resolve some of the issues related to market transformation. We recommend that the working group and the CPUC consider using the material in this report, including the definitions presented in Chapter 2.

3. *We recommend that the CPUC and other policy decision makers make fully informed and conscious choices when making any changes to the policy framework. Although we support the CPUC's increased emphasis on market transformation, we recommend that decision makers remain realistic about the associated risks and rewards, as described below. In addition, we suggest that the potential risks and rewards of market transformation be compared with those of the current resource acquisition framework.*

We see three options regarding the policy framework: (1) continue the current emphasis on resource acquisition; (2) revise the framework to emphasize market transformation; or (3) combine the two strategic objectives in a two-tiered framework. We recommend the third option.

In the first option, the CPUC could continue to place primary emphasis on resource acquisition with its existing mix of risks and rewards (at least to some degree, because it is uncertain how resource acquisition would be pursued as the utility industry restructures). Resource acquisition programs appear to have led to some market effects, and their load impacts have produced substantial societal benefits. However, this approach is unlikely to change markets as much as an explicit market transformation framework with specific strategies and interventions designed to reduce market barriers and achieve lasting market effects.

In the second option, the CPUC could revise the policy framework to emphasize market transformation, but should recognize the tradeoffs resulting from changes in the mix of risks and rewards. As we found in Chapter 4, estimates of market transformation benefits will be less certain than estimates of resource acquisition savings. There may be some failures in early market transformation efforts, and all initiatives probably will not be highly successful. In addition, market transformation may not be an effective approach in all markets because some market barriers are intractable or expensive to reduce. Even if a market transformation initiative is successful, several years may pass before that success is known. However, we believe market transformation has the potential to provide larger total savings and net benefits than resource acquisition, as well as different types of benefits (i.e., by permanently increasing purchases of energy-efficiency products and reducing or eliminating the need for continued intervention), which would continue to accrue after the initiative is discontinued. On balance, we believe the opportunity for larger total savings and net benefits from implementing market

transformation initiatives in many markets outweighs the potential risks associated with less reliable savings estimates and less certain success.

We recommend a third option for a future policy framework: combine these two approaches and develop a two-tiered framework for publicly-funded energy-efficiency efforts. For certain measures, customer sectors, or markets, the policies, incentive mechanisms, and programs developed under the resource acquisition framework could be continued; for others, a new policy framework focused on market transformation could be developed. Over time, as more is learned about both the specific market effects of traditional DSM programs, and the ability of market transformation initiatives to change markets, informed decisions could be made regarding which policies, incentive mechanisms, and programs from the first tier are appropriate to retain under a market transformation framework.

4. *Changes to the existing policy framework need not be global, and should not be made without considering the value of other objectives, including resource acquisition. Although market transformation is an important strategic objective, it is only one strategic objective of publicly funded energy efficiency that can be employed to attain social goals.* The existing utility programs have produced substantial social benefits in a cost-effective manner. Although uncertainty resulting from industry restructuring is making the quantitative value of these benefits increasingly unclear, the finding that the benefits have been substantial appears to be fairly robust to industry changes. In addition, although industry changes may be reducing the role and importance of resource acquisition as a strategic objective, it is likely to remain an appropriate policy objective in some areas, such as in the avoidance and deferral of T&D construction, the capturing of lost opportunities, and the mitigation of environmental damages.

It may not be practical or cost-effective to transform all markets, because, as we found in Chapter 3, some market barriers appear to be intractable or expensive to overcome. In addition, it is not necessary to focus solely on market transformation to the exclusion of all other intervention strategies. Continued intervention based on resource acquisition or other objectives may be warranted and valuable in some markets. If programs or other interventions, such as codes and standards, continue to achieve net benefits, this should be sufficient justification for their continuation.

5. *We recommend that the CPUC ensure a stable policy framework and policy environment for market transformation.* Market transformation initiatives are really up-front investments that have the potential to lead to long-term benefits. To be successful, market transformation initiatives require sustained efforts over a number of years. Market transformation objectives will not be reached, and market transformation initiatives will not succeed if there is a large amount of uncertainty and risk in the policy framework, or if the framework changes every one or two years. We recognize that the industry is going through many changes associated with restructuring. We recommend that the CPUC make special efforts to ensure the stable policy environment that is necessary to support market transformation objectives.

6. *Revisions to the policy framework should depend in part on the agents selected to implement the policy objectives.* Successful intervention in markets relies on aligning the interests of the agents with that of society so that the agents will focus on achieving society's objectives. Whether utilities are appropriate agents for the promotion of market transformation is an important question, with persuasive arguments both pro and con. However, this issue is beyond the scope of our study. Discussions of possible agents and their responsibilities are occurring elsewhere, including in the Energy Services Working Group. Many of our remaining recommendations are framed according to whether or not they presume that the CPUC or others wish to use the utilities as the agents of market transformation efforts. In addition, we distinguish between agents acting as *implementors* responsible for marketing efforts and agents acting as *administrators* responsible for selecting and overseeing implementors.

7. *We recommend that the revised policy framework increase focus on programs and interventions addressing markets (as opposed to individual customers), on reducing market barriers in a lasting manner (as opposed to short-term marketing efforts), and on long-term impacts on the structure and function of markets (as opposed to customer participation in a single year). This will require a shift in focus and strategy, and a shift in some program activities.* We recommend this shift in focus and strategy because we believe it is likely to lead to greater lasting savings and net benefits for customers and society, should help support the development of a vigorous private market for energy efficiency, and is consistent with the CPUC's restructuring decisions.

This recommendation does not necessarily mean that all current efforts should be discarded, or that certain programs or types of program should be eliminated. There should be no *a priori* limits in new policies on what types of programs are viewed as possibly helping to transform markets. For example, customer incentives programs, which the CPUC has suggested should be avoided under a market transformation framework, appear to have been responsible for the bulk of the beneficial market effects that have occurred thus far. What must change if market transformation is to be seriously pursued is *policies*, not necessarily all programs.

We suggest that several changes be considered to help focus programs and interventions more on market transformation, including:

- Focusing research efforts on market studies and market assessments, and conducting pilot projects, in order to examine how specific markets work, determine key actors in the markets, identify the most important market barriers to energy efficiency, and explore how those barriers could be reduced (see recommendations for evaluation and research);
- Providing greater flexibility to better support a strategic, adaptable approach with long-term success in mind;

- Revising the current definitions and classification of programs in the policy rules to increase focus on markets, and decrease focus on broad customer sectors;
- Allowing programs to define and use program elements based on customer and other market characteristics, in addition to size and end use; and
- Encouraging initiatives to span entities, service territories, and state borders when necessary, to better address target markets that are not limited to service territories or individual states.

8. *We recommend that the CPUC and others consider adopting broad definitions of performance and success. Revised definitions of performance and success should be considered for all purposes and potential agents, including utilities, statewide administrators, and state agencies. This reconsideration of the meaning of "success" should not be limited to or dominated by performance incentive issues, which are treated separately.*

Performance or success can be defined, assessed, measured, and rewarded using several different metrics, including:

- *Ultimate outcomes* (e.g., energy and demand savings, product sales as a proxy for energy and demand savings, or market penetration).
- *Indicators of market effects* (e.g., indicators of lasting market effects and/or reductions in market barriers).
- *Effective and efficient performance of planned activities* (e.g., good-faith implementation of planned tasks).

In Chapter 4 we concluded that estimates of market transformation benefits will be less certain than estimates of resource acquisition savings, and often the true success of a market transformation initiative will not be known for several years. Therefore, relying on ultimate outcomes as the primary indicator of success is not practical or viable for most market transformation initiatives. We recommend that indicators of market effects be used as the metric to assess success for most market transformation initiatives because the indicators are timely and observable, the agent has the ability to affect them, they can often be used to develop or forecast estimates of market penetration and load impacts (though less reliably than the current framework which emphasizes resource acquisition), and the information collected can help improve the initiative in a timely manner. We also recommend that good-faith execution of an implementation plan and performance of assigned tasks be used to assess success when the expected risk is low, the expected time period before results will become evident is long, and the agent (e.g., a statewide administrator or distribution utility) is only one of several organizations responsible for the initiative.

9. *We recommend that CPUC oversight, monitoring, and review efforts focus on ensuring long-term performance and success.* Decision makers should stay focused on achieving the long-term objectives of market transformation, rather than on the performance of one initiative in a single year. There may be both successes and failures in the early stages of

implementation, because little is known about market transformation now (compared to resource acquisition), and because some markets may be more difficult or take longer to transform than others. We recommend that the CPUC and other oversight and monitoring organizations (including DRA and CADMAC) allow greater flexibility compared to what is afforded under the existing resource acquisition framework, because of the current lack of knowledge and experience regarding the design, implementation, and evaluation of market transformation efforts, and because market effects and load impacts due to market transformation efforts can be measured only imprecisely. We also suggest that greater patience on the part of the CPUC and other oversight and monitoring organizations may be required because some market transformation efforts may take several years to produce observable effects, and often the largest benefits grow rapidly only in the later stages of an intervention (or after the discontinuation of an intervention) when the market has been at least partially transformed.

In addition, tracking, accounting, and reporting processes and procedures will need to be modified and/or developed to address the fact that market effects may (1) be due to several programs, (2) be due to several program years, (3) be caused by programs of other utilities and organizations, including those from other states, and (4) become evident over long time periods. The current system of reporting annual costs, annual benefits, and lifecycle benefits based on savings from annual installations over the lives of the measures is neither viable nor accurate for assessing the costs and benefits of market transformation efforts, and therefore is insufficient for supporting market transformation objectives.

10. *We recommend that the existing rigorous cost-effectiveness framework not be applied to market transformation initiatives, and that further research be undertaken to develop a practical and meaningful framework for assessing the cost-effectiveness of market transformation efforts.* The greater uncertainties associated with benefits from market transformation initiatives (greater than those under resource acquisition), along with the longer time frame for expected results call into question the continued use of the existing cost-effectiveness framework. There are two main limitations to using the existing framework to assess the cost-effectiveness of market transformation initiatives. First, the data used as inputs to any cost-effectiveness tests will be less certain than those used in current cost-effectiveness tests (and in some cases not reliable enough to make a valid determination, though at the same time giving an illusion of certainty). Second, any economic framework that relies on ultimate outcomes would have to account for the longer time frame during which the market effects caused by market transformation initiatives can be observed (i.e., by assessing expenditures as they are made, but being willing to wait for benefits to accrue over time). Decision-makers are unlikely to wait until final data on the impacts and cost-effectiveness of a given market transformation initiative are available to make decisions about it—they will make decisions along the way, based on the information they have available. We recommend further research to develop a practical and meaningful framework for assessing the cost-effectiveness of market transformation initiatives.

5.2.2 Evaluation and Research

11. *We recommend refocusing evaluation and research efforts to ensure that the information needs of a market transformation approach are better met.* The CPUC, utilities, and other parties will not be able to make effective progress on market transformation in the absence of critical information. In order to have this information available, greater focus is needed on assessing markets, evaluating market effects, and evaluating reductions in market barriers.

We use the term "evaluation and research" broadly to include market research, market intelligence, baseline studies, impact and process evaluations, verification, and measurement. This is a broader and more balanced set of activities than the current M&E efforts which are dominated by measurement associated with utility performance incentives. The broader evaluation and research focus for market transformation is appropriate because of the newness of market transformation as a strategic objective, and the current lack of experience with and knowledge of market transformation.

Several types of information are needed to support the shift to a market transformation framework, including information on:

- Current programs (the degree to which existing programs focus on achieving lasting reductions in market barriers, and how existing programs could be more effective in changing markets);
- Future programs and initiatives (viable approaches for programs and interventions);
- Market effects of past programs (building on our scoping work in Chapter 3); and
- Approaches for evaluating market effects and reductions in market barriers.

12. *Evaluation and research related to market transformation efforts should not be focused solely on end results, or be used primarily for performance incentives.* There are many purposes for evaluation and research of market transformation, including:

- Supporting the planning and design of the programs and initiatives, including providing up-front market studies and baseline analyses;
- Providing corrective and constructive guidance regarding the implementation of market transformation initiatives;
- Providing indicators of the effectiveness of specific market transformation strategies and activities (i.e., by evaluating indicators of market effects and reductions in market barriers);
- Assessing the overall level of performance and success of market transformation initiatives (both medium- and long-term); and
- Informing decisions regarding performance incentives provided to administrators (e.g., statewide entities or distribution utilities) for market transformation activities.

13. *Regardless of the policy framework, or of who is responsible for evaluating market transformation initiatives, efforts to evaluate the market effects of programs and interventions should recognize that market effects can be measured only imprecisely.* The reasons for this imprecision revolve around the characteristics of markets themselves. Markets are complex, dynamic, and constantly evolving—all of which increase evaluation challenges. Many factors affect markets and changes in markets, thereby making it very difficult to isolate the effect of any one influence, including a particular market intervention. In addition, markets change and evolve over time, often at different rates, which means it may take years before the expected changes due to an intervention could be observed.

This imprecision in the estimation of market effects increases the potential for subjectivity and gaming on the part of agents. Institutional procedures and mechanisms will need to be developed to minimize the impact of any potential gaming.

14. *The approach to evaluation and research will depend to some degree on the agents selected to administer the overall market transformation effort, implement the specific programs and interventions, and conduct the evaluation studies—and on the responsibilities assigned to these agents.* There are three main options for evaluation and research agents: utilities (assuming utilities will continue to be administrative agents), a statewide entity, or an independent third party. Several issues should be considered when selecting an evaluation agent, including: (1) the importance of independent and objective research, especially because of the larger uncertainties associated with the evaluation of market transformation; (2) threats to objectivity arising from conflicts of interest; and (3) integration and coordination of evaluation efforts, so that ongoing monitoring efforts of implementors can feed into the overall evaluation efforts of the evaluation agent without undue duplication of effort, or intrusions on customers or other market actors.

If utilities are selected as administrative agents, they could also be the evaluation agents, much as under the current framework. For this approach to be viable, concerns about conflicts of interest and gaming arising from conflicts between the private interests of utilities and the interests of society would have to be addressed. Another challenge in this regard is that, because of the emphasis of the existing policy framework on resource acquisition, the utilities currently have little incentive to study market effects.

If a statewide entity is created to administer the market transformation effort, it could evaluate the effects of its own interventions. Concerns about conflicts of interest and subjectivity would have to be addressed, though we suspect these concerns would be smaller for a statewide entity than for a for-profit utility. The statewide entity could also be assigned the responsibility of evaluating the overall state of energy-efficiency markets, and the effects of any continuing utility interventions. In essence, the statewide entity would then be functioning as the research arm of the regulators responsible for developing continuing policies regarding intervention in energy-efficiency markets.

An independent third party could be assigned the evaluation responsibility if there are large concerns about threats to objectivity arising from the administrative agent's conflicts of interest, whether the agent is a utility or a statewide entity (though we believe these concerns will be larger in the event that utilities continue to be administrative, implementation, and evaluation agents).

15. *We recommend increased attention to the following list of new considerations for evaluating market effects and the reduction of market barriers in the face of the imprecision associated with measuring the effects of market transformation.* We believe it will be generally necessary to:

- Articulate specific theories about what market effects and reductions in market barriers specific interventions are expected to have;
- Measure a wide range of market indicators, both before, during, and after interventions, using a variety of methods;[69]
- Compare observed changes in market indicators (i.e., market effects), and the sequence of these changes, to what would be expected if the program is working as intended, as well as to estimates of what would have occurred in the absence of the intervention (i.e., identify market effects caused by the program);
- Link observations of market effects to reductions in market barriers;
- Develop a system for ongoing feedback, so that indicators of effects can be assessed along the way;
- Use forecasts and scenario analysis to assess likely future outcomes and inform interim decisions (because it is not practical to wait for longer term results);
- When quantifying environmental and resource benefits, focus efforts on the causal role of the program in increasing market adoption of measures, rather than on estimating the net savings per measure adopted;
- Recognize that changes can take place in multiple markets and market segments, and can result from multiple interventions over several years (rather than from one program in a single year); and
- Accept that the estimates and results, though they may well be sufficient for the needs of policy makers, will still be relatively imprecise (compared to the results of load impact studies conducted under a resource acquisition framework).

We recognize that the evaluation of market effects and market transformation will be both challenging and difficult, and that the results will likely be less precise than many desire.

---

69 For example, methods for evaluating market effects may include: (1) surveys or interviews of manufacturers, other actors in the distribution chain, and customers; (2) surveys or compilation of existing data on manufacturer and distributor shipments; (3) surveys or compilation of existing data on retail or wholesale sales; (4) surveys of floor stock and shelf space; (5) surveys of prices and changes in prices; (6) surveys of changes in advertising practices, marketing materials, and catalog offerings; (7) and approaches for analyzing many of these data (which may include stated/revealed preference, discrete choice, conjoint, trend, and scenario analyses).

However, we believe it is possible to conduct studies that can provide useful information, at a sufficient level of precision, to inform the decisions of policy makers, administrators, and program managers.

16. *We recommend that the CPUC, utilities, and other parties assess the role and value of the existing M&E protocols in supporting a revised policy framework with greater focus on market transformation.* First, we recommend that the M&E protocols be revised to reduce the frequency and/or the intensity of required traditional utility impact evaluations, in exchange for explicit requirements that the utilities conduct collaboratively-designed evaluations of market effects and reductions in market barriers.[70] Second, we recommend that the role of M&E protocols in the revised policy framework be reassessed. Given the uncertainty and lack of evaluation experience associated with market transformation, it will be important for the various parties to work together up-front to explore and develop evaluation approaches. We recommend that this be done primarily by using a collaborative process rather than formal protocols, because such a process can provide the greater flexibility needed when developing evaluation approaches in a relatively unexplored area. We believe that protocols could play a role in this process, but the role would be less than the current central role of the M&E protocols,[71] and the revised protocols would need to be more flexible, with the focus more on market effects than on individual customer participation.

5.2.3 Performance Incentives

17. *We recommend that policy makers develop performance incentives specifically intended to encourage support for, and effective implementation of, market transformation initiatives.* Performance incentives are almost always useful in aligning the private interests of an agent selected to pursue a social goal with those of society as a whole; incentives are particularly appropriate when the goal being pursued is as challenging as changing the structure and functioning of energy-efficiency markets. Furthermore, the findings of this report suggest that incentive mechanisms initially developed to facilitate other policy objectives should not be relied upon exclusively to further market transformation.

Although performance incentives for energy-efficiency marketing efforts have most often been discussed in connection with vertically integrated utilities, they could be applied to other

---

70 We provide more specific recommendations for near-term revisions to the protocols and incentive mechanisms in our recommendations on transition issues at the end of this chapter.

71 The role of M&E protocols for market transformation would be less central than the existing M&E protocols because of the current lack of experience and knowledge regarding the evaluation of market effects, the lack of agreement on the viability and accuracy of available methods, the need for a wider variety of methods across programs and initiatives, the generally lesser precision of estimates of market effects and load impacts due to market transformation efforts, and reductions in the degree of emphasis placed on the linkage between performance incentives and evaluation estimates.

agents selected to transform markets. Current policy debates in California suggest those agents of market transformation efforts could be: (1) utilities or their successors, such as distribution companies (DISCos); (2) a statewide nonprofit organization developed specifically to pursue market transformation; (3) a state agency; or (4) some combination of these options. Regardless of which course is chosen, performance incentives, tailored to the unique circumstances of each option, would appear to be a potentially useful tool.

Second, many of the policy scenarios currently being debated involve an increased role for the competitive acquisition of energy-efficiency marketing services. If this increased role materializes, we can distinguish between performance incentives intended to shape the behavior of the administrator and the behavior of the implementors of market transformation efforts.[72] Performance incentives are a potentially useful tool for aligning the interests of either agent with those of society.

Thus, we can identify at least three types of market transformation agents for whom performance incentives could be useful: (1) utilities; (2) a nonprofit organization; and (3) a state agency. We can also identify two roles for agents: (1) a program administrator; and (2) a program implementor. In the remainder of this section, we attempt to be clear regarding whether we view our recommendations as being universally applicable, or specific to one or more of the above agents or roles.

18. *The specific nature of the performance incentives developed should depend in part on whether the targeted market transformation agent is a program administrator or program implementor.* Because of the differences between the roles of a program administrator and program implementors, the type of incentive mechanism that is optimal for shaping the behavior of each of these types of organizations is likely to be significantly different. The administrator is likely to be responsible for selecting broad objectives, strategies and target markets, with implementors being charged with developing and implementing specific programs that respond effectively to the administrator's stated priorities. Thus, although it may well be appropriate to hold the administrator accountable for the overall effect of its actions on energy-efficiency markets, implementors should probably be held accountable only for the extent to which their actions are effective within the constraints set by the administrator.

One option for performance incentives targeted at program implementors would simply be to allow the implementor to build a profit margin into the bid price, as in most private transactions.

19. *The specific nature of the performance incentives developed should also depend in part on whether the targeted market transformation agent is a utility, nonprofit organization, or*

---

72 Earlier, we define the implementor as the organization or organizations responsible for actual marketing efforts, and the administrator as the organization or organizations responsible for selecting and overseeing implementors.

state agency. The structure of other existing incentives and disincentives facing the targeted agent must be considered.

Utilities or their successors, nonprofits, and state agencies all have unique characteristics that can be expected to shape the effort to align their interests with those of society as a whole. Below, we discuss some of these unique characteristics.

Utilities. Although performance incentives are potentially useful in all of the individual scenarios discussed, depending on the specifics of restructuring, they may be most critical if the utilities or their successors are to be used as the principal agents of market transformation (either as implementors or as administrators). The analysis presented in Chapter 4 of this report suggests that, under many plausible scenarios, DISCos (arguably the most likely of all the potential utility successors to be made the agents of market transformation efforts) will face substantial disincentives to the aggressive pursuit of market transformation. Thus, if DISCos were used as market transformation agents, performance incentives could become a critical necessity rather than just a useful option. Performance incentives might also have to be significantly larger than in the case of any other organization (e.g., nonprofit or state agency), in order to effectively counter the unique disincentives faced by DISCos. In fact, this is an argument that has sometimes been raised against using utilities as the agent of market transformation activities.

It is possible, however, to envision restructuring scenarios in which DISCos do not face major disincentives to pursuit of market transformation—for example, if DISCos are: (1) thoroughly separated, either via full divestiture or functional disaggregation, from other utility functions; (2) regulated so that their profits are not closely tied to throughput; and (3) able to find relatively few ways of increasing their earnings over time, so that relatively modest performance incentives can play a significant role in the array of business factors influencing their decisions.

Nonprofit Organization. If a nonprofit organization is to be used as the principal agent of market transformation, then any performance incentives offered to this organization would need to recognize that, by definition, the agent cannot be rewarded simply by the opportunity for increased profit. One option under this scenario would be to tie the compensation of officers of the corporation to the organization's effectiveness in improving the structure and functioning of energy-efficiency markets.

One potential problem applying mainly to a nonprofit organization is that, once in place, the nonprofit organization would have a mission (the transformation of energy-efficiency markets to the point where intervention is no longer needed) which, if fulfilled, could eliminate the need for the organization's continued existence. The organization would therefore have an incentive not to solve the problem. This potential problem might be dealt with through the introduction of a regular external review, during which the status of energy-efficiency markets, and the need for continued intervention, are assessed.

State Agency. If a state agency is to be used as the principal agent of market transformation, then, as with a nonprofit organization, the opportunity for increased profits is not a viable form for performance incentives. In addition, the need for state agencies to function under an established and democratic structure of authority suggests that instituting any meaningful performance incentive might be difficult. One option might be to divide responsibility for market transformation between two or more agencies, which compete for available funds on the basis of their past effectiveness in addressing market barriers.

20. *Regardless of the agent or agents for whom an incentive mechanism is intended, there are a number of general principles that can be used to develop a performance incentive mechanism.* Specifically, we recommend that any incentive mechanisms intended to encourage the pursuit of market transformation objectives be:

- Carefully and thoughtfully aligned with explicit policy objectives.
- Clear in their intended message.
- Understandable and accessible.
- Composed or rewards and/or penalties tied to outcomes the agent can affect.
- Reasonably balanced between risks and rewards for the agent and society as a whole.
- Large enough to attract and retain the attention of the agent's management.
- Timely.
- Relatively easy to monitor with respect to evaluating performance.

21. *Regardless of the agent or agents selected, performance incentive mechanisms intended to encourage the pursuit of market transformation initiatives must take into account the nature of markets and of market effects.*

First, the measurement challenges discussed both in Chapter 4 and earlier in this chapter suggest that it will generally be neither feasible nor desirable to base performance incentive mechanisms for market transformation on direct load impacts. Instead, such incentive mechanisms will need to be based either on indicators of market effects or on the good-faith implementation of planned tasks. In a majority of cases, we recommend that performance incentives be based on indicators of market effects, and the observed market effects linked to reductions of market barriers. We prefer this approach because it holds agents at least partially accountable for the ultimate effects of their actions. In addition, if the market effects used are selected judiciously, this approach can yield both timely and observable results. It also offers the advantage that the data collected to determine the agent's performance (e.g., changes in market indicators) can often also be used to improve the effectiveness of the intervention.

Under some circumstances, however, it may be preferable to base performance incentives simply on the good-faith execution of a consensus-based implementation plan. We believe this may be an appropriate approach when: (1) the expected risk is low; (2) the effectiveness of the intervention is especially difficult to measure; (3) the effectiveness of actions by the

agent receiving the incentive is not likely to be significantly increased by linking the agent's compensation directly to performance; (4) the expected elapsed time before results become apparent is unusually long; (5) the agent receiving the performance incentive is only one of several organizations responsible for the initiative; and (6) the agent receiving the incentive is highly risk-averse, and is therefore unlikely to respond enthusiastically to incentives that are dependent on the outcome of the intervention.

Second, because not all markets are structured at the level of end-uses or programs, these may not be appropriate categories by which to structure market transformation incentive mechanisms. Instead, it will be necessary to establish the structure and boundaries of individual energy-efficiency markets, and structure incentive mechanisms along the lines of targeted markets. For example, if market research determines that the buying and selling of lighting equipment for the renovation or remodeling of retail establishments forms a discrete market, then it may be appropriate to establish a performance incentive mechanism based on the penetration of energy-efficiency measures within this market.[73]

Third, because markets change only gradually, performance incentives based on market effects must allow sufficient time—in some cases, at least several years—for the effects to occur. As suggested above, if the lag time before a market effect is expected to occur is so long that the prospect of such a distant reward will be insufficient to motivate the agent, incentives could be based on good-faith performance rather than on market effects.

22. *Regardless of the agent or agents responsible for market transformation efforts, incentive mechanisms based on market effects must take into account the limited precision with which the market effects of energy-efficiency programs can be measured.* This imprecision creates a fundamental challenge, revolving around the potential risks to ratepayers, as well as the potential for systematic gaming of the results.

There are a number of ways in which the challenge of imprecision could be approached. One simple approach would be to establish a cap on performance incentive payments that is low enough that no plausible overstatement of benefits, either accidental or intentional, is likely to leave ratepayers worse off than they would have been without the intervention. However, depending on the structure of other incentives and disincentives confronting the agent responsible for market transformation, any incentive cap that is low enough to protect society against overcompensation may be too low to sufficiently motivate the agent. This would probably be the case in the current environment, where even a 30% share of estimated

---

73 An important question in this regard is what ultimately constitutes an individual market. A good starting point in answering this question might be to rely on the traditional definition of a market as a stable system of exchange between an inter-related set of players. Individual markets would thus be defined based on an analysis of which exchanges of energy-efficiency related measures or practices involve the most consistent types of transactions or combinations of market players. However, because of the extensive overlaps and interweavings of the economic relationships among various energy-efficiency market actors, this approach would need to be pursued on a market-by-market basis.

resource benefits has not always been sufficient to capture the enthusiasm of California's energy utilities—particularly for programs with marginal cost-benefit ratios. However, if in the future the utilities become completely or at least functionally disaggregated, we can envision a scenario in which DISCos have few enough disincentives to save energy, and few enough other sources of increased earnings, to be sufficiently motivated by a modest incentive.

A second approach to dealing with the imprecision with which market effects can be measured would be to delegate responsibility for the evaluation function or responsibility for adjudicating disputes over evaluation results to a neutral third party, rather than to the market transformation agent itself. Although such an approach would not make estimates of program effects any more precise, it would probably reduce the potential for the market transformation agent to take advantage of this imprecision to overstate program benefits.[74]

A third approach to reducing risk associated with the imprecision of market effects estimates would be to combine market transformation initiatives in portfolios, thereby balancing the variations in performance across the initiatives and minimizing the influence of any one imprecise estimate.

Finally, a fourth approach to dealing with imprecision would be to base performance incentive payments on multiple indicators of market effects. The underlying principle behind this approach is that if five separate indicators all suggest that marketing efforts have yielded substantial beneficial market effects, the conclusion that substantial benefits are present is much safer than if only one market indicator suggests it.

5.2.4 Recommendations on Transition Issues

23. *We recommend that the CPUC, the utilities, and other parties begin now to gain valuable experience and gather useful information during the transition to a restructured industry, and to revise the policy framework to increase its support for market transformation.* The CPUC, the utilities, and other parties should use the next one or two years to gain valuable experience and gather useful information. Information should be developed now on (1) some ways to focus programs and interventions on achieving lasting reductions in market barriers, (2) the effectiveness of past and current programs and initiatives in causing market effects and transforming markets (building on our scoping work in Chapter 3), (3) the role and design of performance incentive mechanisms to encourage increased focus

[74] This approach would be at least partly compatible with the scenario discussed earlier in this chapter, under which the utilities retain responsibility for implementing resource acquisition programs, while a statewide organization is responsible for implementing market transformation programs and for assessing the market effects of both its own and the utilities' actions. Under this scenario, the utilities would lose any opportunity to game market transformation evaluation results, although the statewide organization would retain such an opportunity.

on achieving market effects and reducing market barriers, (4) the nature of distribution utility rate design and the associated incentives/disincentives for market transformation, and (5) the ability of various methods to evaluate market effects and reductions in market barriers. In addition, existing vertically-integrated utilities could conduct studies of markets to address in the future, the market effects of past programs, and current and evolving baselines.

Incremental progress on many of the DSM policy framework issues we identified above should be made now while restructuring decisions are being implemented, to increase the policy framework's support for market transformation. Below are three of our near-term recommendations:

- We recommend that the M&E protocols be revised to reduce the frequency and/or the intensity of required traditional impact evaluations, in exchange for explicit requirements that the utilities conduct collaboratively-designed evaluations of market effects and reductions in market barriers. The protocol revisions could be made in several ways, ranging from waivers of existing protocol requirements in exchange for conducting substitute studies of market effects,[75] to protocol modifications for some programs or program elements.

- We recommend that performance incentive mechanisms based on indicators of market effects be explored. For programs with existing shared savings or performance adder mechanisms, mechanisms based on indicators of market effects should be implemented either in place of[76] or in addition to[77] the existing shareholder incentive mechanisms. In addition, a performance incentive mechanism for commercialization efforts should be designed and implemented.

- We recommend that the CPUC consider directing the utilities to allocate a portion of the M&E budgets, which have been underspent in recent years, to fund studies of market effects and reductions in market barriers. The CPUC would also have to

---

75 One such substitute study on PG&E's and SCE's residential new construction programs is currently underway.

76 If the existing incentive mechanisms are to be partially replaced with exploratory market transformation incentive mechanisms, it might make sense to begin with those measures, customer sectors, or markets where the existing policy framework does not appear to be working. One alternative would be to focus on either gas energy-efficiency programs or on the residential sector, where, because cost-benefit ratios tend to be relatively marginal, the existing incentive mechanisms do not appear to be consistently generating utility enthusiasm. Another alternative would be to focus on selected measures for which existing programs have either yielded relatively little customer response, or for which few beneficial market effects appear to have occurred.

77 Performance incentive mechanisms targeting market transformation are not necessarily incompatible with those targeting direct load impacts. However, if the two are to exist side by side, careful thought must be given to issues such as: (1) the overall structure of incentives created for the utility; (2) competition for resources between programs covered under each mechanism; and (3) the potential for gaming revolving around the attribution of various program costs and benefits to specific programs.

direct the utilities or CADMAC to *conduct* the studies, since allocating the resources in a utility M&E budget is not sufficient for ensuring that the study actually gets done. Alternatively, the necessary funds could be transferred to a third party to conduct the studies.

Individuals and organizations in California have a great opportunity now to begin to shift the focus of the policy framework and existing practice towards increased support of market transformation objectives. Failure to make progress and increase the experience and knowledge of market transformation beginning now and continuing over the next two years will hinder the development of the new energy-efficiency framework that the CPUC envisioned in its restructuring decisions.

References

California Public Utilities Commission (1995). *Decision 95-12-063.* San Francisco, CA: California Public Utilities Commission.

Commission Advisory and Compliance Division (1993). *DSM Workshop Report.* San Francisco, CA: California Public Utilities Commission.

Feldman, S. (1995a) "Selected Definitions of Market Transformation." *Strategies.* Washington, DC: Association of Energy Service Professionals.

Feldman, S. (1995b) "How Do We Measure the Invisible Hand?" *Proceedings, 1995 International Energy Program Evaluation Conference.* Evanston, IL: National Energy Program Evaluation Conference.

Goldstone, S. (1995) "Restructuring: A Stimulus to Improving Utility DSM, How Economists Might Help." *Proceedings Western Economic Association, 70th Annual Conference.* San Diego, CA, July 5-9.

Goldstone, S. (1996) *The Changing Nature of Public Interest in Energy Efficiency Due to a Restructuring: A Foundation Paper.* Sacramento, CA: California Energy Commission. April 19.

Golove, W. and. J. Eto (1996) *Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency.* Report No. LBL-38059, Berkeley, CA: Lawrence Berkeley National Laboratory.

Harris, R. and J. Carmen (1983) "Public Regulation of Marketing Activity: Part 1: Institutional Typologies of Market Failure." *Journal of Macromarketing.* Spring:49-58.

Jaffe, A. and R. Stavins (1994) "The Energy-Efficiency Gap, What Does it Mean?" *Energy Policy.* 22(10):804-810.

Prahl, R., and J. Schlegel (1994) "DSM Resource Acquisition and Market Transformation: Two Inconsistent Policy Objectives?" *Proceedings, ACEEE 1994 Summer Study on Energy Efficiency in Buildings.* 6:157-166. Washington, DC: American Council for an Energy Efficient Economy.

Schlegel, J., G. Edgar, R. Prahl, M. Kushler, D. Narum, et al. (1993). *Evaluation of DSM Shareholder Incentive Mechanisms.* Madison, WI: Wisconsin Energy Conservation Corporation.

Williamson, Oliver. 1989. "Transaction Cost Economics." in *Handbook of Industrial Organization, Vol. 1.* Schmalensee and Willig, eds. New York: Elsevier Science Publishers B.V.

List of Interviews and Interview Guides

DSM Director/Supervisor Interviews:

SDG&E	April 3, 1996	JS, RP, JE
PG&E	April 3, 1996	JS, RP, JE
SCG	April 4, 1996	JS, RP, JE
SCE	April 26, 1996	RP

DSM Program Manager Interviews

SCG	CEEI program	April 4, 1996	RP/JE
SCG	Nonresidential New Construction	April 4, 1996	JE/RP
PG&E	C/I/A EEI, Retrofit Express	April 8, 1996	JS
PG&E	C/I/A EEI, Capital Advantage and Energy Advantage	April 8, 1996	JS
PG&E	RAEI	April 9, 1996	JS
PG&E	C&I EEI/EMS, Chiller Replacement	April 9, 1996	JS
PG&E	C/I/A EMS	April 10, 1996	JS
PG&E	C/I/A EEI, Retrofit Efficiency Options, Advanced Performance Options, Customer Efficiency Options, Customized Incentives	April 12, 1996	JS
SDG&E	C/I/A EEI	April 12, 1996	JS
SDG&E	Nonresidential Other Information	April 12, 1996	JS
SCE	CEEI Program	April 12, 1996	RP
SCE	Manufacturer Rebate Programs	April 12, 1996	RP
SCE	Commercial Programs	April 12, 1996	RP
SCE	Residential EMS Programs	April 12, 1996	RP
PG&E	Nonresidential New Construction	April 12, 1996	JE
PG&E	Commercialization Programs	April 15, 1996	JS
SDG&E	Residential New Construction	April 15, 1996	JE
SCG	Residential New Construction	April 15, 1996	JE
SCG	Direct Assistance	April 16, 1996	JE
SCE	C&I EMS Programs	April 17, 1996	RP
SDG&E	RAEI	April 19, 1996	JS

Interview Topics and Questions for DSM Directors/Supervisors
March 29, 1996

1. Discuss the background and objectives of the scoping study. Does the company have any questions about the study?

2. What are the overall objectives of your energy-efficiency programs at this point?

3. Please describe the key program strategies you use to meet these objectives.

4. How have your programs changed in the past year or so, and how do you expect them to change over the next year or so?

5. Are your programs designed to change markets and address basic market barriers to energy efficiency? If so, please describe which markets, how the programs are designed to change markets, and which market barriers you believe the programs are designed to address.

6. Please list and describe the key factors that influence your program decisions.

7. How significant are the DSM policy rules, your shareholder incentive mechanisms, and the M&E protocols in the overall constellation of factors influencing your program decisions?

8. What effect do the DSM policy rules have on your program decisions? In what ways do you think the DSM policy rules facilitate or impede the design and implementation of programs that effectively address market barriers and change markets?

9. What effect do your shareholder incentive mechanisms have on your program decisions? What kinds of programs do you believe the mechanisms encourage you to implement? How do you think your programs would differ in the absence of the incentive mechanisms?

10. What effect do the M&E protocols have on your program and evaluation decisions? How do you think your programs would differ in the absence of the protocols? How do you think your evaluation efforts would differ in the absence of the protocols?

11. Which of your programs do you think are most likely to have had significant, lasting market effects at this point? (By "lasting" we mean effects that will continue after the market intervention is stopped or changes substantially.) Which of your programs do you think are most likely to have had other market effects that may not be lasting?

Please describe the nature and scope of these market effects. What evidence or indications do you have to support your hypotheses?

12. Discuss the process and schedule for interviewing program managers.

Interview Topics and Questions for DSM Program Managers
April 6, 1996

1. Introduction, background of study, purpose of interview

2. Clarification of current status of program and recent and future changes to it

3. Program objectives and strategies

4. Barriers to energy efficiency in the target market(s) and how the program addresses them

5. Program design and implementation (may include issues such as promotion, delivery methods, market segmentation, targeting, day-to-day management, and differences among specific program elements or enduses)

6. Influences on decision making regarding program design and implementation

   -- Regulatory influences: incentive mechanisms, M&E protocols, DSM policy rules
   --Other influences

7. Effects of the program on energy-efficiency markets

   -- Temporary effects
   -- Lasting effects
   -- Evidence for these effects

NOTE: This list of topics is intended to give interviewees a general idea of the types of questions we will we asking. However, because the characteristics of the individual programs we are reviewing vary widely, individual interviews may address other issues or address the above issues in a different order than listed here.