

# **MARKET EFFECTS SUMMARY STUDY**

## **FINAL REPORT**

### **Volume 2**

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# TABLE OF CONTENTS

## VOLUME 2: PROGRAM STUDIES

<b>2.1 RESIDENTIAL NEW CONSTRUCTION: MARKET TRANSFORMATION STUDY ...V2-1</b>	
STUDY OBJECTIVES AND PROGRAM DESCRIPTION.....	1
SUMMARY TABLES .....	2
COMPARISON WITH SCOPING STUDY FRAMEWORK.....	6
Market Effects.....	6
Market Barriers.....	7
Sustainability and Lastingness.....	8
Recommendations for Modifications to Scoping Study.....	8
STRENGTHS AND WEAKNESSES OF METHODOLOGIES.....	9
Strengths and Weaknesses of Evaluation Design .....	9
STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES.....	11
Assessment of Data Completeness.....	11
Assessment of Data Collection Procedures .....	13
SUSTAINABILITY AND LASTINGNESS .....	14
Critiques of the Evaluation's Evidence and Conclusions with Regard to Sustainability.....	14
OPPORTUNITIES FOR USE OF THE MARKET EFFECTS EVALUATION.....	14
Strengths and Weaknesses of Program as Market Transformation Program.....	14
Potential for Future Use of New Market Transformation Evaluation Techniques Tested.....	16
<b>2.2 RESIDENTIAL MARKET EFFECTS STUDY FOR REFRIGERATORS AND COMPACT FLUORESCENT LIGHTS.....V2-17</b>	
STUDY OBJECTIVES AND PROGRAM DESCRIPTION.....	17
SUMMARY TABLE .....	18
COMPARISON WITH SCOPING STUDY FRAMEWORK.....	21
Market Effects.....	21
Market Barriers.....	21
Sustainability and Lastingness.....	22
Comparison to Other Market Transformation Frameworks .....	23
Recommendations for Modifications to Scoping Study.....	23
STRENGTHS AND WEAKNESSES OF METHODOLOGIES.....	23
Strengths and Weaknesses of Evaluation Design .....	24
Comparison to Economic Framework .....	25
STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES.....	25
Assessment of Data Completeness.....	25
Assessment of Data Collection Procedures .....	25

SUSTAINABILITY AND LASTINGNESS.....	26
Criteria Examined for Sustainability .....	26
Critique of the Evaluation’s Evidence and Conclusions with Regard to Sustainability .....	26
OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION.....	26
Strengths and Weaknesses of the Refrigerator and CFL Programs as Market Transformation Programs.....	26
Potential for Future Use of New Market Transformation Evaluation Techniques Tested.....	27
<b>2.3 COMMERCIAL LIGHTING MARKET EFFECTS STUDY FOR PGE&amp;E AND SDG&amp;E.....</b>	<b>V2-29</b>
STUDY OBJECTIVES AND PROGRAM DESCRIPTION.....	29
SUMMARY TABLES .....	30
COMPARISON WITH SCOPING STUDY FRAMEWORK.....	35
Market Effects.....	35
Market Barriers.....	35
Sustainability and Lastingness.....	35
Comparison to Other Market Transformation Frameworks .....	36
Recommendations for Modifications to Scoping Study.....	36
STRENGTHS AND WEAKNESSES OF METHODOLOGIES.....	37
Strengths and Weaknesses of Evaluation Design .....	37
Comparison to Economic Framework .....	37
STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES.....	37
Assessment of Data Completeness.....	37
Assessment of Data Collection Procedures .....	38
SUSTAINABILITY AND LASTINGNESS.....	38
Criteria Examined for Sustainability .....	38
Critique of the Evaluation’s Evidence and Conclusions with Regard to Sustainability .....	39
OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION.....	39
Lessons Learned from the Market Effects Evaluation about the Commercial Lighting Market.....	39
Strengths and Weaknesses of Commercial Lighting Rebate Programs as Market Transformation Programs.....	39
Potential for Future Use of New Market Transformation Evaluation Techniques Tested.....	40
<b>2.4 PG&amp;E ENERGY CENTER MARKET EFFECTS STUDY.....</b>	<b>V2-41</b>
STUDY OBJECTIVES AND PROGRAM DESCRIPTION.....	41
SUMMARY TABLES .....	42
COMPARISON WITH SCOPING STUDY FRAMEWORK.....	45
Market Effects.....	46
Market Barriers.....	46
Sustainability and Lastingness.....	47
Comparison to Other Market Transformation Frameworks .....	47
Recommendations for Modifications to Scoping Study.....	48

STRENGTHS AND WEAKNESSES OF METHODOLOGIES.....	48
Strengths and Weaknesses of Evaluation Design .....	48
Comparison to Economic Framework .....	49
STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES.....	50
Assessment of Data Completeness.....	50
Assessment of Data Collection Procedures .....	51
SUSTAINABILITY AND LASTINGNESS .....	51
Criteria Examined for Sustainability .....	51
Critique of the Evaluation’s Evidence and Conclusions with Regard to Sustainability .....	51
OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION.....	52
Strengths and Weaknesses of PEC as a Market Transformation Program.....	52
Potential for Future Use of New Market Transformation Evaluation Techniques Tested.....	53
<b>2.5 STUDY OF MARKET EFFECTS ON THE SUPERMARKET INDUSTRY.....</b>	<b>V2-55</b>
STUDY OBJECTIVES AND PROGRAM DESCRIPTION.....	55
SUMMARY TABLES .....	56
COMPARISON WITH SCOPING STUDY FRAMEWORK.....	59
Market Effects.....	59
Market Barriers.....	60
Sustainability and Lastingness.....	60
Comparison to Other Market Transformation Frameworks .....	60
Recommendations for Modifications to Scoping Study.....	60
STRENGTHS AND WEAKNESSES OF METHODOLOGIES.....	60
Strengths and Weaknesses of Evaluation Design .....	60
Comparison to Economic Framework .....	61
STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES.....	61
Assessment of Data Completeness.....	61
Assessment of Data Collection Procedures .....	62
SUSTAINABILITY AND LASTINGNESS .....	63
Criteria Examined for Sustainability .....	63
Critique of the Evaluation’s Evidence and Conclusions with Regard to Sustainability .....	63
OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION.....	63
Strengths and Weaknesses of Utility Programs as Market Transformation Programs .....	63
Potential for Future Use of New Market Transformation Evaluation Techniques Tested.....	64
<b>2.6 COMMERCIAL/INDUSTRIAL MARKET EFFECTS BASELINE STUDY .....</b>	<b>V2-67</b>
STUDY OBJECTIVES AND PROGRAM DESCRIPTION.....	67
SUMMARY TABLES .....	68
COMPARISON WITH SCOPING STUDY FRAMEWORK.....	72
Market Effects.....	72
Market Barriers.....	72
Sustainability and Lastingness.....	73
Recommendations for Modifications to Scoping Study.....	74

STRENGTHS AND WEAKNESSES OF METHODOLOGIES.....	74
Strengths and Weaknesses of Evaluation Design .....	74
STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES.....	78
Assessment of Data Completeness.....	78
Sampling Design .....	78
Assessment of Data Collection Procedures .....	80
SUSTAINABILITY AND LASTINGNESS .....	80
Critiques of the Evaluation's Evidence and Conclusions with Regard to Sustainability.....	80
OPPORTUNITIES FOR USE OF THE MARKET EFFECTS EVALUATION.....	81
Strengths and Weaknesses of Program as Market Transformation Program.....	81
Potential for Future Use of New Market Transformation Evaluation Techniques Tested.....	81
<b>2.7 CONSUMERS' ATTITUDES TOWARD ENERGY-EFFICIENT APPLIANCES.....V2-85</b>	
STUDY OBJECTIVES AND PROGRAM DESCRIPTION.....	85
SUMMARY TABLES .....	86
COMPARISON WITH SCOPING STUDY FRAMEWORK.....	88
Market Effects.....	88
Market Barriers.....	88
Sustainability And Lastingness.....	90
Comparison To Other Market Transformation Frameworks.....	90
Recommendations For Modifications To Scoping Study.....	90
STRENGTHS AND WEAKNESSES OF METHODOLOGIES.....	90
Strengths and Weaknesses of Evaluation Design .....	90
Comparison to Economic Framework .....	91
STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES.....	91
Assessment of Data Collection Procedures .....	92
Assessment of Data Completeness.....	92
SUSTAINABILITY AND LASTINGNESS .....	93
OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION.....	93
Strengths and Weaknesses of the Program as a Market Transformation Program.....	93
Potential for Future Use of New Market Transformation Evaluation Techniques Tested.....	95
<b>2.8 CTAC MARKET EFFECTS STUDY.....V2-97</b>	
STUDY OBJECTIVES AND PROGRAM DESCRIPTION.....	97
SUMMARY TABLES .....	98
COMPARISON WITH SCOPING STUDY FRAMEWORK.....	100
Market Effects.....	100
Market Barriers.....	101
Sustainability and Lastingness.....	102
Comparison to Other Market Transformation Frameworks.....	103
Recommendations for Modifications to Scoping Study.....	103

STRENGTHS AND WEAKNESSES OF METHODOLOGIES.....	103
Strengths and Weaknesses of Evaluation Design .....	103
Comparison to Economic Framework .....	105
STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES.....	105
Assessment of Data Completeness.....	105
Assessment of Data Collection Procedures .....	106
SUSTAINABILITY AND LASTINGNESS .....	106
Criteria Examined for Sustainability .....	106
Critique of the Evaluation’s Evidence and Conclusions with Regard to Sustainability .....	107
OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION.....	108
Strengths and Weaknesses of CTAC as a Market Transformation Program.....	108
Potential for Future Use of New Market Transformation Evaluation Techniques Tested.....	108
<b>2.9 COMMERCIAL AND INDUSTRIAL (C&amp;I) ENERGY EFFICIENCY PROGRAMS.V2-109</b>	
STUDY OBJECTIVES AND PROGRAM DESCRIPTION.....	109
SUMMARY TABLES .....	110
COMPARISON WITH SCOPING STUDY FRAMEWORK .....	113
Market Effects.....	113
Market Barriers.....	113
Sustainability and Lastingness.....	114
Recommendations for Modifications to Scoping Study.....	114
STRENGTHS AND WEAKNESSES OF METHODOLOGIES.....	115
Strengths and Weaknesses of Evaluation Design .....	115
STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES.....	117
Assessment of Data Completeness.....	117
Assessment of Data Collection Procedures .....	119
SUSTAINABILITY AND LASTINGNESS .....	119
Critiques of the Evaluation's Evidence and Conclusions with Regard to Sustainability.....	119
OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION.....	119
Strengths and Weaknesses of Program as Market Transformation Program.....	119
Potential for Future Use of New Market Transformation Evaluation Techniques Tested.....	120
<b>2.10 HYDRAULIC SERVICES MARKET EFFECTS STUDY .....V2-121</b>	
SUMMARY TABLES .....	121
COMPARISON WITH SCOPING STUDY FRAMEWORK.....	125
Market Effects.....	125
Market Barriers.....	127
Sustainability and Lastingness.....	128
Recommendations For Modifications To Scoping Study.....	128
STRENGTHS AND WEAKNESSES OF METHODOLOGIES.....	128
Strengths and Weaknesses of Evaluation Design .....	128
Comparison to Economic Framework .....	129

STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES.....	129
Assessment of Data Completeness.....	129
Assessment of Data Collection Procedures.....	130
SUSTAINABILITY AND LASTINGNESS.....	130
Critique of the Evaluation’s Evidence and Conclusions with Regard to Sustainability.....	130
OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION.....	131
Strengths and Weaknesses of the Program as a Market Transformation Program.....	131
Potential for Future Use of the New Market Transformation Evaluation Techniques Tested.....	132
<b>2.11 HOME ENERGY FITNESS PROGRAM MARKET EFFECTS EVALUATION .....</b>	<b>V2-133</b>
STUDY OBJECTIVES AND PROGRAM DESCRIPTION.....	133
SUMMARY TABLES.....	134
COMPARISON WITH SCOPING STUDY FRAMEWORK.....	134
Market Effects.....	135
Market Barriers.....	136
Sustainability and Lastingness.....	136
Comparison to Other Market Transformation Frameworks.....	137
Recommendations for Modifications to Scoping Study.....	137
STRENGTHS AND WEAKNESSES OF METHODOLOGIES.....	137
Strengths and Weaknesses of Evaluation Design.....	137
Comparison to Economic Framework.....	139
STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES.....	139
Assessment of Data Completeness.....	139
Assessment of Data Collection Procedures.....	139
SUSTAINABILITY AND LASTINGNESS.....	140
Criteria Examined for Sustainability.....	140
Critique of the Evaluation’s Evidence and Conclusions with Regard to Sustainability.....	141
OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION.....	141
Strengths and Weaknesses of HEF as a Market Transformation Program.....	141
Potential for Future Use of New Market Transformation Evaluation Techniques Tested.....	141
<b>2.12 RESIDENTIAL MARKET EFFECTS STUDY: SDG&amp;E AND SCG’S RESIDENTIAL NEW CONSTRUCTION PROGRAMS.....</b>	<b>V2-144</b>
STUDY OBJECTIVES AND PROGRAM DESCRIPTION.....	144
SUMMARY TABLES.....	145
COMPARISON WITH SCOPING STUDY FRAMEWORK.....	147
Market Effects.....	148
Market Barriers.....	148
Sustainability and Lastingness.....	148
Comparison to Other Market Transformation Frameworks.....	148
Recommendations for Modifications to Scoping Study.....	148
STRENGTHS AND WEAKNESSES OF METHODOLOGIES.....	149
Strengths and Weaknesses of Evaluation Design.....	149



Comparison to Economic Framework .....	150
STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES.....	150
Assessment of Data Completeness.....	150
Assessment of Data Collection Procedures .....	151
SUSTAINABILITY AND LASTINGNESS .....	152
Criteria Examined for Sustainability .....	152
Critique of the Evaluation’s Evidence and Conclusions with Regard to Sustainability .....	152
OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION.....	152
Strengths and Weaknesses of Residential New Construction as Market Transformation Program.....	152
Potential for Future Use of New Market Transformation Evaluation Techniques Tested.....	153

**APPENDIX B**

**INDIRECT COSTS AND BENEFITS PILOT STUDY**

STUDY OBJECTIVES AND PROGRAM DESCRIPTION

SUMMARY TABLES

COMPARISON WITH SCOPING STUDY FRAMEWORK

STRENGTHS AND WEAKNESSES OF METHODOLOGIES

STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES

SUSTAINABILITY AND LASTINGNESS

OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION

# **MARKET EFFECTS SUMMARY STUDY**

## **Final Report**

### *Volume 2*

### ***PROGRAM STUDIES***



*Megdal & Associates*

FINAL REPORT  
MARKET EFFECTS SUMMARY STUDY



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## 2.1 RESIDENTIAL NEW CONSTRUCTION: MARKET TRANSFORMATION STUDY

### STUDY OBJECTIVES AND PROGRAM DESCRIPTION

Barakat & Chamberlin conducted a residential new construction market transformation study (RNC study) of SCE's Welcome Home program and PG&E's Comfort Home Program. As described in the evaluation, these programs included advertising and information packets directed at increasing the energy-efficiency information available to homeowners and Realtors, and promoting energy-efficient mortgages. In addition, the programs worked directly with builders and subcontractors, offering incentives for the use of energy-efficient measures and setting standards for ductwork installation, among other efforts.

The evaluation was conducted in two stages: the first stage was a market characterization study and the second stage was a market effects study designed around the first-stage results. The market characterization study involved review of secondary data sources and interviews with utility staff, CEC staff and DSM consultants with specific experience working with the residential new construction sector. The market effects study examined 14 indicators of market effects using qualitative and quantitative analysis of phone survey data. The quantitative component applied Analytic Hierarchy Process (AHP) for the analysis.

The study had six objectives:

- Determine the existence of market effects identified in the market characterization study
- Determine the magnitude of these effects
- Estimate a hypothesized baseline for establishing attribution
- Specify whether the market barriers have been reduced, eliminated or bypassed
- Assess the permanence of the observed changes
- Determine the implications of the results on future market transformation program design.

**SUMMARY TABLES**

**Table V2-1: Summary of Study Features**

<b>Title:</b>	Residential New Construction: Market Transformation Study
<b>Project Number:</b>	3301/3501
<b>Sponsoring Utility:</b>	PG&E/SCE
<b>Contractor:</b>	Barakat & Chamberlin (PG&E Energy Services)
<b>Sector:</b>	Residential
<b>End-Use Elements Examined:</b>	Whole building new construction
<b>Program Year(s):</b>	SCE: 1990–1994 PG&E: 1992–1996
<b>Program Intervention(s):</b>	Advertising and information packets directed to homeowners and Realtors; promotion of energy-efficient mortgages; incentives to builders and subcontractors to use energy-efficient measures; standards for ductwork installation

**Table V2-2: Key Study Results**

**BARRIERS ADDRESSED**

<b>BARRIERS</b>	<b>ACTORS AFFECTED</b>	<b>BARRIER DESCRIPTION</b>	<b>PROGRAM SUCCESS IN REDUCING MARKET BARRIER</b>
<b>Split Incentives</b>	Builders	Builders do not see financial benefits from installing measures that exceed code.	Slight limited reduction.
<b>Practices</b>	Subcontractors	Lack of coordination between subcontractors; insufficient space provided for duct installation; air conditioners oversized; energy-inefficient ductwork installation practices.	Some reduction but subcontractors report that builders are reluctant to pay additional costs of mastic seal.
<b>Practices</b>	Lenders	Lenders value ability to resell mortgages if needed. At present there is only a weak secondary market for energy-efficiency mortgages in California.	Some reduction. 2 PG&E builder sales agents report that energy efficiency of program homes is used routinely to help buyers qualify through improved loan ratio.
<b>Lack of Awareness/ Bounded Rationality</b>	Home Buyers	Home buyers do not know energy-efficiency measures exist; they do not know enough about measures to assess benefits or identify whether a home they are considering has the measures. Home buyers are unable to analyze tradeoffs or trade lifetime savings against first cost.	Slight reduction. 2 builders said general buyer demand for energy-saving features had increased, and attributed it to the program. 1 also mentioned bill stuffers. 1 respondent mentioned utility advertising.
<b>Lack of Awareness/ Bounded Rationality</b>	Builders	Builders have limited information with which to select subcontractors; they have limited ability to analyze tradeoffs.	Slight reduction. Attributable to PG&E duct blasting program and SCG program.
<b>Lack of Awareness/ Bounded Rationality</b>	Realtors	Realtors do not know energy-efficiency measures exist; they do not know enough about measures to assess benefits or identify whether a home they are considering has measures. Realtors are unable to analyze tradeoffs or trade lifetime savings against first cost.	Slight limited reduction. All responding sales agents were program participants.

**Table V2-3: Key Study Results**

**MARKET EFFECTS MEASURED**

DESCRIPTION OF EFFECT	KEY RESULTS	HOW MEASURED
Increased homeowner demand for energy efficiency	Respondents perceive buyer demand for features exceeding code as weak, but 2 builders exceed code as part of their marketing strategy.	Surveys of builders, Realtors, T-24 consultants
Increase in Realtor knowledge with respect to energy efficiency and its benefits	Sales agents and Realtors have access to information on basic energy-saving home features. No easy access to more technical information.	Surveys of Realtors and builders' sales agents
Realtor promotion of energy efficiency	Realtors have not had the opportunity to actively promote homes outside the program that exceed code because few are being built. Energy efficiency has become more integral to the sales pitch.	Surveys of Realtors and builders' sales agents
Increased lender awareness of energy-efficiency mortgages	4 of 9 builders' sales agents and 3 of 10 Realtors had heard of them.	Surveys of Realtors and sales agents
Increased availability and sales of energy-efficiency mortgages	2 builder sales agents said energy efficiency now is used routinely to sell program homes; 1 sales agent was contacted by a lender regarding energy efficiency mortgages. 1 Realtor said co-workers had used energy-efficiency mortgages.	Surveys of Realtors and sales agents
Belief that energy efficiency increases a home's market-ability enough to justify costs	6 builders reported changes in practices that increase energy efficiency.	Builder surveys
Builders are designing homes more energy efficient than Title 24 on their own	4 PG&E builders and 2 SCE builders showed evidence of effect. None of the nonparticipants showed evidence of effect.	Builder surveys
Builders are marketing homes as energy-efficient on their own	2 participating builders use the fact that they exceed code in their marketing.	Builder surveys
Title 24 consultants now report % efficiency above T-24 rather than pass/no pass	There is no evidence of market effect.	Title 24 consultant surveys
Increased builder awareness of ways subcontractors cut corners	A few participating builders are using the information to make better subcontractor selections.	Builder surveys

DESCRIPTION OF EFFECT	KEY RESULTS	HOW MEASURED
Better subcontractor coordination	There is no evidence of market effect	HVAC contractor surveys
<i>Continued</i>		
Changes in ductwork installation practices	1 contractor changed sealing method because of the program; 3 said they would continue using mastic sealant after the program ended; 2 started using mastic sealant because of the program.	HVAC contractor surveys

**Table V2-4: Key Study Results**

**EXISTING DATA USED**

DESCRIPTION	COLLECTION PERIOD
National Association of Home Builders' home buyer survey ( <i>Sunset</i> )	1995; 1989/1990
Surveys of participating and nonparticipating home buyers	SCE, 1991; PG&E, 1992
CEC: Energy Characteristics, Code Compliance and Occupancy of California 1993 Title 24 Houses	1995
<i>Professional Builder</i> "New Home Consumer Survey"	Annually for 22 years
CEC: Occupancy Patterns & Energy Consumption in New California Houses (1984-1988)	1990
Residential Appliance Saturation Survey	SCE, 1990; PG&E, 1990, 1994
SCE: Customer Decision Study, Analysis of Residential New Construction Equipment Purchase Decisions	1994
<i>Market Facts, Inc.</i> : "Energy Advantage Home Advertising Tracking Study" for SCG	1996
Surveys of participating and nonparticipating home buyers	SCE, 1993; PG&E, 1992



**Table V2-5: Key Study Results**  
**NEW DATA COLLECTED**

DESCRIPTION	COLLECTION METHOD	COLLECTION PERIOD
12 participating, 8 nonparticipating builders surveyed	In-depth telephone interviews	1997
10 Realtors surveyed	In-depth telephone interviews	1997
9 sales agents surveyed	In-depth telephone interviews	1997
6 HVAC subcontractors surveyed	In-depth telephone interviews	1997
4 Title 24 consultants surveyed	In-depth telephone interviews	1997
Interviewed 17 experts as part of market characterization (primarily utility, CEC, LBNL staff)	In-depth telephone interviews	1997

## COMPARISON WITH SCOPING STUDY FRAMEWORK

### Market Effects

The Residential New Construction Study examined 14 hypothesized key market effects, linked to the following general barrier categories:

- Homeowner/Buyer
  - Information-related barriers
- Builder Sales Agent/Realtor
  - Information-related barriers
- Lender
  - Practices barriers
- Builder
  - Split incentives
  - Information/bounded rationality barrier

- Subcontractor
  - Lack of coordination barrier
  - Practices barrier

We interpret the Scoping Study list of potential market effects as being illustrative of the types of effects that offer significant analysis value. At least three general features stand out in our review of that list: (a) market effects should involve identifiable market actors; (b) market effects should be closely linked to targeted market barriers; and (c) effects should demonstrate changes in those barriers relative to a predetermined baseline condition.

We do not believe the RNC study satisfied all three criteria. Based on the first criteria, we find that the study effectively linked market effects with specific market actors. Based on the second criterion, the degree to which the identified effects were linked to targeted barriers is subject to debate. For example, the effect "builders marketing homes as energy-efficient on their own" was linked to builders' split incentives barrier. One could debate whether this effect actually demonstrates a change in the incentive structure builders face or whether it merely provides circumstantial evidence of such a change. At issue is "how close is 'close'?" Even if one concludes that the effect is not closely linked to the targeted barrier, one cannot conclude that another effect would be a superior measure of change without considering measurability.

Based on the third criterion, the study was obviously hampered by the lack of any pre-existing market transformation baseline analysis for this market and program. Any identified changes are necessarily tentative and reflect structural constraints rather than flaws in the evaluation design or implementation.

## **Market Barriers**

The RNC Study provides abundant evidence of the subjective nature of market barriers, both in their definition and in their application. For example, the study listed "practices" as a barrier experienced by HVAC subcontractors, whom the study described as subcontractors who did not generally understand air flows. Further research into market effects related to this barrier revealed that subcontractors were surprised at the amount of leakage evident from duct blast tests. These results suggest that the "practices" barrier also could have been classified as "information or search costs" or as "performance uncertainties." In this vein, there are many other opportunities within the study to second-guess the barrier classifications adopted by the authors. This does not mean that the barrier assignments were wrong; rather, they simply reflected the authors' subjective judgment, as would any proposed alternative scheme.

In general, barrier classifications used in the RNC study were consistent with those used in the Scoping Study report. In the few instances where the two diverged, we have assigned the RNC study barrier to a Scoping Study category in order to compile the summary tables.

## **Sustainability and Lastingness**

The RNC Study classified market effects as removing, reducing or circumventing a market barrier. Including circumvention on the list is consistent with the Scoping Study notion that a market effect can be either transitory or permanent. The most apparent difference between the RNC Study notion of lastingness and that in the Scoping Study is the standard of evidence. While neither study spelled out specific criteria for assuming lastingness of any particular market effect, the Scoping Study's application of the notion of lastingness in its discussion of past program results seemed to rely on relatively strict evidence such as changes in government standards or regulations, physical changes in production or distribution practices that are not easily undone or institutional changes in standard practice that do not rely on the continuing influence of individuals for their permanence.

The RNC study, on the other hand, applied a much more flexible standard. For example, increased awareness among home buyers of the value of energy efficiency was considered likely to be permanent even though the population of home buyers completely changes every few months. To consider this change permanent, one must assume that home buyers' primary sources of information about energy efficiency (currently Realtors and builders' representatives) were constant, that the population of individuals making up those information sources was static, that those individuals will retain most of what they had learned about the program, and that they will continue to treat dissemination of that awareness and knowledge to potential home buyers as a high priority. These assumptions were much more generous than the Scoping Study standard of evidence apparently would allow.

## **Recommendations for Modifications to Scoping Study**

The Scoping Study did not explicitly link market barriers and market effects but it did imply such a link. The Scoping Study defined a market effect as "a change in the structure of a market of the behavior of participants in a market that is...causally related to market intervention(s)." An intervention, in turn, was defined in the Scoping Study as a deliberate effort by government or utilities to reduce market barriers. ..." The authors' inclusion of a market characterization study as part of the overall work program represented an important contribution toward understanding the practical implications for program planners and evaluators of linking actors, barriers, interventions and effects.

## STRENGTHS AND WEAKNESSES OF METHODOLOGIES

### Strengths and Weaknesses of Evaluation Design

#### *Importance of Market Characterization*

The market characterization study was conducted as a preliminary study. The results of the market characterization provided a basis for prioritizing market barriers and hypothesized market effects for the market effects analysis. It was thus an essential precursor for developing a market effects work plan that offered a reasonable expectation of adequately studying the key market barriers and effects without either overlooking an essential element or spending project resources studying minor barriers and effects.

We believe that adopting a two-tiered approach, the first tier being a market characterization study and the second tier being a market effects study designed around the first tier results, should be a high priority element of any evaluation that attempts to assess the market effects of programs that were not explicitly designed as market transformation programs. Adopting such an approach may be less critical for future market transformation programs if they include detailed market characterization studies as part of the program design.

#### *Upstream Identification of Market Barriers*

The evaluation team assigned market barriers by moving up the delivery chain, starting with the end-user (in this case the home buyer) and moving upstream to product manufacturers. At each stage in the delivery process, the team assumed that the market downstream was completely efficient. This approach is intuitively appealing because it avoids the temptation to double-count a market barrier, once from the perspective of the downstream actor and then again from the perspective of the upstream actor.

This approach immediately begs the question of whether it might be equally valid to take a downstream approach, beginning with the manufacturer, and assuming at each stage that the market upstream is completely efficient. The evaluation team explained its preference for the upstream approach by saying: "In a market structure, information regarding end-user demands flows upstream stimulating supply and its corresponding derived demand to each higher level. Products and services flow back down this system."<sup>1</sup>

This explanation suggests that supply is merely a passive reaction to demand. Alternatively, the downstream perspective would imply that demand is merely a passive reaction to supply.

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<sup>1</sup> Herman, P., S. Feldman, L. Hershey, and D. Mahone, *Residential New Construction Market Characterization.*, Barakat & Chamberlin, Inc., December 1996, p. 9.

Both perspectives may be oversimplified. Further analysis may be required to determine whether adopting either perspective introduces the possibility of systematic bias into the analysis.

### *Application of the Analytical Hierarchy Process*

The inclusion of AHP in the evaluation design for this project represents an important test of the feasibility of this method in evaluating market transformation programs. The study authors noted four strengths of the AHP approach:

- It provides a logical and systematic framework for structuring the decision problem.
- It can generate quantitative measures from responses to qualitative questions.
- It can identify inconsistencies in preferences and decision criteria.
- It produces composite indices of criteria used by different players, giving an indication of market-wide results.

In addition to these strengths, AHP, being a nonparametric method, is not as vulnerable to threats to internal validity from small sample sizes; AHP results are valid for the sample analyzed, regardless of sample size. At the extreme, AHP could be used to analyze responses from a single person and produce valid results for that person. In contrast, parametric methods such as regression models require analysis samples of a minimum size to produce statistically significant estimates of model coefficients.

AHP shares a limitation with parametric methods: both require large, randomly-selected samples for their external validity. In other words, AHP results can be generalized to a larger population only if the analysis sample is sufficiently large and statistically representative of that population. As an example of the threat external validity poses to the interpretation of analysis results, Table 16 (page 74 of the evaluation report) shows that sales price as a criterion affecting home marketability has increased in relative importance over time among the 31 respondents analyzed. However, the Title 24 consultants, a subset, reported a net decrease in the relative importance of sales price. While this result can be considered perfectly valid for the four Title 24 consultants surveyed for this analysis, it would be a mistake to generalize conclusions drawn from their responses to the population of all Title 24 consultants unless it could be shown that the sample analyzed is statistically representative of the broader population of Title 24 consultants.

Another apparent limitation of the method, judging from this evaluation, is the enormous data requirement. For example, in the builder survey alone, 29 different comparisons were tested between different features, measures or reasons for observed actions. Even so, the barriers

analyzed using AHP were only a subset of those identified as key in the market characterization study.

A further limitation of AHP is that, unlike regression methods, it does not control for explanatory factors. Thus, applied in isolation, AHP cannot be used to test hypotheses about observed differences in results for subsets of the analysis sample. For example, Table 19 (page 80 of the evaluation report) shows that the two Title 24 consultants from the SCE service territory consider the relative effectiveness of HVAC measures for exceeding Title 24 to be much higher than do the two consultants from the PG&E service territory. However, these results do not explain whether the observed differences are due to differences in the utility programs' climate or some other reason.

This limitation is particularly acute in the study's comparison of relative preferences and perceptions of program participants and nonparticipants. In making such comparisons, the implicit assumption is that observed differences are attributable to the program. However, other hypotheses are equally plausible. For example, the observed differences in perceptions could actually explain builders' participation decisions rather than vice versa, or both the observed differences in perceptions and the participation decisions could be explained by some third unidentified factor. These hypotheses cannot be tested relying only on AHP.

## **STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES**

### **Assessment of Data Completeness**

#### ***Strength***

- The primary data collection effort appears to have been quite thorough in terms of the level of qualitative detail contained in the survey instruments and the interviewers' willingness to probe for additional information. A good example of the depth of examination is the finding that some builders thought they were exceeding Title 24 because they exceeded the minimum baseline for AC SEER but actually had not exceeded code. The survey responses also provide multiple indications of potential market barriers that were not identified in the market characterization study.

#### ***Weaknesses***

- The small sample sizes shown for the primary data collection may represent the most serious weakness of the study. The qualitative analysis relied on interviews with only 49 market actors, which included PG&E and SCE market actors, participating and nonparticipating builders, Title 24 consultants, sales agents, HVAC subcontractors and Realtors. No single subcategory included more than five market actors. The

quantitative analysis using AHP relied on interviews with only 31 market actors, again spread over multiple subcategories. No single subcategory included more than four market actors.

- No primary data were collected from home buyers, although the market characterization study identified several market barriers for this group. Furthermore, given an “upstream,” demand-oriented approach to characterizing market barriers, one would expect that the barriers experienced by home buyers would be among the most important. Excluding home buyers from interviews was, in part, a resource tradeoff. The evaluation team initially judged that more was already known about home buyers than other actors so they deserved less emphasis. The team counted on getting more information from secondary sources about home buyers, but those sources were not as useful as anticipated. In the future, greater consideration should be given to data collection from home buyers for studies that identify and rank the importance of market barriers.
- Similarly, no primary data were collected from lenders, although the market characterization study identified potentially key market barriers for this group. Instead, the analysis relied on information from Realtors and builders’ sales agents about energy-efficiency mortgages. While their perspective is undoubtedly useful for understanding the overall market dynamics, we consider it an unsatisfactory substitute for primary data collected from lenders.
- The market characterization study itself relied almost exclusively on interviews with DSM professionals. Only a few actual market actors were interviewed in the process, leading us to question whether the identified barriers are actually based on empirical evidence or are merely hypothetical.
- Follow-up discussions with members of the evaluation team indicated that the small sample sizes were symptomatic of the significant tradeoffs in resource allocation that confronted the team. In particular, the original project scope had not envisioned a systematic market characterization study as a component of the project. Anticipating the value of such a study, the evaluation team advocated for, and was granted, its inclusion in the project scope. However, expansion of project resources did not accompany expansion of the project scope, so inclusion of the market characterization study compromised data collection.

In considering the tradeoffs made in the evaluation design, we question the value of implementing a resource-intensive analysis method such as AHP when the data available to produce useful results from the method may have been inadequate. While inclusion of AHP in the evaluation design has great value to illustrate the analytic power such a technique might offer to the evaluation of market transformation programs, we believe that more immediately useful

evaluation results could have been obtained with greater emphasis on data collection and qualitative analysis. Alternatively, more resources could have been committed to the evaluation to ensure more thorough data collection.

One potentially mitigating factor on the effect of small sample size is that, in the residential new construction sector, a few builders account for the majority of the construction activity. To support this thesis, the study would have been greatly enhanced by the inclusion of approximate indicators of overall market size, total number of builders in the market, their relative market share, total number of each of the actors in the market, and the relative number and size of actors interviewed. This information is critical for assessing the comprehensiveness of NYNEX information technologies company's nationwide list of builders and the validity of using it to construct a representative sample. Similarly, the market share data would have allowed assessment of the validity of basing the trade ally sampling on referrals from builders versus sources such as the Yellow Pages or Dun & Bradstreet. Finally, this information would address concerns about extrapolating results beyond the set of actors interviewed and would enable the development of at least ballpark estimates of overall market penetration and market effects.

### **Assessment of Data Collection Procedures**

The analysis design and interpretation of results appear to have been significantly limited by the lack of a pre-established baseline or benchmark by which to measure changes in market barriers resulting from program intervention. This is not an inherent limitation of the data collection or analysis approach; rather, it reflects the fact that the programs being evaluated were designed to meet resource acquisition objectives rather than market transformation objectives.

The evaluation team compensated for this lack of baseline by incorporating historical and change-of-condition questions into both the qualitative and quantitative components of their survey instruments. In developing the data collection plan to support the AHP analysis, the team recognized the potential for bias stemming from inclusion of questions about both historical and current conditions and preferences in the same instrument. Presented with both sets of questions, respondents might have been inclined to report differences between historical and current conditions and preferences that do not actually exist, simply because an expectation of differences is inferred in the line of questioning.

The team considered two strategies for addressing this potential source of bias. The first strategy involved dividing the study sample into two groups. They would have asked the first group questions only about historical conditions and preferences and the second group only about current conditions and preferences. The second strategy also involved dividing the study sample into two groups, but both groups were to be asked both sets of questions. The first group would begin with historical questions and then proceed to current questions; the second group would begin with the current questions and then proceed to the historical questions. This second



strategy was chosen for implementation because the first strategy would have exacerbated problems with already small sample sizes. While we believe this choice was reasonable given the other project constraints, we are concerned that inclusion of both historical and current questions in the same instrument represents a threat to the validity of the quantitative results of the AHP analysis.

## **SUSTAINABILITY AND LASTINGNESS**

### **Critiques of the Evaluation's Evidence and Conclusions with Regard to Sustainability**

As noted above, this evaluation applied a generous standard for concluding that an observed effect is likely to be permanent. By this standard, most observed effects are considered likely to be permanent, even when they are considered slight in magnitude. In general, we are skeptical of any claims of permanence that do not rely on some evidence of physical or institutional change that is not easily reversed. Absent such evidence, we are inclined to assume that the rapid pace of change in every sector of the economy and society will quickly dilute or negate observed market effects once the market intervention is withdrawn. Clearly, future research could better explain the process by which innovation diffuses throughout the marketplace, and the conditions under which that diffusion becomes permanent.

## **OPPORTUNITIES FOR USE OF THE MARKET EFFECTS EVALUATION**

### **Strengths and Weaknesses of Program as Market Transformation Program**

Considerable caution should be exercised in applying the results of this evaluation to assess the strengths and weaknesses of the historical programs as market transformation efforts. This caution stems from the fact that, from the onset, the evaluation was intended to be primarily forward-looking rather than backward-looking. Toward this end, the evaluation focused on barriers that were judged to continue to limit the penetration of energy efficiency in the residential new construction sector. By emphasizing opportunities for future market transformation, the evaluation necessarily minimized its assessment of past program successes.

The clearest example of this dynamic is the program's treatment of changes in Title 24. For purposes of this evaluation, energy efficiency was defined relative to current Title 24 standards, adopted in 1992. This strategy either rules out the possibility that the program made substantive contributions to the Title 24 revisions or it ignores benefits of the pre-1992 programs. In effect, the analysis took the perspective that the market for measures covered by Title 24 already has been transformed so there is little to be gained for future programs by studying it.

A further limitation of applying the evaluation results to assess the market-transforming effects of the historical programs is the manner in which attribution was assigned. Attribution of market

effects to the program was limited to those effects for which direct evidence of program influence existed. Further research into diffusion channels that produce indirect program effects was identified in the study as an important priority but it exceeded the scope and resources of this study. Attribution of indirect effects to market transformation programs is likely to be a primary challenge to future program evaluations.

As noted previously, the quantitative results are the most problematical of the study, due to various threats to external validity. One component of that threat is the small sample size and the questions that raises for extrapolating results to the larger population of market actors. At a more detailed level, the majority of reported results were based on comparisons between subsets of the analysis sample or between differences in responses about current conditions, compared to historical conditions. In making these comparisons, the evaluation team reported using a rule-of-thumb of 5% absolute difference as a threshold for significant differences when comparing attributes. Using the same standard for comparisons over time, no category showed significant change in Tables 16 and 20 of the final report. The percent changes reported in that table are actually relative differences, calculated as  $100\% \times (\text{present-past})/\text{past}$ . Thus, any conclusions based on measured changes over time deserve close scrutiny. While we do not underestimate the fundamental difficulty of establishing a viable baseline after the fact, we do question the value of reporting results that do not pass basic tests for significance.

A review of qualitative responses from various market actors suggests several potential market barriers that might merit analysis in a future study. For example, builders' sales agents reported almost always telling potential buyers about the homes' energy-saving features, suggesting that sales agents are an important source of information to potential buyers. If so, a potential market barrier that affects buyers would be asymmetric information. As a second example, builders reportedly did not give buyers payback information, in part because confounding variables (such as the number of occupants and their behavior) could discount the claimed savings. In the absence of such information, buyers may have faced a performance uncertainty barrier. As a final example, the evaluation found that nonparticipants estimated higher costs to build a home 10% above code. Important future work would include obtaining average and median estimates of the true costs of exceeding code. This information would clarify whether high costs are a true disincentive to energy-efficient investments or whether the perception of higher costs is a market barrier.

The evaluation's final report included a detailed discussion of study implications, including implications for future program design and research. We concur with those qualitative conclusions with one exception. The evaluation team stated that "Incentives have some effect, but may not be the best way to transform the market for energy efficiency in new homes." This conclusion was based on the limited observed reductions in several key market barriers in the residential new construction sector. However, as has been noted, the evaluation, by having chosen a future-oriented rather than historical-oriented perspective, essentially focused on

program shortcomings and minimized program successes. Thus while the conclusion may be plausible, we do not believe it is demonstrable based on this study.

### **Potential for Future Use of New Market Transformation Evaluation Techniques Tested**

This study suggested that AHP could prove to be a powerful tool for the evaluation of market transformation programs. However, in applying this method, evaluators should not have underestimated the data requirements needed to produce meaningful results that could be generalized to the study population of interest.

## 2.2 RESIDENTIAL MARKET EFFECTS STUDY FOR REFRIGERATORS AND COMPACT FLUORESCENT LIGHTS

### STUDY OBJECTIVES AND PROGRAM DESCRIPTION

The PG&E and SDG&E Residential Market Effects Study for Refrigerators and Compact Fluorescent Lights (Refrigerator and CFL study) was conducted by Hagler Bailly Consulting, Inc. The study was conducted during the summer and fall of 1997. The research team was led by Jeff Erickson of Hagler Bailly's Madison, Wisconsin office. The report was organized into eight chapters with a detailed executive summary. The full report included extensive appendices of the data collection instruments and data tables.

The refrigerator and compact fluorescent lights (CFL) programs offered by PG&E and SDG&E operated between 1989 and 1997. SDG&E launched its program in 1990; PGE began its in 1989. The utilities' refrigerator programs' characteristics changed every year and were different across utilities.

They offered various combinations of the following: rebates to customers, point-of-purchase discounts on purchase price, spiffs to retailers and salespersons (in some years), education and market materials, manufacturer "credits" (rebates), and for low-income customers, free refrigerators. During this period, PG&E also participated in the Super-Efficient Refrigerator Program (SERP).

As was the case for the refrigerator studies, the CFL program characteristics changed each year and varied from utility to utility. The distribution methods included direct installation and distribution, direct mail coupons, manufacturer buy-down, cost credits to manufacturers, new construction incentives, multifamily incentives for hard-wired CFLs, and consumer information and education.

The market effects research provided an examination of both lagging and leading indicators of market effects for the two products over the program period. The two types of indicators were distinguished in the report as follows:

- Leading Indicators - Market Effects: effects that helped predict future changes in market share by measuring changes in barriers that stood in the way of energy-efficient purchases.
- Lagging Indicators - Market Share: change in market share of energy-efficient equipment.

The measurement of these indicators was accomplished through customer surveys, free rider surveys with program participants, retailer surveys, manufacturer surveys and a review of historical program and utility records and past evaluations.

**SUMMARY TABLE**

**Table V2-6: Summary of Study Features**

<b>Title:</b>	Residential Market Effects Study for Refrigerators and Compact Fluorescent Lights
<b>Project Number:</b>	3302/3902
<b>Sponsoring Utility:</b>	PG&E/SDG&E
<b>Contractor:</b>	Hagler Bailly Consulting
<b>Sector:</b>	Residential
<b>End-Use Elements Examined:</b>	Refrigeration and lighting
<b>Program Year(s):</b>	1989-1997 (emphasis on 1996)
<b>Program Intervention(s):</b>	Refrigeration: customer, dealer, and manufacturer rebates; information; direct installation Lighting: customer, retailer, and manufacturer rebates; information and no-cost distribution to customers

**Table V2-7: Key Study Results**

**BARRIERS ADDRESSED**

<b>BARRIERS</b>	<b>ACTORS AFFECTED</b>	<b>BARRIER DESCRIPTION</b>	<b>PROGRAM SUCCESS IN REDUCING MARKET BARRIER</b>
<b>Information Or Search Costs</b>	Customers	Lack of customer awareness; limited customer knowledge.	Survey results show increase in awareness and knowledge. For refrigeration, findings not explicitly linked to program; for lighting, indirectly attributes by showing difference between CA and rest U.S. in utility as information source.
<b>Information Or Search Costs/ Bounded Rationality</b>	Retailers	Lack of retailer awareness; limited retailer knowledge; low relative priority.	94% of CA retailers have participated in refrigerator program vs. 22% nationwide; higher % of CA retailers attribute influence to program. For lighting, no attributable difference between California and rest of U.S.
<b>Bounded Rationality</b>	Customers	Limited customer interest; low relative priority given to energy efficiency.	California customers show more interest than rest of U.S. and retailers in CA attribute interest to programs more often than in rest of U.S. (84% vs 29% for refrigerator rebates; 43% vs 6% for information); refrigerator differences decreased in 1996; no noted change in lighting.
<b>Product Unavailability / Inseparability Of Product Features</b>	Customers	Lack of availability; lack of availability of relatively inexpensive refrigerators; lack of availability with and without common features.	No difference between CA and rest of U.S. attributable to program. Little evidence that this is a barrier.
<b>Split Incentives</b>	Building Owners	Landlords and building managers pay costs of refrigerators but do not reap benefits from energy savings.	PG&E eliminated efforts to address this in 1994; effects not analyzed.
<b>Irreversibility</b>	Manufacturers	Expense of decommissioning a product line or retooling.	No evidence of barrier.
<b>Performance Uncertainty</b>	Customers	Customers (but not retailers) still believe there are problems with CFLs.	No differences found between California and rest of U.S.

**Table V2-8: Key Study Results**

**MARKET EFFECTS MEASURED**

DESCRIPTION OF EFFECT	KEY RESULTS	HOW MEASURED
People in California appear to be more aware and better educated on refrigerator efficiency issues than people in the rest of the country	Percent of survey respondents who said they bought a high efficiency refrigerator but whose refrigerator was less than 15% more efficient than federal standard is significantly lower in CA than in rest of the country (30% vs. 78%)  People in California are more aware of CFLs and are more likely to have purchased one than the rest of the country (68% vs 44% and 44% vs 33%, respectively)	Customer surveys
Higher ratings of customer knowledge of efficient refrigerators	California customers scored 5.9 on refrigerator knowledge scale of 1-10, compared to national average of 5.1 as rated by retailers	Retailer surveys
Customers show greater interest in energy efficiency for both refrigeration and lighting	By 1996, participant refrigerator efficiency was 23% above Federal standards vs. efficiency 13% above standards in California as a whole and 7% above in rest of U.S. Resulting net annual program savings were calculated at almost 12 GWh plus 8.5 GWh in spillover savings  Surveys show higher purchase and penetration rates of CFLs in California than rest of U.S. but attribution not clear; analysis suggests that considerable CFL program spillover has occurred	Customer surveys, program data and impact studies
Less concern about lightbulb purchase prices	For all Californians (not just participants), lightbulb price was less important than energy efficiency; for the rest of the country, it was the opposite.	Customer surveys

**Table V2-9: Key Study Results**

**EXISTING DATA USED**

DESCRIPTION	COLLECTION PERIOD
Program records and savings estimates	Various program years 1989-1996

**Table V2-10: Key Study Results**

**NEW DATA COLLECTED**

DESCRIPTION	COLLECTION METHOD	COLLECTION PERIOD
337 surveys of 1996 CFL purchasers; 150 surveys of nonpurchasers who were aware of CFLs; 717 refrigerator surveys (213 refrigerator participants)	Random digit dialing phone survey	Summer/fall 1997
29 California CFL retailers, 29 national CFL retailers; interviewed staff at national headquarters for Sears and Circuit City	Phone surveys	Summer/fall 1997
62 California refrigerator retailers, 50 national refrigerator retailers; interviewed staff at national headquarters for Sears and Circuit City	Phone surveys	Summer/fall 1997
Interviewed representatives from Whirlpool and General Electric	Phone surveys	Summer/fall 1997
Interviewed staff at two key companies in residential new construction market	Phone surveys	Summer/fall 1997

**COMPARISON WITH SCOPING STUDY FRAMEWORK**

**Market Effects**

The Refrigerator and CFL study is one of only two studies to use market share as an indicator of market effects and market transformation. In doing so, it provided an example of the full application of the Scoping Study framework. The authors, however, did carefully distinguish between and define lagging and leading indicators of market effects in order to differentiate their analysis of market barrier reduction and market share.

As noted in Appendix A, our review of the Scoping Study and other market transformation literature, Feldman (1995a, 1995b) defined lagging and leading indicators and suggested that leading indicators were likely to be more useful to program planning and strategy and more current than lagging indicators. This study, therefore, provided a test of the limits and opportunities of using lagging and leading indicators as measures of market effects.

**Market Barriers**

The authors developed listings of barriers to test for market effects based on their review of SDG&E and PG&E programs. The barriers used for this therefore reflect those that were



implicitly or explicitly addressed by the DSM programs. This listing was extensive and was fully described in two tables, at the conclusion of the review of market effects for each study.

The method used to generate the barriers had both a strength and a weakness. The primary strength was that it emanated directly from the programs implemented by the utilities. This facilitated the process of addressing attribution of barrier reduction to the utility program. That is, it allowed the evaluators to distinguish market effects from market changes. In the case of this study, the authors tested for reduction in quite a few hypothesized barriers and found some market effects. For those effects they did find, they were able to address the question of what caused the effects to occur. In addition, their market share analysis estimated net program savings of 20 GWh for refrigerators and CFLs.

A small weakness was in the possibility that other market barriers existed that were never identified and addressed by the program's design. This leads to two concerns. First, the market effects could be overestimated, essentially a Type 2 error. This is more of a hypothetical concern than one observable in the study results. Since so few market effects were identified, we doubt there was any overestimation.

However, a more important concern about the use of this study in developing market transformation programs is that since the authors did not identify the barriers in the two markets, this study did not characterize the market well enough that opportunities to further reduce barriers could be readily identified.

### **Sustainability and Lastingness**

The authors did not state clearly their criteria for assessing sustainability or lastingness. Rather they suggested that by taking a "multi-perspective or triangulation approach" they could find patterns of evidence for market effects. This approach is actually consistent with the Scoping Study, though it was less well-defined than we have recommended.

In other reviews we noted that authors sometimes failed to apply a qualitative assessment of lastingness with any rigor. That was not an issue in this study. The authors did not specify any criteria for lastingness but did require that multiple indicators pointed to lastingness before they concluded that there was a market effect, thus using an acceptable level of rigor. The authors noted for refrigerators that, "there is little evidence that these effects will prove to be long-lasting," while for CFLs they noted that, "in only two cases can a case be made that the market effects are permanent."

## **Comparison to Other Market Transformation Frameworks**

The framework tested here was consistent with the Scoping Study, relying upon an analysis of market share to estimate net savings associated with the utility programs. We find this preferable to an analysis of billing data, which can confound effects. The confusion occurs because it is hard to control for all factors that could coincide with, but are unrelated to, the uses of efficiency measures. Also, bill analysis is a great tool with utilities to measure persistence. However, it registers only the effect of single events, or a single program year, rather than evidence of change in market structure or behavior.

The approach used in this study to estimate net savings requires a significant effort. The survey conducted for the study enabled the authors to develop a time-series analysis with a baseline by finding consumers who had purchased refrigerators or CFLs in 1986, 1991 and in 1996 (and for CFLs, 1997 as well). The name plate data for refrigerators could be cross-referenced with documented information from manufacturers regarding energy consumption. This type of approach could be implemented during program implementation as well as in a post-program approach such as that demonstrated here.

## **Recommendations for Modifications to Scoping Study**

One modification of the Scoping Study emerged from the application of the framework in this study. The authors identified an important issue by noting that the differences between lagging and leading indicators are important. In particular, it is essential to address how these can be interpreted for measurement of market effects and sustained market transformation.

## **STRENGTHS AND WEAKNESSES OF METHODOLOGIES**

The evaluation design had two components: market effects and market share. The market effects analysis was a direct application of the Scoping Study framework. It was therefore quite comparable to the other studies that examine the reduction of market barriers in order to measure market effects. The analysis of market share may be viewed as an expansion of the Scoping Study framework to estimate net savings attributable to the program efforts. To the extent that the Scoping Study refers to adoption of energy-efficiency products, series and practices as a reflection of changes in market structure and behavior, the analysis of market share was completely consistent with the Scoping Study framework. In addition, it differed completely from any billing analysis that tracked specific program-year post-participation energy use, which is akin to a DSM-style persistence analysis.

## Strengths and Weaknesses of Evaluation Design

The methodology for measuring the reduction in market barriers was solidly within the Scoping Study framework, using multiple indicators of market barrier reduction to draw conclusions about market effects. The approach was sound and well-executed.

The primary weakness in their design arose from two factors. First, the authors relied on an analysis of programs offered by the two utilities to identify market barriers. While this was reasonable for determining if the programs reduced the barriers they targeted, it did not provide sufficient information to determine whether other market barriers existed and perhaps even overwhelmed those barriers addressed by the utility programs. The authors neither conducted nor seemed to have had access to a market characterization which might have allowed them to see all market barriers. As a result, we can conjecture with confidence but cannot know for certain that the study did not address the full set.

The second weakness lies in the failure to specify the criteria for lasting market effects. The authors stated that they relied on multiple indicators or triangulation to draw conclusions about market effects. While this was consistent with the Scoping Study, a clear statement of criteria would have improved the reader's ability to interpret the authors' basis for their conclusions.

The methodology for using market share to estimate net program savings expanded the Scoping Study framework. The methodology was well-considered and well-executed. The approach essentially created a time-series/cross-sectional analysis while collecting data at a single point in time. The strength of this approach was its transparency, replicability and comparability to previous impact evaluation work conducted under the California measurement and verification protocols<sup>2</sup> and in the fact that the methodology can be employed during as well as after programs have been implemented. In addition, it is important to commend the authors for their use of name plate information as a basis for calculating savings. This lent considerable credibility to the analysis since the comparative savings relied neither on accuracy of self-report (of refrigerator efficiency or even size of the unit for calculation of savings) nor on inference from a billing analysis that might or might not have controlled adequately for changes in energy usage coincident with but unrelated to the program.

The applicability of this approach suited each measure well, and might not transfer to other measures. For instance, it is relatively easy for residents to find name plate information for refrigerators but more difficult for room air conditioners, furnaces and other HVAC equipment. It is also difficult to implement such a survey by telephone in commercial settings where it may be difficult to reach equipment or identify operators.

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<sup>2</sup> Measurement Subcommittee. *Measurement Protocols for DSM Programs Eligible for Shareholder Incentives (An Energy Efficiency Blueprint for California: Report of the Statewide Collaborative Process)*. State of California, January 1990, Appendix A.

Ultimately, because the programs were operating at the time of the study, the market barriers analysis was required for the authors to interpret the lastingness of the net savings measured in the market share analysis. Thus, the methodology for market share analysis could not stand alone as an indicator of market transformation unless it had been conducted several years after the elimination of the program.

### **Comparison to Economic Framework**

The study was solidly within the Scoping Study framework and thus did not provide any critique of or comparison to the economic framework implicit in the Scoping Study.

## **STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES**

### **Assessment of Data Completeness**

The study was based on two types of data: a review of past program reports, evaluations and documentation; and interviews and surveys with consumers and key trade allies.

The review of past program reports, evaluations, and documentation was thorough and complete. The authors gleaned much more from these data than have some of the other studies. They were able to identify market barriers targeted by the programs in different years and were able to explain to the reader the reasons why the program effects occurred.

The survey data also were complete. The surveys were detailed and well-designed. The sample dispositions were included for each sample, although populations were not always included. The collection of usable name plate data was innovative and successful, lending credibility to the market share analysis.

### **Assessment of Data Collection Procedures**

The authors included an in-state sample and an out-of-state national sample in order to draw conclusions about naturally-occurring conservation as compared to program-induced conservation and to compare the presence or reduction of market barriers. By using a national sample, the authors provided a more conservative estimate than if they had targeted areas with limited utility offerings. That is, because the national (comparison group) sample included some areas with programs but were implicitly treated as though they had no program influence, the authors (admittedly) overestimated the amount of naturally-occurring savings in the comparison group.

## **SUSTAINABILITY AND LASTINGNESS**

### **Criteria Examined for Sustainability**

As noted above, no specific criteria were stated. The authors chose to take a “multi-perspective or triangulation approach” to finding patterns of evidence for market effects.

### **Critique of the Evaluation’s Evidence and Conclusions with Regard to Sustainability**

The authors were rigorous in their application of this qualitative approach to lastingness. They compared California consumers and retailers to a national sample of consumers and retailers and found evidence of barrier reduction for both refrigerators and CFLs and indicated that this might be long-lasting. They also found some significant barriers remaining and were able to conclude unequivocally that the reduced barriers had been permanently reduced in only two instances and only for CFLs.

The two permanent changes were price reductions and technical performance standards for the lamps. While these changes indeed may be permanent, we do not feel that the authors sufficiently demonstrated that they are the result solely of efforts by California utilities. Other utilities in the Northeast and Midwest offered CFL programs during the same period. Almost all of these utilities have been similarly concerned about performance specification and together likely created the volume that led to price reductions.

The market share analysis did not have a sustainability component. If the rebates for these measures are eliminated, the market share analysis would be able to test for sustainability at a later date.

## **OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION**

### **Strengths and Weaknesses of the Refrigerator and CFL Programs as Market Transformation Programs**

The market share analyses demonstrated that the utility refrigerator and CFL programs did result in spillover effects, which are a component of market transformation. The market effects analyses demonstrated that the programs reduced market barriers during the time that the programs were in effect and some may be reduced for the long term. However, the evaluation did not make a case for the programs as excellent market transformation programs, i.e., programs that after ten years led to substantial sustainable market effects.

The end result of the evaluation was that the programs did increase the awareness by California utility customers of energy-efficient refrigerators and CFLs, and this may be long lasting. The

market share for these products increased as a direct result of the programs through purchases made using incentives and from spillover purchases. The authors made no claim as to the degree to which this increase would diminish if rebates were eliminated.

### **Potential for Future Use of New Market Transformation Evaluation Techniques Tested**

The market share analysis of net savings can be readily implemented for many types of energy-efficient products, enabling evaluators to implement a time-series/cross-sectional design. The authors implicitly recommended that the analysis be conducted periodically during the implementation period for a program creating a time-series measure. However, the study also demonstrated that it could be conducted retrospectively. The primary requirement for using this method to demonstrate sustainable effects, however, is that program efforts cease prior to the final measurement.



*Megdal & Associates*

## 2.3 COMMERCIAL LIGHTING MARKET EFFECTS STUDY FOR PGE&E AND SDG&E

### STUDY OBJECTIVES AND PROGRAM DESCRIPTION

The PG&E and SDG&E Commercial Lighting Market Effects Study was conducted by Xenergy, Inc. with assistance from Easton Consultants. The study was conducted during 1997 and provides a retrospective analysis of the effects of commercial lighting programs from 1992 to 1996. The research team was lead by Mike Rufo of Xenergy's Oakland, California office and Mitch Rosenberg of Xenergy's Burlington, Massachusetts office. The report is organized into nine chapters with a detailed executive summary and extensive appendices.

The commercial lighting programs offered by PG&E and SDG&E between 1992 and 1996 included rebates and a variety of delivery strategies. These strategies varied by year and by utility and included prescriptive, customized and specialty targeted programs for different sectors and sub-market sectors. Both utilities also offered programs for existing and new construction.

The market effects research was extensive and attempted to answer four research questions using a variety of methods. These are described briefly below:

1. **Market changes.** *To what extent did indicators of the adoption of efficient fluorescent technology change during the study period?* Used key indicators for each actor population such as market share, levels of awareness, adoption of corporate policies, price changes, promotional practices, stocking and promotion procedures.
2. **Attribution to utility programs: efficient product adoption.** *To what extent did the sponsors' program assist commercial customers in overcoming barriers to the adoption of efficient fluorescent lighting technologies?* Used cross-section comparisons of measure adoption and market share.
3. **Attribution to utility programs: reduction of market barriers.** *In what specific ways did the sponsors' programs help customers overcome market barriers that may have inhibited or reduced their use of efficient fluorescent lighting technology? Similarly, to what extent did the program induce manufacturers and other supply-side actors to overcome barriers to expanded production, distribution, promotion, and specification of efficient fluorescent components?* Developed hypotheses of market effects; gathered survey, interview and secondary data; analyzed attrition through cross-sectional comparison, self-reports, and reconstruction of historical sequence of events.



1. **Assessment of durability of market changes.** *How likely is it that market effects that occurred during the study period will persist after the reduction or elimination of sponsor programs to promote efficient commercial fluorescent lighting? Compared findings on practices to assumptions of requirements for durability.*

## SUMMARY TABLES

**Table V2-11: Summary of Study Features**

<b>Title:</b>	PG&E and SDG&E Commercial Lighting Market Effects Study
<b>Project Number:</b>	3303 / 3903
<b>Sponsoring Utility:</b>	PG&E/SDG&E
<b>Contractor:</b>	Xenergy
<b>Sector:</b>	Commercial/Industrial
<b>End-Use Elements Examined:</b>	Lighting
<b>Program Year(s):</b>	1992–1996
<b>Program Intervention(s):</b>	Incentives

**Table V2-12: Key Study Results**

**BARRIERS ADDRESSED**

<b>BARRIERS</b>	<b>ACTORS AFFECTED</b>	<b>BARRIER DESCRIPTION</b>	<b>PROGRAM SUCCESS IN REDUCING MARKET BARRIERS</b>
<b>Information Or Search Costs</b>	Customers	Lack of awareness of efficient fluorescent lighting components.	Strong evidence for change. Strong utility program attribution.
<b>Information Or Search Costs</b>	Customers	Lack of knowledge of the full range of benefits of efficient fluorescent components.	Strong evidence for change. Strong utility program attribution.
<b>Performance Uncertainties</b>	Customers	Customer concerns regarding the reliability and performance of efficient fluorescent lighting components.	
<b>Hassle Or Transaction Costs</b>	Customers	Lack of staff or procedures to analyze the costs and benefits of efficient equipment.	
<b>High First Cost*</b>	Customers	Perceptions of high first cost.	Strong evidence for change. Moderate utility program attribution.
<b>Hidden Costs</b>	Customers	Some T-8s require a different socket.	Strong evidence for change. Moderate utility program attribution.
<b>Bounded Rationality</b>	Customers	End-users' "fear of technology."	

*\*Not in Scoping Study*

**Table V2-13: Study Results**

**MARKET EFFECTS MEASURED**

DESCRIPTION OF EFFECT	KEY RESULTS	HOW MEASURED
Increase in awareness and knowledge of the product.	Lack of awareness of efficient technologies mentioned most often as a barrier to adoption early in program period.	
Increased awareness of full range of program benefits.	High percentages of program participants are aware of a broad range of product advantages, including: longer useful life, reduced lumen degradation, reduced maintenance costs.	
Reduced perception of costs associated with switching from standard to efficient lighting.	Over half of program participants mention reluctance to take on expense associated with use of two kinds of fluorescent technologies during transition.	
Increase in use of internal energy managers.	Survey finds significantly higher percentage of establishments with energy managers in program area than in nonprogram area. Strong association between having an energy manager and penetration of efficient components.	
Increase in adoption of policies to purchase only efficient fluorescent components.	Survey finds significantly higher percentage of establishments with purchase policies in program area than in nonprogram area. Strong association between having such a policy and penetration of efficient components.	
Programs lead designers and installers to use specification of efficient lighting equipment as a competitive strategy.	Great deal of self-reported change in specification practices during the study period.	
Changes in distributor stocking.	Great deal of self-reported change in stocking practices during the study period. Also, large cross-sectional difference in stocking patterns between program area and nonprogram area distributors.	
Changes in government codes and standards.	High likelihood of revision to Title 24 that will virtually require T-8 lamps and electronic ballasts.	

**Table V2-14: Key Study Results**

**EXISTING DATA USED**

DESCRIPTION	COLLECTION PERIOD
ADM Associates: DSM Technology Saturation Study	1992
ADM Associates: Non-Residential New Construction Impact Evaluation Study, PG&E	1993
Barakat & Chamberlin: Residential Statewide Lighting Study	1994
BPA: Service Life of Energy Conservation Measures	1997
Hagler Bailly: Impact Evaluation of 1994 Commercial and Industrial Energy Management Services (EMS) Program, PG&E	1996
QEI, Inc.: 1990 Commercial End-use Study	1990-1991
Quantum: Evaluation of Pacific Gas & Electric Company's 1995 Nonresidential Energy Efficiency Incentives Program for Commercial Sector Lighting Technologies	1997
Quantum: 1994 Commercial Retrofit Program Evaluation of Lighting Technologies	1996
RER: 1995 Nonresidential New Construction Program (for SDG&E)	1997
RLW: Impact Evaluation of Pacific Gas & Electric Company and Southern California Edison 1994 Nonresidential New Construction Programs	1997
SBW: PG&E 1992 and 1993 Non-Residential New Construction Programs: Statistical Analysis of Gross Impacts Study	1995
SDG&E: 1995 Commercial Energy Efficiency Incentives Program -- First Year Load Impact Evaluation	1997
SDG&E: Nonresidential Energy Management Services: Large Commercial/Industrial Audit Program -- Analysis of Gross Energy Impacts	1994
SDG&E: Nonresidential Energy Management Services: Small & Medium Commercial/Industrial Audit Program -- Analysis of Gross Energy Impacts	1994
SDG&E: 1992 Commercial Energy Use Study Final Report	1993
U.S. Census Bureau: Electric Lamps, Current Industrial Report MQ36B	
<i>Continued</i>	

DESCRIPTION	COLLECTION PERIOD
U.S. Census Bureau: Fluorescent Lamp Ballasts, Current Industrial Report MQ36C	
U.S. Census Bureau: Electric Lighting Fixtures, Current Industrial Report MA36L	
XENERGY: 1996 Measure Cost Study	1996
XENERGY: Statewide Impact Evaluation of 1994 residential Compact Fluorescent Lighting (CFL) Programs	1996
XENERGY: Nonresidential Retrofit Measure Retention Study, PG&E	1995
XENERGY: 1994 Measure Cost Study	1994
XENERGY: 1992 Commercial End-use Study (for SDG&E)	1993
XENERGY: Evaluation of the CIA Retrofit Rebate Program, PG&E	1993
XENERGY: 1992 Measure Cost Study	1992

**Table V2-15: Key Study Results**

**NEW DATA COLLECTED**

DESCRIPTION	COLLECTION METHOD*	COLLECTION PERIOD
18 program distributors	In-depth phone interviews	1997
60 program and 30 nonprogram distributors	Phone interviews	1997
57 program and 25 nonprogram designers	In-depth phone interviews	1997
30 program and 8 nonprogram installers	In-depth phone interviews	1997
20 national/state manufacturers	In-depth phone interviews	1997
25 government and others	In-depth phone interviews	1997
579 program and 287 nonprogram end-users	In-depth phone interviews	1997
10 real estate investment management firms	In-depth phone interviews	1997

\* 10% of in-depth interviews were conducted in person.

## COMPARISON WITH SCOPING STUDY FRAMEWORK

### Market Effects

The authors of the Commercial Lighting Market Effects study adhered closely to the Scoping Study. They distinguished clearly between market changes that occurred as a result of overall market factors and market effects that were attributable to the utility programs being studied. The study relied on interviews with supply- and demand-side market actors in both program and nonprogram areas. The nonprogram areas included states with limited utility program activity during the 1992-1996 period: Arkansas, Kansas, Louisiana, Mississippi, Missouri, New Mexico, North Carolina, Oklahoma, Pennsylvania, South Carolina and Texas.

This cross-sectional approach provided a strong basis for accurate comparisons between the market conditions in the program and nonprogram areas during a specific time period. The weakness in the approach was that it lacked data about preprogram conditions that would provide longitudinal and cross-sectional comparisons. However, in the case of this study, the changes occurring from 1991 to 1996 were sufficiently distinct to permit conclusions to be drawn with confidence.

### Market Barriers

The authors developed hypotheses about market barriers that they believed would provide evidence of market effects. Tables E-4 and E-5 in the study provide hypothesized effects of demand-side and supply-side market barriers. The tables included the evidence necessary to conclude that a change had occurred, that the change could be attributed to the program, and that researchers could estimate the importance of the change in assessing durability.

Conversations with the authors indicated that these hypotheses were critical to the study. The hypotheses were developed from the authors' experience. They framed the research design data analysis. Though the Scoping Study itself was not used to develop the hypotheses, there is a strong correlation between the hypotheses and the list of possible market barriers provided in the Scoping Study.

Unlike other studies in this review, where the hypothesized market barriers did not always seem reasonable or sufficient, in this case the process appeared sufficient.

### Sustainability and Lastingness

The authors used the term “durability” instead of sustainability or lastingness. Since some people have expressed dissatisfaction with the latter two terms, durability may be a good compromise.

The authors created a set of hypothetical conditions that would prove if the market effects were durable. These conditions were relatively independent; proof that one had been met did not guarantee that the other conditions would be.

Even with this rigorous approach, however, the authors' conclusions are imprecise; they identified segments where durable change would be likely, and segments where it would be less likely. This imprecision may be unsatisfactory to some policy makers.

### **Comparison to Other Market Transformation Frameworks**

We feel there is one weakness in this analysis: the lack of explanation about why these utility programs were successful at changing the market, since that was the study's conclusion. The Scoping Study methodology, we suspect, was partially to blame for this weakness. The process of analyzing market effects from a barriers-reduction point of view requires cataloging what happened, when it happened and what caused it. For instance, if it is concluded that the utility caused the effect, there is no need to determine what actions reduced the barrier.

The authors concluded that the rebates themselves caused these changes. This may be true, but we would like to see a more detailed analysis of how program delivery features actually influenced customers. To conclude that rebates were the cause seems to contradict what we know of the implementation process. Changes in program delivery were developed over several years to simplify program participation. The study did not resolve whether or not the market effects would have occurred without an efficient delivery process.

The Scoping Study suggested that market characterizations include product supply chain and various influence diagrams. Another component of this should be information flow diagrams, such as those that emerge when considering a diffusion of innovation model of market change. The inclusion of this component could have provided the data needed to understand the role of the delivery mechanism in the lighting market.

### **Recommendations for Modifications to Scoping Study**

We believe that the term “durability” is quite satisfactory as a replacement for “sustainability and lastingness.” The Scoping Study might have found more converts to the idea of lasting market transformation had the authors used the term “durability.”

No specific modifications emerged from the market effects study. However, a potential weakness of the Scoping Study approach became apparent only because the study executed the Scoping Study model so effectively, yet was unable to explain clearly how it had done so. We believe this points to the value of considering a diffusion of innovation framework.

## **STRENGTHS AND WEAKNESSES OF METHODOLOGIES**

### **Strengths and Weaknesses of Evaluation Design**

The methodology used for the Commercial Lighting Market Effects study was multifaceted. It involved:

- Surveys of end-users across multiple building industry segments, as well as manufacturers, contractors, distributors, designers and government representatives
- Analysis of program data from before 1992 to 1996
- Access to secondary data for the entire country.

This multifaceted approach enabled the authors to draw conclusions based on a preponderance of evidence rather than statistical inference, which would have been unobtainable.

The inherent weakness of the design was its retrospective nature, since there were no preprogram measurements and no systematic process for tracking data over time. Yet, using the wealth of data the authors were able to obtain – primarily because they had a sufficient budget – an essentially longitudinal cross-sectional study was pieced together to analyze marketshare and supply-side effects. We therefore find little to fault with the methodology, other than the relative difficulty of replicating it across a variety of technologies.

### **Comparison to Economic Framework**

The analysis fit squarely within the economic framework of the Scoping Study.

## **STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES**

### **Assessment of Data Completeness**

The surveys were comprehensive. In the Final Research Plan the authors noted that surveys must strike a balance between collecting data on “why” and “what” when determining what is practical in the interview.<sup>3</sup> The authors strove to gather sufficient information to quantify the “whats” (market penetration, market segmentation and changes in penetration and incidence of

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<sup>3</sup> *Final Research Plan: Commercial Lighting Market Effects Study*, August 14, 1997.



barriers) and to understand the “whys” (business motivation and barriers to using and selling equipment and interactions with the utility programs.

As we noted before, we feel that the study did not articulate fully the “whys” of how data collection has changed decision-making processes. However, we suspect this has more to do with the Scoping Study framework’s failure to fully recognize the importance of communication channels than it does with the data collection process itself.

### **Assessment of Data Collection Procedures**

The data collection procedures met very high standards. The sample sizes were adequate and the authors carefully explored and defined the population prior to sample selection. We did find it slightly annoying that the authors did not provide complete information on sample disposition. This would help inform readers of two things:

- The sufficiency of the sample itself, which the authors often stated was nonrandom because of the poor response rate. A reader would be more knowledgeable of any problems from this nonrandomness if the sample disposition were displayed.
- Readers also learn from sample disposition information about problems in data collection among certain sectors. This would inform future researchers which market actors in the commercial/industrial sector might be responsive and which might be problematic for data collection activities. This in turn would help researchers make more valid assumptions about data collection procedures prior to conducting their research.

## **SUSTAINABILITY AND LASTINGNESS**

### **Criteria Examined for Sustainability**

The authors used the term “durability” and provided three primary criteria to help customers select efficient lighting equipment. The authors hypothesized that durability would exist if one or more of the following conditions were found:

- Use of efficient lighting products is directly related to key modes of competition or management
- Adoption of stated purchase policies
- High saturation of efficient equipment.

## **Critique of the Evaluation’s Evidence and Conclusions with Regard to Sustainability**

The authors concluded that there was evidence of durable market effects in the commercial lighting market specifically for T-8s and electronic ballasts. However, they also found that durable market effects on the demand side were most likely to occur in specific segments: office and institutional, particularly in owner-occupied spaces and by larger companies. They stated that in retail and miscellaneous sectors, in smaller facilities, and in leased spaces, durability was less assured. According to them, durable effects on the supply side appeared likely unless the industry structure changes, which is always a risk.

These conclusions were drawn solely by inference. The authors appeared capable of conducting research that examines how durability might be limited or enhanced, therefore making the reliance on inference fairly convincing. They cited multiple sources for their conclusions and included a depth of responses from multiple-market actors for each question. We believe that their conclusions were substantiated and that they applied a high degree of rigor to their analysis.

## **OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION**

### **Lessons Learned from the Market Effects Evaluation about the Commercial Lighting Market**

The conclusions from the study suggest that some segments of the commercial lighting market for some technologies has been transformed by the utility programs. The evidence also suggests that these changes will be durable. However, the transformation is less durable in some segments than others. Thus, the transformation is incomplete, especially if 100% transformation is the goal.

### **Strengths and Weaknesses of Commercial Lighting Rebate Programs as Market Transformation Programs**

The evaluation design allowed the authors to draw conclusions by market segment and by type of lighting equipment. Thus, it is clear in the recommendations section that targeted opportunities can further the market transformation process. The authors also identified a specific concern: that potential consolidation in the industry should be monitored so that programs could be developed when and if that consolidation occurs.

In response to the policy question—should one invest in energy-efficient lighting for the commercial sector, or should one invest in other equipment or other sectors—the study did not provide a conclusive answer. It was outside the scope of the study to conduct a specific analysis of the cost-effectiveness of suggested actions. Nor was it within the study’s scope to compare such suggestions to other options for other sectors or equipment. However, this study’s

suggestions can be used as a basis for program screening by others who will conduct those analyses.

### **Potential for Future Use of New Market Transformation Evaluation Techniques Tested**

The evaluation techniques used in this study can be applied readily to other technologies and programs. However, it is clear that this study required a resource commitment that may be unavailable to others. Such a depth of analysis is useful but is not required to draw similarly reliable conclusions. As can be seen in some of the other studies, if the population is identified and sampling is carefully drawn from the population, appropriate questions can be developed and surveys implemented that elicit the necessary information to conduct a satisfactory analysis. Even with the significant resources available for this study, the question of how (or if) the delivery mechanisms interacted with the rebates was not answered. Nor was the study able to develop quantitative estimates of durability. The type of data that is available just doesn't support that type of analysis, even if an organization has the resources to fund it.

The study also confirmed one of the key problems with all of the market effects studies we reviewed. For the most part, the studies provide good to excellent retrospective data, but they provide limited guidance for those planning evaluations of market transformation programs. Retrospectively, one has access to data in the marketplace. Prospectively, one has the opportunity to plan for and attempt to facilitate the development of data that might not otherwise be available. Throughout the Commercial Lighting Market Effects Study there was little opportunity for the authors to identify what they might like to have had as data, as they were focused on analyzing and interpreting the data they could obtain.

## 2.4 PG&E ENERGY CENTER MARKET EFFECTS STUDY

### STUDY OBJECTIVES AND PROGRAM DESCRIPTION

The PG&E Energy Center Market Effects Study, completed in May of 1998, was conducted for Pacific Gas & Electric by TecMRKT Works. The PG&E Energy Center (PEC) provides educational programs, consulting services and building performance tools to professionals who make design and operations decisions for commercial buildings – architects, HVAC engineers, electrical engineers, lighting designers, building owners, facility managers and facility engineers. Its goal is to educate and train professionals in order to create a sustainable market for energy-efficiency and energy-efficient products by promoting a systems (whole building) approach to design that optimizes owner value, user comfort and energy efficiency.

The evaluation study sought to answer seven questions:

1. What are the key market structures and who are the key actors in the commercial building products and services markets?
2. To what extent is the PEC reaching the actors in these markets?
3. When the PEC reaches these markets, is it able to effectively communicate its message in ways that induce changes in behavior?
4. What are the most important factors that influence market actors to change their behaviors?
5. If market actors have changed their behaviors in response to the PEC, what have the effects been?
6. Are the changes in behavior and the impacts associated with the behaviors sustainable?
7. What lessons for future market transformation studies can be learned from this research?

## SUMMARY TABLES

**Table V2-16: Summary of Study Features**

<b>Title:</b>	PG&E Energy Center Market Effects Study
<b>Project Number:</b>	3304
<b>Sponsoring Utility:</b>	Pacific Gas and Electric Company
<b>Contractor:</b>	TecMRKT Works
<b>Sector:</b>	Commercial
<b>End-Use Elements Examined:</b>	Whole Building
<b>Program Year(s):</b>	1991–1997
<b>Program Intervention(s):</b>	Workshops and classes, library services, lighting classroom, lending measurement devices, one-to-one consultation services

**Table V2-17: Key Study Results**

**MARKET EFFECTS MEASURED**

DESCRIPTION OF EFFECT	KEY RESULTS	HOW MEASURED
<b>Market Penetration</b>	Approximately 30,000 people have attended one or more events at the PEC since it opened in December 1991. In terms of the three or four most important target market segments, the PEC has had at least one representative from 30% to 40% of the firms in Northern California. The PEC seems to have reached nearly 40% of building owner/managers and a large number of the employees of owner/managers.	Comparison of participant lists to D&B, professional association member lists
<b>Influence On Professionals And Social Networks</b>	<p>84% recommended that a client or colleague attend a PEC event.</p> <p>80% demonstrated or explained to a colleague a technique that was presented at the PEC</p> <p>74% used technical data from the PEC to support a decision</p> <p>70% lent or copied materials obtained at the PEC to others</p> <p>67% promoted or implemented changes to internal policies or practices in response to something presented at the PEC</p> <p>62% suggested or insisted that a partner or subcontractor incorporate ideas learned at the PEC</p>	Phone survey
<b>Changes In Building Design Behaviors</b>	<p>69% increase in discussion with clients about the interactions among different building systems</p> <p>53% increase in effort devoted to analyzing the initial and long-term costs associated with the trade-offs among building orientation, shell design, shading devices, windows and glazings, mechanical systems and lighting</p> <p>51% increase in use of daylighting</p> <p>45% increase in use of external shading devices</p> <p>41% increase in use of controls in conjunction with electric lights and daylight to reduce energy consumption and increase visual comfort</p> <p>31% increase in attention to commissioning of building systems and controls</p>	Phone survey
<i>Continued</i>		

DESCRIPTION OF EFFECT	KEY RESULTS	HOW MEASURED
<p><b>Changes In Lighting Design Behaviors</b></p>	<p>79% increase in specification and use of more efficient lamps, ballasts, reflectors</p> <p>68% increase in use of energy efficiency as a decision criterion when selecting equipment</p> <p>63% increase in use of analysis to determine the quantity of illumination, quality, and color of lighting to make space visually comfortable and attractive</p> <p>54% increase in attention to the interactions between lighting systems and other building systems</p> <p>47% increase in attempting to enhance productivity through the careful integration of daylighting, quality lighting and task lighting</p> <p>44% increase in the use of daylighting in conjunction with controls for electric lights</p> <p>33% increase in the integration of lighting controls with other building control systems</p> <p>31% increase in the use of life cycle cost or other discounted cash flow methods in decision making</p> <p>31% increase in attention to the commissioning and fine tuning of controls</p>	<p>Phone survey</p>
<p><b>Changes In HVAC Design Behaviors</b></p>	<p>49% increase in attention to the interactions between the HVAC system and other building systems and components in the design phase</p> <p>47% increase in use of variable speed drives in HVAC applications</p> <p>46% increase in attention and effort to commissioning and recommissioning</p> <p>46% increase in efforts to convince customers of the benefits of a more sophisticated and extensive analysis during design</p> <p>39% increase in use of monitored data in pre-retrofit designs</p> <p>39% increase in use of more sophisticated control strategies such as condensed water reset to optimize instantaneous performance across climate and load conditions</p> <p>32% increase in use of monitored data for post installation performance analysis</p>	<p>Phone survey</p>

**Table V2-18: Key Study Results**

**EXISTING DATA USED**

DESCRIPTION	COLLECTION PERIOD
PEC participation data (~30,000)	1991–1997
Membership lists from the Building Owners and Managers Association (BOMA) (478 members), the Illumination Engineering Society (IES) (309 members), and the American Institute of Architects (AIA) (419 firms and 1,098 architects)	
Dun and Bradstreet (D&B) data	

**Table V2-19: Key Study Results**

**NEW DATA COLLECTED**

DESCRIPTION	COLLECTION METHOD	COLLECTION PERIOD
38 in-depth interviews of key informants	In-person	July, October November 1997
216 interviews of PEC participants	Telephone	November 1997

**COMPARISON WITH SCOPING STUDY FRAMEWORK**

The PEC study discussed the Scoping Study market transformation model at some length. In doing so, it offered the following comments: “The [Scoping Study] model focuses on barriers to transformation rather than the process of transformation... The model assumes a flow of information but it does not describe the structure and functioning of information flows... The perceived characteristics of the product or innovation have much to do with whether and how rapidly an innovation is adopted and markets transformed. The [Scoping Study] market transformation model only partially speaks to this issue through the identification of barriers... [T]he market transformation literature does not yet deal with characteristics of those doing the adopting. Transformation occurs in stages and the importance of the barriers change with the stage... [T]here are well-established personal characteristics that are correlated with [each] stage of adoption.”

We agree with the above critique of the Scoping Study. However, we disagree with the PEC Study’s reference to the Scoping Study market transformation model as a “typology rather than a theory.” The Scoping Study framework is, in fact, closely linked to economic theory, particularly



transaction cost economics. Thus, while the Scoping Study does not state so explicitly, it implicitly includes a rich theoretical structure for modeling the decision-making process by which people weigh trade-offs between competing “goods” and allocate scarce resources. Taken in the context of economic theory, the Scoping Study provides a powerful set of “problem-solving” tools. That is, it gives a framework for examining a market, identifying “imperfections” in the market, determining if an intervention is warranted, designing a set of interventions to address the “imperfections,” and then measuring the success of those interventions.

We believe that the Scoping Study model would be greatly enhanced by incorporating a theory of communication from the diffusion of innovation literature. We concur with the authors of the PEC study that diffusion of innovation theory is more properly considered a complementary market view that fills significant gaps in the Scoping Study market transformation framework rather than a competing theory that replaces it.

### **Market Effects**

The study did not address explicitly the issue of market effects. Nevertheless the study discussed at considerable length the changes in the various market segments related to building design, retrofit, operation and maintenance that can be attributed to the program. Thus, these changes coincided directly with the Scoping Study’s definition of market effects. Specific market effects attributable to the program are listed in Table V2-17, above.

### **Market Barriers**

The study noted the similarity between market barriers described in the Scoping Study and factors influencing the rate of diffusion of innovation. The authors pointed out a number of these factors, including the nature of the social system, communication channels, attributes of the product or innovation, type of innovation decision and the extent of promotional efforts. Therefore, the study showed that diffusion of innovation theory lends itself to an analysis of market structure that diagnoses market strengths and weaknesses and identifies opportunities to improve market performance through program interventions. The study developed a series of recommendations for improving the Energy Center’s services but did not explicitly apply the concept of market barriers or diffusion rate-limiting factors to analyze the market attributes the Energy Center sought to change. Rather, the study implied that, in the absence of the Energy Center, professionals responsible for building design, construction, renovation, operation and maintenance generally were not aware of the benefits to be derived from an integrated, systems-level approach to their work, and that those who were aware of these benefits lacked the tools and skills to apply the approach successfully.

Future research efforts could make a potentially significant contribution by developing a direct correspondence between specific diffusion rate-limiting factors and market barriers from the Scoping Study typology or market failures from transaction cost economics.

### **Sustainability and Lastingness**

An attractive feature of the diffusion of innovation framework for estimating market effects and their sustainability is the framework's usefulness in modeling the rate of adoption as a function of time. (In this context, "adoption" should be understood broadly to include adoption of practices and behaviors as well as technologies.) The literature describes successful applications of diffusion models to project future adoption rates, based on past adoption rates. Short of a quantitative analysis to estimate a diffusion curve, diffusion of innovation theory provides critical insights into market dynamics that permit a qualitative assessment of the likelihood of sustainable effects, based on knowledge of adoption rates, information flows, decision-maker characteristics and characteristics of the product or practice.

While a quantitative analysis was out of the scope of this study, its general emphasis on diffusion of innovation opened the door for increased application of these diffusion of innovation concepts for market transformation evaluation.

In the context of adoption of technologies, a quantitative modeling technique can circumvent at least one of the objections to the use of sales data, namely, that it is a lagging indicator of program success. Put simply, prospects for sustainable effects can be analyzed from a diffusion model forecast of future adoption rates, thereby eliminating the need to wait an extended period after the program intervention to observe if adoption rates proved sustainable. Of course, the difficulty of obtaining quality sales data remains an issue, regardless of how the data are analyzed.

### **Comparison to Other Market Transformation Frameworks**

By adopting the diffusion of innovation model as the framework for the study design, the authors provided a useful case study of how this model would work as a practical framework for market transformation. The diffusion of innovation framework also proved a useful perspective from which to review and critique the Scoping Study framework. The critique emerging from this study should provide a basis from which to integrate the Scoping Study and diffusion of innovation frameworks and hence to develop a market transformation framework that maximizes the strengths of both perspectives.

## Recommendations for Modifications to Scoping Study

While the study did not explicitly advocate modifications to the Scoping Study, the following recommendations for modifications can be inferred by recasting critiques that it offered:

- A market transformation framework should incorporate descriptions of the market structure into the market transformation model.
- A market transformation framework should further account for the role of information flows in the diffusion of innovation.
- A market transformation framework should incorporate the notion of product barriers<sup>4</sup> as well as market barriers and should explain relationships between those barriers rather than simply list typologies.
- A market transformation framework should deal with characteristics of those doing the adopting. In particular, it should account for the different roles of key personal characteristics that influence the adoption process.

## STRENGTHS AND WEAKNESSES OF METHODOLOGIES

### Strengths and Weaknesses of Evaluation Design

This evaluation framework was derived from diffusion of innovation theory. The theory describes the process by which market actors adopt an innovation as a progression, from awareness to persuasion, decision, implementation and confirmation. With these general considerations in mind, the evaluation was structured around a framework with four analysis components:

- Market structure
- Awareness
- Market penetration
- Market impacts.

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<sup>4</sup> Product barriers are defined by the diffusion of innovation literature as product features that do not offer a relative advantage over alternate products or services.

Since diffusion of innovation theory explicitly addresses information flow mechanisms and the importance of those mechanisms in diffusing innovations (or transforming markets), it is well suited to evaluations of an information program, such as the PEC.

The report discussed at some length the importance of including a combination of time-series and cross-sectional measurements in a sound evaluation design. The authors then explained the limitations that prevented them from collecting or examining time-series data and that forced them to rely on cross-sectional analysis. However, work scope and budget limitations reduced the cross-sectional component to an analysis of nonparticipant information from Dun & Bradstreet and various professional organization membership lists. These information sources were used effectively but future evaluations of these types of programs would do well to expand primary data collection efforts to include a complete cross-section of nonparticipants as well as participants. Nonparticipant interviews offer the following analysis possibilities:

- Probing for further insights into the extent of diffusion through interpersonal communication channels
- Comparing decision-making profiles for participants and nonparticipants (from the principal components analysis)
- Refining estimates of the size of the target population.

The evaluation used principal components analysis to identify four clusters of decision criteria, labeled “globally attentive,” “client-oriented creatures of habit,” “systems-oriented investors,” and “first cost is primo.” The evaluators attempted to extend the analysis by relating the principal components to the diffusion model typologies – innovators, early adopters, early majority, late majority and laggards – and then exploring the relative importance of the four decision components among the sample of participants analyzed. Data constraints limited the statistical robustness of those results, so they were not reported.

Future evaluations should allocate sufficient resources to data collection to support detailed analysis of decision criteria by model typologies and demographic subsets. Such an analysis, combined with a parallel analysis of program nonparticipants, could shed additional light on the types of people and businesses that use the program products and services and the steps the program might need to take to expand its influence.

### **Comparison to Economic Framework**

By emphasizing the importance of communication channels, diffusion of innovation theory recognizes the fundamental sociability of human beings. This perspective contrasts sharply with the classical economic model, which envisions humans as isolated, purely rational, fully informed, self-interested decision-makers. Nevertheless, diffusion of innovation literature encompasses

economic concepts in the diffusion model via the factors influencing the rate of diffusion, such as the nature of the social system, communication channels, attributes of the product or innovation, type of innovation decision, and the extent of promotional efforts. For example, a key attribute of products and services that drive diffusion is relative advantage, which includes economic components such as degree of economic profitability, initial cost, savings in time and effort, and immediacy of reward, as well as a number of non-economic components.

Based on these observations, we feel that this study offered a valuable critique of the economic framework, since it documented the need to integrate the complementary concepts of diffusion of innovations research into market transformation research and the Scoping Study in order to provide a more comprehensive picture of market dynamics. However, it should be stressed that the study's intent was not to propose an alternative or competing framework. It should also be stressed that this study, while pointing to the potential value of a more integrated framework, does not actually provide that integration.

## **STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES**

### **Assessment of Data Completeness**

The evaluation relied on:

- In-depth one-on-one interviews with 38 key informants
- Participation data from the PEC tracking system
- Membership lists from key professional organizations, in particular, the Building Owners and Managers Association (BOMA), the Illumination Engineering Society (IES), and the American Institute of Architects (AIA)
- Dun & Bradstreet (D&B) data for firms from the PEC participant database that matched the D&B list
- Telephone survey data from 216 people who had attended at least one PEC-sponsored event after January 1995.

As noted above, data collection could have been more complete had the study's authors gathered telephone survey data from nonparticipants among the targeted professional groups.

## **Assessment of Data Collection Procedures**

The report documented well the data collection methods, sampling methods and data processing steps. Since a significant portion of the analysis required cross-referencing information from multiple data sources, the authors faced the challenge of reconciling numerous coding inconsistencies. Based on the report documentation, it would appear that the evaluators addressed the issue to the extent possible and adequately considered threats to the validity of the results posed by data inconsistencies.

## **SUSTAINABILITY AND LASTINGNESS**

### **Criteria Examined for Sustainability**

The assessment of sustainability is a challenge for a program such as the PEC because the analysis must focus on sustained changes in attitudes and behaviors. Lacking the data to conduct a time-series analysis, the evaluation team resorted to collecting self-reports of likely sustainability. The study authors prudently assumed that changes in the practices of work groups and companies would be more sustainable than changes by individuals.

Drawing from diffusion of innovation theory, the report pointed out two basic channels of communication that affect the sustainability of the diffusion process: broadcast and interpersonal. It stressed that “transformation of the market [i.e., sustainability] does not kick in until the interpersonal channels really begin to work.” In this context, the evaluation only partially supported the conclusion that the PEC had market-transforming effects.

The evidence for market transformation was based primarily on analysis of direct program effects exhibited by participants, i.e., the broadcast component. The evaluation team sought to identify evidence of program effects via interpersonal communication. To do so, they studied the roles of program participants in opinion-making institutions such as professional associations. In fact, the team did find evidence of program effects via interpersonal communication, but available data collection resources did not support conclusions that the level of information flow through interpersonal channels was sufficient to be self-sustaining and therefore continue the diffusion process. Developing innovative techniques to provide evidence of such self-sustaining dynamics is likely to present a significant methodological challenge to evaluators of market transformation programs.

### **Critique of the Evaluation’s Evidence and Conclusions with Regard to Sustainability**

We believe that the approach used to assess sustainability is as reliable as any, given the nature of the program, the availability of data from just one time period, and the evaluation resources available. However, the study’s assessment of the likely sustainability of effects among program

participants did not consider market dynamics that could potentially mute or reverse the diffusion process, such as attrition from the professional ranks. (If the rate of attrition among the innovators and early adopters who participated in the PEC program exceeds the rate of diffusion from interpersonal communication, then, in the absence of continued PEC activities, one might expect the effects of the program to diminish.)

## **OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION**

### **Strengths and Weaknesses of PEC as a Market Transformation Program**

The study made a number of key findings that indicated that the PEC has been successful in its mission. In particular,

- The PEC is reaching its target audiences. The study estimated that “the PEC has reached more than 40% of its key targets in Northern California and substantially higher percentages in areas of close proximity to the PEC.”
- The PEC’s program offerings are very strong. This was indicated by the high percentages of those who used PEC products and services multiple times.
- The PEC’s program efforts are evolving in directions that appear to be consistent with the direction of the market.
- The PEC is influencing the behaviors of target market professionals.
- The PEC is influencing the design and construction of buildings in ways that are likely to continue.

For those who might wish to replicate the PEC program elsewhere, the study provided a useful characterization of the general market, including an analysis of energy-efficiency-related decision processes for both new construction and existing building maintenance and management. It identified emerging technology trends and trends within the building industry that could significantly affect the program needs of the PEC’s target population. Finally, it provided a thorough analysis of the program elements that contributed to the PEC’s success. Examples of findings related to specific program elements include the following:

- “Respondents said they use the technical data and technical explanations presented during the workshops quite a bit or a lot.”
- “PEC participants also make substantial use of knowledge gained from physical demonstrations and hands-on methods.”

- “Nearly all heliodon users indicated that they had made changes to architectural elements in their designs as a result of the heliodon session.”
- Expertise, knowledge of specific technical information, and accessibility were key reasons why users sought consultations with PEC staff.

For those responsible for PEC programming in the future, the study suggested improvements to achieve the program objectives. Examples of findings related to potential program improvements included the following:

- Building engineers are a target market that may deserve more attention.
- The design/build community needs more attention.
- For the client-oriented decision-maker, the PEC needs to make sure that the message gets to the decision-maker’s client.
- More off-site programming would help the center reach more of its target audience.

### **Potential for Future Use of New Market Transformation Evaluation Techniques Tested**

While the actual data collection and analysis techniques applied in this study are used commonly in evaluation circles, the study provided some key insights into the market transformation process. These should help evaluators frame research questions. In particular, it introduced a body of theory and research that has long been overlooked by evaluators of utility energy-efficiency programs. The study emphasized the importance of understanding the role of communication in market transformation processes and provided evidence that the diffusion of innovation model can be used to measure market effects and assess whether a market is transforming. Finally, it provided an instructive critique of the Scoping Study framework of market transformation.





*Megdal & Associates*

## 2.5 STUDY OF MARKET EFFECTS ON THE SUPERMARKET INDUSTRY

### STUDY OBJECTIVES AND PROGRAM DESCRIPTION

The Study of Market Effects on the Supermarket Industry, completed in July 1998, was conducted for Pacific Gas & Electric by Quantum Consulting Inc. with assistance from Shel Feldman Management Consulting and KVDR Inc. The study focused on:

- Determining the extent, if any, to which the actions of customers in the supermarket industry in PG&E's service territory indicated market effects
- Determining the extent to which the current state of the supermarket industry in PG&E's territory reflected the effects of past market interventions by PG&E
- Using the results of this analysis to make recommendations regarding future program design to facilitate future evaluations of market interventions.

Based on focus group results, the study chose to confine its analysis to supermarkets. The Food Marketing Institute (industry trade association) defines a "supermarket" as a grocery store with more than \$2 million in annual sales. This study focused on supermarkets because they are most likely to have centralized refrigeration systems rather than the stand-alone cases common in smaller grocery stores and convenience stores. Because refrigeration and lighting represent the largest portion of supermarket energy usage, those two end-uses were the primary focus of the study.

PG&E has fielded a number of programs that have served the supermarket industry, including incentives programs (Energy Efficiency Incentives) and information programs (e.g., Energy Management Systems, Safeway Test Store, and Food Technology Center).

## SUMMARY TABLES

**Table V2-20: Summary of Study Features**

<b>Title:</b>	Study of Market Effects on the Supermarket Industry
<b>Project Number:</b>	3305
<b>Sponsoring Utility:</b>	Pacific Gas and Electric
<b>Contractor:</b>	Quantum Consulting Inc.
<b>Sector:</b>	Supermarkets
<b>End-Use Elements Examined:</b>	Refrigeration, Lighting
<b>Program Year(s):</b>	1991-1997
<b>Program Intervention(s):</b>	Rebates, Audits, Information, Demonstrations

**Table V2-21: Key Study Results**

**BARRIERS ADDRESSED**

<b>BARRIERS</b>	<b>ACTORS AFFECTED</b>	<b>BARRIER DESCRIPTION</b>	<b>PROGRAM SUCCESS IN REDUCING MARKET BARRIER</b>
<b>Bounded Rationality</b>	Supermarkets	Overwhelming emphasis placed on increasing sales, to the exclusion of energy efficiency and most other operational concerns.	Low
<b>Performance Uncertainties</b>	Supermarkets	Ban on CFCs, greater concern about refrigerant leaks, tightening of regulations affecting food safety, concerns about preserving freshness of prepared foods.	Low
<b>Performance Uncertainties</b>	Supermarkets	Concern that store systems have become so sophisticated that the cost of managing them outweighs potential energy benefits.	Low
<b>Organization Practices</b>	Supermarkets	Emphasis placed on getting new store built rather than optimizing its design to ensure maximum energy efficiency.	Low
<i>Continued</i>			
<b>Hidden Cost</b>	Supermarkets	Concerns that refrigerant might reach flash point; operation outside of compressor manufacturer specification.	High

<b>BARRIERS</b>	<b>ACTORS AFFECTED</b>	<b>BARRIER DESCRIPTION</b>	<b>PROGRAM SUCCESS IN REDUCING MARKET BARRIER</b>
<b>Performance Uncertainty</b>	Supermarkets	Uncertainty about technique's ability to deliver promised savings.	High
<b>Organization Practices</b>	Supermarkets	Desire to maintain standard equipment across all stores in chain.	Low
<b>Performance Uncertainty</b>	Supermarkets	High-efficiency compressors not designed for supermarket refrigeration systems.	Medium
<b>Unavailability</b>	Supermarkets	Compressors not available in all sizes needed for multiplexed rack system.	Medium
<b>Unavailability</b>	Supermarkets	PSC motors not stocked by refrigeration contractors.	High
<b>Hidden Cost</b>	Supermarkets	Concern that inadequate control of condensation would hamper sales.	High
<b>Asymmetric Information And Opportunism</b>	Supermarkets	Bad experiences with some EMS vendors; unreliable systems did not deliver promised savings.	Medium
<b>Hidden Cost/ Performance Uncertainty</b>	Supermarkets	Limiting customer access to food could reduce sales.	Medium
<b>Performance Uncertainty/ Access To Financing</b>	Supermarkets	Not worth the cost of spending money to retrofit existing lighting.	High
<b>Bounded Rationality</b>	Supermarkets	Concerns about efficiency display lighting's effect on sales.	Medium
<b>Split Incentives</b>	Supermarkets	For manufacturers to include electronic ballasts in cases would raise costs, reduce market share.	Medium

**Table V2-22: Key Study Results**

**MARKET EFFECTS MEASURED**

DESCRIPTION OF EFFECT	KEY RESULTS	HOW MEASURED
<b>Increased Penetration Of Energy-Efficient Technologies</b>	High penetration rates for energy-efficient store lighting, including energy management systems, T-8 lamps and electronic ballasts, and HID bulbs. Also electronic ballasts for case lighting, high efficiency compressors, cycling of anti-sweat heaters, high-efficiency motors for evaporator fans, and store humidity controls.	Comparison with Commonwealth Edison customers

**Table V2-23: Key Study Results**

**EXISTING DATA USED**

DESCRIPTION	COLLECTION PERIOD
Program data	Not stated
Billing data	Not stated
Web site	Not stated
Marketing materials	Not stated
Impact evaluations	Not stated
Other Studies/Surveys	Not stated
Market data (census bureau, trade publications, Food Marketing Institute)	Not stated
Equipment Data (EPRI, ORNL, equipment catalogs, ARI)	Not stated

**Table V2-24: Key Study Results**  
**NEW DATA COLLECTED**

DESCRIPTION	COLLECTION METHOD	COLLECTION PERIOD
4 Staff interviews with PG&E program staff	Interviews	February 1998
Three focus groups were conducted: two within PG&E's service territory (one with large customers, one with small groceries and convenience stores) and one in the comparison territory served by Commonwealth Edison.	Focus groups	Not stated
A dozen vendors who supply equipment to the supermarket industry were interviewed informally at the Food Marketing Institute show in Chicago May 3-5.	Interviews	Not stated
An interview with EPRI's supermarket specialist	Interviews	Not stated
5 PG&E and 5 comparison area architects, designers, and technical specification managers	Interviews	Not stated
15 PG&E and 15 vendors and manufacturers	Interviews	Not stated
15 PG&E and 10 comparison area supermarket decision-makers	Interviews	Not stated

**COMPARISON WITH SCOPING STUDY FRAMEWORK**

The analysis framework drew from the Scoping Study. The authors interpreted that the Scoping Study comprises three basic components: program interventions (i.e., programs), customer actions (i.e., specific energy-efficiency measures installed), and barriers (i.e., impediments to those energy-efficiency measures).

**Market Effects**

It appears to us that the authors equated market effects with customer actions. In our opinion, this interpretation is significantly narrower than the Scoping Study's intent. This more restricted vision of market effects can produce two negative consequences: it encourages a focus on end-users to the exclusion of other market actors and it encourages over-dependence on sales data as the primary measure of program success.

## **Market Barriers**

The study addressed various barriers at some length. In doing so, the authors applied the basic concept in a manner that is generally consistent with the Scoping Study, although the relationship between identified barriers and the Scoping Study's barrier categories was not always immediately evident. More important, the study occasionally left out important information needed to demonstrate the existence of a barrier. For example, the study cited as a case of bounded rationality the fact that energy-efficiency investments were given a lower priority than investments that spurred sales. As evidence of this barrier, the study pointed out that an energy-efficiency investment that reduces costs by \$10,000 contributes as much to total profits as an investment that generates \$1 million in sales. But the study did not estimate the level of investment needed to save \$10,000 on energy bills, nor the level needed to generate \$1 million in sales. The study also did not explore the value supermarkets derived from expanded market share, even when it came at the expense of return on investment. Without this type of information, one cannot be sure whether a bounded rationality barrier actually existed or whether supermarket managers were, in fact, acting consistently with their economic self-interest.

## **Sustainability and Lastingness**

The issue of sustainability was given only cursory treatment in this study.

## **Comparison to Other Market Transformation Frameworks**

The study did not posit a framework that differs in any significant way from the Scoping Study framework.

## **Recommendations for Modifications to Scoping Study**

No recommendations for modifying the Scoping Study were made.

## **STRENGTHS AND WEAKNESSES OF METHODOLOGIES**

### **Strengths and Weaknesses of Evaluation Design**

The core of the evaluation design consisted of a cross-sectional comparison of results from the PG&E service territory to analogous results from a selected comparison service territory, Commonwealth Edison. The study followed a two-track approach: (1) it compared installations in existing and new supermarkets in the PG&E service territory to those in a comparison territory (Chicago area); (2) it examined program exposure, attitudes, and barriers for customers (supermarkets), manufacturers, contractors, and engineering/design firms. The study then

combined the results from (1) and (2) to assess the extent of market effects and attribution to PG&E's programs.

Though the study did not explicitly discuss the limitations of not having a pre-program baseline for assessing market effects, the limitation was evident in the evaluation design. Without the baseline, the study was forced to rely almost exclusively on cross-sectional comparisons, supplemented with market actors' recall, to evaluate changes in the supermarket industry over time. Perhaps because of this limitation, the results of this study were primarily qualitative and the conclusions were somewhat tentative.

### **Comparison to Economic Framework**

The study did not rely on an economic framework for its design.

## **STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES**

### **Assessment of Data Completeness**

The data collection process reflected a three-tiered design: the first tier consisted of a thorough literature review; the second focus groups and unstructured interviews; and the third, structured surveys. With this design, the data collection began with a limited number of informants and broad-based lines of inquiry and progressed toward large numbers of informants and focused lines of inquiry. This strategy helped avoid study "blind spots" from overlooked questions, excluded market actors and small sample sizes.

According to the study, preliminary data collection and analysis activities included the following:

- A review of PG&E data sources and existing literature
- Four interviews with PG&E program staff
- Two focus groups within PG&E's service territory and one in the Commonwealth Edison service territory
- A series of open-ended interviews with vendors at the Food Marketing Institute show in Chicago
- An interview with EPRI's supermarket specialist
- Interviews with 25 supermarket decision-makers (15 from PG&E's service territory, 10 from Commonwealth Edison's service territory)



- 10 interviews with architects, designers & technical specification managers (five from each utility service territory)
- 30 interviews with vendors and manufacturers (15 from each utility service territory).

Sources for developing the data collection samples appear reasonably complete. Supermarkets within the PG&E service territory were identified from the utility databases. Dun & Bradstreet data were used to select supermarkets in the comparison service territory. Leads for vendors and designers were obtained from a number of sources, including Dun & Bradstreet, Food Marketing Institute show participants, supermarket decision-makers, an American Institute of Architects database and PG&E program staff. Because of the concentrated nature of the market, sampling focused on the major players in each category rather than on statistically representative samples.

Basic market statistics, such as total number of supermarkets, annual sales, and relative ranking of top chains (based on sales), were reported only at the national level. However, numbers and types of other market actors were provided on a study area basis, as were percentages of stores with various types of equipment. The study did not link the two areas.

### **Assessment of Data Collection Procedures**

The study employed a range of methods to gather information, including literature review; in-person interviews with utility program staff and Food Marketing Institute show participants; focus groups with decision-makers from supermarkets, convenience stores and small groceries; and phone interviews with vendors, designers and supermarket decision-makers.

It appears that the data collection design was well focused on the key issues of the industry, as they pertained to the study objectives. Our confidence in the data collection design is further enhanced by the study's reliance on a thorough literature review, followed by multiple focus groups, as the basis of the design effort. The data collection effort seems to be relatively thorough, judging from the fact that contacts with important vendors were made at multiple levels, including corporate, marketing, R&D and field marketing and service.

The selection of the area served by Commonwealth Edison as a comparison area probably was a good choice. The study made a good case for the similarities between the supermarket industries in California and the Midwest, while noting differences in the relative proportions of large and small chains. However, the documentation of other criteria supporting the choice was somewhat thin, showing only a close match on cooling degree days and "green" attitude as measured by Congressional voting records. Use of Congressional voting records may be of limited value as a social indicator, based on research by the Center for Voting and Democracy, which has produced significant documentation indicating that the current electoral system does a poor job of producing legislative bodies that reflect the political makeup of the electorate. While the close

match on cooling degree days was encouraging, it would have been useful if the study's authors had compared other measures of weather as well, such as wet bulb maximums. Differences in summer humidity might explain the study finding that store dehumidification to reduce case load was more common in Illinois than in California.

## **SUSTAINABILITY AND LASTINGNESS**

### **Criteria Examined for Sustainability**

The study offered some conclusions related to sustainability but provided little or no explanation of the rationale for coming to those conclusions. The clearest statement of sustainability-related conclusions appeared in Exhibit 4-7, which listed “evidence of sustainability” for various program effects. A review of the various types of evidence presented suggested that some were arguments in support of sustainability, while others were arguments against sustainability. Thus no clear pattern emerged suggesting a systematic set of criteria assessing sustainability. Furthermore, some of the evidence raised the question of whether observed effects, particularly evidence citing changes in government standards, should properly be attributed to utility programs.

### **Critique of the Evaluation's Evidence and Conclusions with Regard to Sustainability**

The study expressed the opinion that customer attitudes, uses of information and perceptions of market barriers indicated likely sustainability of market effects. This conclusion seems to contradict the later finding that program effects other than increases in general awareness appeared to be linked to program rebates and that the program might have fostered an over-dependence on rebates as a precondition for undertaking energy-efficiency actions.

## **OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION**

### **Strengths and Weaknesses of Utility Programs as Market Transformation Programs**

While the study examined the potential cumulative effects of PG&E's DSM programs on the supermarket industry, it did not attempt to isolate the effects of individual programs. The decision to focus evaluation resources on a specific market segment rather than a particular program was an important element of the evaluation design.

Overall, there is evidence that the programs have achieved some market effects but the evidence suggests that the programs had significant limitations as market transformation initiatives. The study found that “...utility programs [have] helped create awareness of energy efficiency and a constituency for improving facilities and operations with respect to energy consumption.

However,...supermarkets [have] not been converted by the programs into a segment that is committed to investing in these activities on its own.”

While the programs appeared to have increased awareness of energy efficiency, they might have conditioned supermarket decision-makers to expect rebates as a precondition for undertaking energy-efficiency actions. A further negative consequence might have been the emphasis on individual measures rather than systems optimization. One design engineer complained that “...prescriptive HVAC rebates have had deleterious effects on overall store efficiency in the past; when stores installed high-efficiency packaged AC systems to obtain a rebate, they increased the humidity in their store..., thereby placing a substantial extra load on the case cooling system and leading to a net increase in energy usage.”

### **Potential for Future Use of New Market Transformation Evaluation Techniques Tested**

As with other studies that attempt to measure market effects of historical DSM programs, this study was limited by the lack of a pre-program baseline and its complete reliance on a cross-sectional study design to find evidence of temporal effects. The study recommended tracking potential market effects through a panel of supermarket decision-makers and other market actors. This recommendation would mitigate the lack of baseline information. “Talking to the same players over time and obtaining their perception on specific changes that have occurred in the market and how their firms have responded to those changes would provide a consistent, albeit qualitative, look at the extent of market effects of future market interventions.” Going beyond qualitative may not be economically justified.

While the evaluation techniques employed in this study are widely known, specific findings from the evaluation should prove useful to the design of future market transformation programs targeted to supermarkets and to the evaluation of those programs. In particular, the study produced a relatively thorough characterization of the market, which included identification of a number of existing market barriers, such as the following:

- Emphasis on presentation, design, and particularly on increasing sales, to the exclusion of energy-efficiency and other operational concerns (classified as bounded rationality)
- Emphasis on getting new stores built quickly rather than optimizing design to ensure maximum energy efficiency
- Unwillingness to make non-core investments, such as energy-efficiency improvements, while a merger or acquisition is pending

- Various barriers related to transition to non-CFC refrigerants, including performance uncertainty, limited availability and fear of hidden costs
- Concerns about increased risk of food spoilage from more energy-efficient equipment (could be classified as performance uncertainties)
- Concerns about the level of expertise needed to operate, maintain and repair new systems
- Emphasis on having a “consistent, uncomplicated approach to the design and management of systems” in all the stores in a chain (could be classified as organizational practices).

The study also made a number of potentially valuable recommendations for future market interventions. For each measure or technology recommended for promotion, the study documented potential savings, the current adoption status of the recommended measure or technology, market barriers and potential market interventions and leverage points. Perhaps the single most important recommendation, applicable across all measures and technologies, was to “emphasize non-energy benefits.” This recommendation was particularly *apropos* given the apparent importance of barriers relating to concerns about the effect of energy-efficiency investments on other facets of a supermarket’s business.



*Mogdal & Associates*

## 2.6 COMMERCIAL/INDUSTRIAL MARKET EFFECTS BASELINE STUDY

### STUDY OBJECTIVES AND PROGRAM DESCRIPTION

Quantum Consulting conducted a market characterization of the motors and packaged air conditioning market for Pacific Gas and Electric Company (PG&E) in 1997/1998. The study seemed to have departed from its initial objectives. The title of the study, which must have carried over, did not really describe Quantum's analysis. While it is not uncommon for the objectives of a study to evolve as a project progresses, the reasons should be explained.

The title claimed this was a baseline study for market effects. Although the final product had certain elements of such a study, it did not specifically measure market effects, nor did it follow certain precedents set by other market effects studies. Specifically, it did not measure the penetration of the energy-efficient equipment--something that a baseline study would normally do. Although penetration estimates from focus groups were reported, it is obvious from the small size of market actor groups surveyed that the study was not designed to obtain baseline estimates of penetration. (Baseline estimates of penetration could have been cost-effectively obtained from the market actor interviews if self-reported end-user results were expected to be too unreliable.)

This was also not a true market effects study. The authors should have linked specific market barriers to the PG&E program attributes, then tested if the hypothesized program effects were valid.

Nonetheless, the study was a valuable market characterization. It examined market barriers, customer actions and intentions related to the purchase of high-efficiency motors and packaged air conditioning systems very well. It also proposed and tested techniques that could be quite useful in other market effects and market transformation testing and analyses.

## SUMMARY TABLES

**Table V2-25: Summary of Study Features**

<b>Title:</b>	Commercial/Industrial Market Effects Baseline Study Results
<b>Project Number:</b>	3306
<b>Sponsoring Utility:</b>	Pacific Gas & Electric
<b>Contractor:</b>	Quantum Consulting, Inc.
<b>Sector:</b>	Commercial/Industrial
<b>End-Use Elements Examined:</b>	Packaged AC, Motors
<b>Program Year(s):</b>	NA
<b>Program Intervention(s):</b>	NA

**Table V2-26: Key Study Results**

**BARRIERS ADDRESSED**

BARRIERS	ACTORS AFFECTED	BARRIER DESCRIPTION	PROGRAM SUCCESS IN REDUCING MARKET BARRIER
<b>Split Incentives</b>	HVAC End-users	Customer concerns that savings wouldn't go to company, that people who make investments won't see benefits; unwillingness to take risks involved in high efficiency	NA
<b>Financial Focus</b>	HVAC End-users	Difficulties finding financing; inadequate return on extra cost given energy prices; lost investment opportunities due to energy-efficiency investment; difficulty identifying energy-efficient option; uncertain return on investment; initial costs	NA
<b>Hassle Avoidance</b>	HVAC End-users	Preference for easy-to-install option; practice of oversizing units; no perceived reason to be proactive in energy efficiency; greater consideration given to immediate delivery	NA
<b>Technological Ignorance</b>	HVAC End-users	Lack of concern about equipment until it breaks down; lack of in-house expertise in performance; perceived risks of unanticipated problems and costs	NA
<b>Focus On Immediacy</b>	Motors End-users	Need for immediately available replacement when motors fail; lack of concern about equipment until it breaks; lack of time to consider options when motors fail; low priority of energy costs relative to other operations issues	NA
<i>Continued</i>			



<b>BARRIERS</b>	<b>ACTORS AFFECTED</b>	<b>BARRIER DESCRIPTION</b>	<b>PROGRAM SUCCESS IN REDUCING MARKET BARRIER</b>
<b>Downtime Concern</b>	Motors End-users	Need to upgrade whole system as part of buying premium-efficiency motors; downtime due to lack of available supply	NA
<b>Reluctant Investing</b>	Motors End-users	Lack of access to financing; need for in-field demonstrations before investing	NA
<b>Motor Sophistication</b>	Motors End-users	Emphasis on reliability; confidence in selecting correct size and type	NA
<b>Advanced System Orientation</b>	Motors End-users	Lack of time to learn about premium-efficiency motors; priority given to investments in re-engineering processes or controls	NA
<b>Make-Do Orientation</b>	Motors End-users	Practice of rewinding rather than replacing with new motors; unwillingness to pay price of premium-efficiency motors	NA
<b>Low Incentives</b>	Motors End-users	Preference for replacing failed motor with identical model; aversion to risk of unknown; concerns that savings do not justify costs; too few operating hours on equipment; investment not justified by low energy usage of small motors	NA

**Table V2-27: Key Study Results**

**EXISTING DATA USED**

DESCRIPTION	COLLECTION PERIOD
Annual Summary Report on Demand Side Management Programs in 1996 and 1997	1996-1997
Commercial Building Survey Report	September 1997
Customer Space Conditioning Choice Research	January 1996
Impact Evaluation of 1994 Industrial Miscellaneous Measures Energy Efficiency Projects	March 1996
Impact Evaluation of Pacific Gas & Electric's 1995 Industrial Sector Energy Efficiency Incentives Programs: Lighting, HVAC; Process	March 1997
Motor Challenge Sourcebook: A Compendium of Current Activities and Resources in the Industrial Motor Systems Markets	1996
New England Motor Baseline Study	July 1992

**Table V2-28: Key Study Results**  
**NEW DATA COLLECTED**

DESCRIPTION	COLLECTION METHOD	COLLECTION PERIOD
Staff Interviews (4 PG&E)	Interviews	Not stated
Motor End-users (100 PG&E, 100 comparison service territory)	Phone Surveys	Not stated
HVAC End-users (200 PG&E, 100 comparison service territory)	Phone Surveys	Not stated
Motor Vendors (PG&E)	2 Focus Groups	Not stated
20 Motor Vendors, comparison service territory	Interviews	Not stated
HVAC Vendors, PG&E	2 Focus Groups	Not stated
25 HVAC Vendors, comparison service territory	Interviews	Not stated
Architects and Engineers (15 PG&E, 10 comparison service territory)	Phone Surveys	Not stated
10 ESCOs	Phone Surveys	Not stated

## COMPARISON WITH SCOPING STUDY FRAMEWORK

### Market Effects

The Market Effects Baseline Study is a misnomer since; it did not really produce estimates of market effects or serve as a baseline study. As it did not actually measure market effects, the Study can not be said to be a market effects study that was consistent with the Scoping Study. However, it did successfully examine market barriers and commercial customers' intentions to purchase HVAC equipment and motors. The study did a good job of establishing links between awareness of PG&E's programs, perceived barriers and equipment purchase intentions.

### Market Barriers

An analysis of market barriers is central to any analysis of market effects. Although this study considered market barriers, it did not clearly communicate which barriers the authors felt were

important. Nor did it provide evidence of the pathway of the effect (both in terms of understanding market operation and in providing evidence of causality).

It is clear, however, that market barriers were investigated using the terms contained in the Scoping Study. This was an improvement over several prior industry studies that superficially discussed the Scoping Study, but did not really understand these concepts or incorporate them appropriately. The authors of this study understood the Scoping Study well. This may indicate that the industry is maturing.

Nonetheless, the report used a much narrower definition of market effect than was intended in the Scoping Study. In its discussion of the three basic components of the theoretical framework<sup>5</sup>, the study implicitly equated market effects with customer actions and failed to consider market effects as they apply to barrier removal in other areas of the delivery chain. This led to an over-reliance on intentions-to-purchase data (as a proxy intermediate for sales data) to gauge program success.

The report would have been strengthened if the authors had clearly laid out hypothesized market barriers and linked them, even in a footnote, to the definitions in the Scoping Study. The report did not provide any definitions or list specific barriers or explain its measurement approach.

This does not mean the examination of market barriers was entirely overlooked. The report described how focus groups were used to explore market barriers experienced by equipment dealers and distributors. This information then was used to develop questions about market barriers for the customer surveys. The two-tier approach is superior to that of earlier market effects studies for which investigators used their own judgment (or that of utility staff) about market barriers to develop customer surveys. So, although the theoretical groundwork and initial assumptions regarding market barriers were not laid out, the customer surveys were informed by the response of key stakeholders who knew about many of these barriers.

The study also did a better-than-expected job at quantifying market effects of past programs. Yet, in this regard it maintained a more historical focus than future focus as would have been expected from a baseline study. Authors of a baseline study or market assessment might be expected to use their results to develop a benchmark for likely market effects from future programs.

## **Sustainability and Lastingness**

Sustainability and lastingness of market impacts were not addressed in this study.

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<sup>5</sup> *Commercial/Industrial Market Effects Baseline Study Results*, p. 14.

## **Recommendations for Modifications to Scoping Study**

We would like the authors to have linked explicitly program interventions and market barriers, and then market barriers to market effects. This sequential view of the market transformation process should work well in studies using a structural equation model approach. Unfortunately this study did not complete those links. The Scoping Study did not explicitly tie together market barriers and market effects, though it did imply such a connection. When the Scoping Study is used in the future, it will be necessary to examine all of the links in the process, theoretically and through measurement.

## **STRENGTHS AND WEAKNESSES OF METHODOLOGIES**

### **Strengths and Weaknesses of Evaluation Design**

The evaluation design used four types of data collection:

1. An initial literature review
2. Interviews with PG&E program staff
3. Telephone surveys with end-users
4. Focus groups with market actors.

The telephone survey information was analyzed using many statistical techniques. The major advance was the introduction of structural equation modeling (SEM) to market effects and market transformation analyses in the energy-efficiency field.

The study generally relied upon the literature review to provide much of the baseline measurements. In addition, the literature review and focus groups provided the information that study authors used to create the market characterization.

Quantitative analysis relies heavily on a variety of modeling techniques and statistics, including the following:

- Principal components to control for the correlations between market barriers and to obtain information about perceived market barriers from the end-user
- Hotelling t-squared test on differences in question wording
- Levene's test of homogeneity of variances to determine t-test for bivariate comparison between PG&E and non-PG&E

- Standard regression models
- Structural equation modeling (SEM) to examine links in the HVAC market between program exposure, perceptions and purchase intentions.

The study was quite useful due to the literature review, qualitative study elements and the quantitative techniques employed. Each of these provided important information and insights. In fact, this study's drawback was that these elements were not woven together well, as if each lead did their separate components without a strong team effort to answer the study's overall objectives. (This could have been the result of confusion about the objectives of the study, as mentioned earlier.) Each element made very significant contributions. Unfortunately, the gaps between them left many questions unanswered.

### ***Literature Review***

A literature review was conducted at the beginning of the project to identify changes that should be made in project scope or methodology. The Quantum team identified one aspect of market transformation that had already occurred: the establishment of minimum ARI efficiency levels among utilities and manufacturers. This took three years to accomplish. It probably resulted from generous rebates, along with a commitment that rebates continue for at least two more years. ASHRAE and the Federal government subsequently adopted the efficiency standards from these rebate programs. In the literature review section, the authors also noted that market transformation analyses should reflect progress made by large, sophisticated users.

The literature review section also included recommendations about the remaining analysis for the study. One was a recommendation that the Quantum team conduct and include a baseline market study. A decision was made, based upon the literature review, to narrow the focus of the motors component of the Study to the packaged HVAC market and to motors within a specified size range (10 to 100 horsepower) that are used for drives for process pumps and industrial fan/blower systems. The team chose those motors because most of them are replaced frequently and they could use existing efficiency standards as a basis of comparison. The air compression market also was determined to be a good focus for the analysis.

### ***Focus Groups***

Four focus groups were conducted with dealers and distributors. These identified the market barriers that needed to be addressed in the end-user surveys. They also figured prominently in the study's market characterization.

## ***Statistical Modeling***

Fairly sophisticated statistical analysis and modeling techniques were used in this study. Two of these techniques were central to the analysis to help develop the survey instruments and to interpret customer survey data. The end-user questionnaire was developed to collect primary data on customers concerning market barriers and decision processes, as described earlier. After collecting that data, the authors analyzed the survey data using modeling techniques. It appears to us that the right kinds of data were collected from end-users, and interesting (and plausible) results were found.

In the HVAC market, a set of market barriers was found to be statistically correlated in a small, but consistent fashion. The study authors found relationships between PG&E programs, specific market barriers and purchase intentions. In the motors market, interesting correlations were found between purchase intentions and certain customer attributes, such as a “made-do orientation” and a focus on immediacy.

## ***Strengths***

The main strengths of the design are as follows:

- The analysis made innovative use of statistical techniques to weigh the kinds of data and survey questions important for the analysis. The techniques also helped the team establish key analytic and behavioral relationships after they had collected the survey data. These techniques included the following:
  - Principal component analysis to understand how market barriers vary together. This was innovative because it did not make the simplistic assumption that the barriers were independent of each other. Seven factors were identified--financial focus, hassle avoidance, split incentives, operations focus, technological ignorance, suspicion and analytic orientation.
  - Structural equation modeling (SEM) to establish links between parameters that could be potentially related (i.e., program exposure, perceived barriers and purchase intentions) was tested using the end-user survey data for the packaged HVAC market.
- The analysis addressed the issue of survey wording in an interesting way. For instance, the team created two versions of the survey, using differing definitions of efficiency in the market barrier questions. The evaluation team conducted random assignment to decide which customers were asked which version. A “means of factors” was used to test for differences in responses due to these differing definitions. No differences were found.

## *Weaknesses*

The main weaknesses of the design are:

- The surveys probed end-users about their purchase intentions instead of the actual efficiencies of purchased equipment. In other words, customers were asked which equipment efficiencies they would select if they were to buy HVAC or motor equipment today. This hypothetical approach avoids having to screen customers for actual purchasers. (Very few customers actually replace equipment in any given year, making them hard to find in a survey.) However, the use of answers to a hypothetical did not allow the team to measure actual actions taken nor did it give much insight into market barriers for equipment that customers would encounter if they were actually in the market for such equipment.
- Using a SEM made a significant contribution to the energy-efficiency field. Yet, since this technique is still relatively new it would have been more useful to a broader audience if the study had provided more background and references, including its use in economics, and its relationship to path analysis in sociology and LISREL modeling in labor studies.
- The method used to select and analyze the sample of HVAC end-users within PG&E's service territory introduced complexities that made it difficult to find a good comparison group. It might have been better to settle for a less perfect sampling design for the PG&E service territory, but one that could have been replicated for the non-PG&E territory. The evaluation team might have considered such trade-offs, but they did not say so in the report.
- Where a judgment call was necessary, the authors might have emphasized what its models were saying or desiring instead of human judgment. For example, in conducting the principal components analysis of motors, eight market barriers were deleted in order to get the analysis to converge. (These eight had too little correlation with the other 22 items). This was an appropriate way to make this tool work. However, the discussion of market barriers and survey findings of market barriers should have included these eight market barriers, which were measured in the customer survey. Market barriers, even those that did not fit the sophisticated tool chosen for the analysis still exist.
- The structural equation model requires there be no missing data, which meant that certain values needed to be imputed. The authors chose NORM software that used iterative regressions to impute values (pg. 43). This was an interesting use of NORM. Yet, the study should have included the proportion of data that had to be "manufactured" in order for readers to have confidence in the results.



## STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES

### Assessment of Data Completeness

Most of the primary data were collected via telephone surveys of end-users. There were also telephone interviews of architects, engineers and PG&E staff. There were also two focus groups, for motor vendors and HVAC vendors. The sample sizes were as follows:

- Motor end-users
  - 100 within PG&E territory
  - 100 outside PG&E territory
- HVAC end-users
  - 200 within PG&E territory
  - 100 outside PG&E territory
- Architects and engineers – 15 within PG&E territory
- Energy service companies – 10 ESCOs that served various areas
- Motor vendors within PG&E territory (2 focus groups)
- HVAC vendors within PG&E territory (2 focus groups).

### Sampling Design

#### *Strengths*

The main strengths of the sampling design were:

- The evaluation team designed the HVAC end-user sample using a method that was intended to achieve the best possible information about customers in the PG&E territory. Although this approach had some limitations (described below), it was a good choice. This involved a Delenius-Hodges stratification scheme based on an allocation of packaged HVAC capacity across business times and climate zones, using information from another PG&E study (*Commercial Building Survey Report, 1997*). Ultimately, 60% of the sample was drawn for customers of medium usage and 20% each for the small- and large-usage customers. Survey results were then weighted by the segment's contribution to packaged HVAC cooling capacity in the population. This strategy maximized the number of participants likely to have had packaged HVAC units and deliberately over-sampled customers who were likely to be

interested in performance contracting (i.e., colleges, schools and hospitals). This approach, to both sampling and extrapolation of results, was sound and made good use of an earlier study.

- The evaluation team designed the motor end-user sample from PG&E customers in industries that accounted for the largest share of motors nationwide, according to an earlier PG&E study by Xenergy (*National Motor Market Baseline Study*, 1997). Survey results were weighted according to the estimated motor electricity usage. This was based on the annual kWh for each segment, multiplied by the estimated percentage of usage by motors in that segment. This straightforward and appropriate approach to sample design made judicious use of the prior related research.
- The survey design used to derive the non-PG&E customer samples for HVAC and motor end-users was intended to reflect the characteristics of the market in which PG&E's end-users operate. Survey results were weighted to reflect the population distribution of PG&E customers. This was a sound approach, with a weighting scheme that eliminated potential biases resulting from uncontrolled differences (i.e., economies, industrial mix).
- With certain exceptions (described below) the analysis seemed to be based on fairly complete data. Key market participant groups were either interviewed (PG&E staff, architects/engineers, ESCOs), surveyed (end-users) or included in focus groups (motor vendors, HVAC vendors).
- The surveys were relatively thorough and complete. For example, both end-user surveys included 30 questions concerning 10 market barriers.

### ***Weaknesses***

The main weaknesses of the sampling design were:

- The study sample was confined to schools, universities and hospitals due to budget constraints and PG&E's previous success with these large users. Under ideal circumstances, a broader set of C&I customers would have been included in the sample, especially since the focus groups indicated that many larger users might have been in markets that had already been transformed. As a market effects study, this should have included previously transformed markets; this would have helped the authors determine if the program results could have been attributed to that transformation. A baseline study does not to study a transformed market, on the other hand, as baseline studies are in preparation for program intervention.

- The authors based their estimates of equipment efficiency levels from the focus groups of vendors instead of from survey data from end-users or interview data from a larger sample of vendors. Consequently, the authors based their estimates of penetration on an extremely small sample.

## **Assessment of Data Collection Procedures**

The authors used a variety of data collection procedures. These procedures meet industry standards.

### ***Focus Groups***

Four focus groups were conducted with dealers and distributors within PG&E's service territory: two mini-focus groups of each HVAC vendors and motor vendors. The purpose was to develop a more thorough understanding of market conditions and interactions. These focus groups successfully identified market barriers to include preliminary identification of market barriers seen by end-users. These were market players who certainly would have been aware of obstacles to purchasing high-efficiency HVAC equipment and motors. Several market barriers were identified through this process and were used to develop market barrier questions for the customer surveys. We believe that this is an example of how the analysis went beyond previous data collection efforts. Too many prior studies have relied on the *a priori* judgment of the evaluation team and have not explicitly sought market information from the beginning of the study.

The use of vendor focus groups to derive estimates of equipment efficiency levels was less successful. While the authors conceded that survey data from end-users would have been superior, they knew it would have been costly and difficult to get and use it properly. Consequently, estimates of the penetration of HVAC and motors were predicated on extremely small sample sizes. The results, while interesting, were of limited value. Another option would have been to derive penetration estimates from interviews with more vendors than participated in the focus groups. (For example, using questions on percentages for different types of equipment and general overall business size data to derive penetration estimates have been successful in other studies.)

## **SUSTAINABILITY AND LASTINGNESS**

### **Critiques of the Evaluation's Evidence and Conclusions with Regard to Sustainability**

Sustainability of market impacts was not examined in this study. Study authors stated that they focused on the current status of the market and that the final study was designed to serve as a

baseline for future market transformation efforts in this market. As such, market effects and the subsequent testing for sustainability did not receive much attention.

## **OPPORTUNITIES FOR USE OF THE MARKET EFFECTS EVALUATION**

### **Strengths and Weaknesses of Program as Market Transformation Program**

The study examined the impacts of PG&E's programs for HVAC and packaged air conditioning, but did not provide defensible estimates of market effects. A better starting point of the analysis would have been a mapping of specific program attributes to market barriers, followed by a plan to establish cause-and-market-effect relationships. However, a somewhat different kind of study actually was conducted. Consequently, it was difficult to assess the strengths and weaknesses of PG&E's programs for market transformation potential.

Certain things are clear, however. The focus groups for HVAC suggested that PG&E's rebate program helped increase the penetration of high-efficiency equipment, with the exception of very high efficiency (Tier 2) equipment. However, the program did not transform the market for such equipment. Market transformation appeared to have occurred among industrial purchasers and larger consumers purchasing motors (over 50 horsepower). However, the study did not prove that the program actually caused this transformation or just a market change. Yet, there was still little incentive in the market for smaller premium motors (below 25 horsepower) since the marginal profit for higher efficiencies did not make it worth the time or effort to educate consumers.

### **Potential for Future Use of New Market Transformation Evaluation Techniques Tested**

The study had much merit and a few problems, as described throughout this section. A variety of data collection and statistical techniques were used in a fairly rational and, in some cases, innovative fashion. Several could prove quite useful for future studies. These are described below, more or less in sequence.

The literature review in this study served as a basis for identifying markets and HVAC and motor equipment categories. This was a good starting point for this kind of analysis and should certainly be an element of future studies. Too often the literature review component of studies is under-emphasized. This study exemplified how useful a thorough literature review can be.

Similarly, program staff interviews are a basic ingredient of most studies like this. They offer an opportunity to learn about programs that may have changed the marketplace, and to gather information from those who have been involved in this process.

Focus groups also have great potential for use in subsequent market transformation studies. Here, they were used judiciously to structure the market barrier questions in the customer surveys.

Information from focus groups, however, was less useful as a basis for estimating the penetration of specific equipment.

Statistical modeling was used successfully in a number of ways. However, other evaluators might be advised to use the technique only where it will bring the most value. Future studies could build on the techniques used in this project and the lessons learned from this experience. These include: principal component analysis to better understand customer's perceptions of market barriers, and structural equation modeling to understand the path, and importance of various elements in the path, to market transformation.

Subsequent studies might also explore links between purchase intentions and actual behavior. Measurement of actual behavior is a necessary part of a complete baseline study and subsequent long-term studies designed to measure ultimate indicators of market transformation.

In this study of the HVAC market, modeling techniques were used effectively to establish links between program exposure, perceived barriers and purchase intentions. This was a significant addition to the field. This technique certainly should be considered for use in future studies, and further developed. Over the longer run, it would be interesting to learn which, if any, program interventions are effective at increasing the probability that purchase intentions result in actual behavior.

Principal component analysis was used in the motors component of the study to derive seven factors from the survey questions on market barriers. These factors are probably more useful for market transformation program design than Scoping Study definitions of market barriers.

The HVAC analysis also initially identified seven "barriers" with principal component analysis. Then, in the course of relating the barriers to purchase intentions, the list was whittled down to two. It may be possible in future studies to use similar techniques and yet to consider a market barrier typology to identify seven customer types, then analyze the relative propensities of those types to purchase efficient equipment. Researchers could then infer the existence of two key barriers. Based on this interpretation, the seven barrier-based customer types could be related to more broadly known firmographic characteristics. This orientation would help future program designers target those customers most likely to be constrained by key barriers, and which interventions might create behavioral effects from that customer type.

One of the more sophisticated elements in the survey design was the random assignment of whether market barrier questions referred to high-efficiency (HE) as equipment with SEER 11 or SEER 14. (Responses for these two definitions were not found to be statistically different.) Future research could determine whether market barriers for HVAC are the same if different definitions of HE are used. For example, is the market linear in its consideration of HE, or does it tend to operate step-wise? Are the same market barriers evident, and are the magnitudes of them the same or linear? Does the relationship between market barriers and market acceptance change

as we move from SEER 11 to SEER 14? These questions could prove critical as those creating market transformation initiatives determine which efficiency level they will promote, and which program intervention might be most effective given that efficiency level.

On the whole, the evaluation techniques were generally appropriate and the results were reasonable. The report was fairly interesting to read. It also provided a good market characterization through the literature review, focus groups and analyses.



*Megdal & Associates*

## 2.7 CONSUMERS' ATTITUDES TOWARD ENERGY-EFFICIENT APPLIANCES

### STUDY OBJECTIVES AND PROGRAM DESCRIPTION

This study was conducted as a market research effort on SCE's ENERGY STAR<sup>®</sup> appliance labeling pilot program. The program evaluation was carried out by Brown & Whiting, under subcontract to the U.S. Department of Energy's (DOE) program administrator, D&R International. Since the study was not conceived as a market effects study, it bore virtually no relationship to the market transformation framework outlined in the Scoping Study. SCE attempted to bridge the gap between this study and the Scoping Study via a cover memo. The memo discussed program implementation, market barriers hypothetically addressed by the program, hypothetical market effects that would result from the program, evaluation research planned and conducted, evaluation findings and conclusions and recommendations. In reviewing the study, we found it useful to treat the cover memo as an integral part of the report, serving as an executive summary. Throughout the discussion that follows, we have attempted to differentiate findings from the study and conclusions or information drawn from the cover memo.

As described in SCE's cover memo, the ENERGY STAR<sup>®</sup> program is a joint partnership with the US Department of Energy (DOE) and the US Environmental Protection Agency (EPA). The program, which began as a pilot in 1996, provided target levels for "high efficiency" appliance classifications and rated the efficiency of refrigerators, dishwashers, and room air conditioners. Program collateral materials included a program training guide for the retail dealer's salespeople, static-cling ENERGY STAR<sup>®</sup> labels for qualifying appliances, and point-of-purchase banners, posters, product "tents," and customer brochures for each type of appliance in the program. The pilot program involved 30 Circuit City retailers in SCE's service area.

Under SCE's Major Appliance Labeling Retail Initiative Pilot Program, typical participation agreements covered retail dealer issues such as qualifying appliance stocking and inventory, sales staff compensation, education and training, point-of-purchase displays, advertising, promotion and consumer finance options. SCE for its part agreed to match a portion of the participating retailers' investment for the activities on an agreed-performance basis.

According to SCE's cover memo, the study's principal objective was to provide a basis for evaluating the viability of the program pilot.

Specific study objectives were to look at:

- Consumer knowledge about energy efficiency



- Overall consumer purchasing factors
- Effects of program-related energy-efficiency information
- Opinions on how to enhance the communication effectiveness of point-of-purchase energy information
- Consumer awareness and understanding of energy-efficiency ratings
- Relative importance of energy efficiency in consumers' appliance purchasing decisions
- Consumers' attitudes toward energy-efficient products
- Consumers' preference for various sources of product information
- Adequacy of the sales associate training program in energy efficiency.

## SUMMARY TABLES

**Table V2-29: Summary of Study Features**

<b>Title:</b>	Consumers' Attitudes Toward Energy-Efficient Appliances
<b>Project Number:</b>	3503
<b>Sponsoring Utility:</b>	Southern California Edison
<b>Contractor:</b>	Brown & Whiting
<b>Sector:</b>	Residential
<b>End-Use Elements Examined:</b>	Refrigeration
<b>Program Year(s):</b>	1996-1997
<b>Program Intervention(s):</b>	Appliance labeling; sales staff compensation, education and training; point-of-purchase displays; advertising; promotion; and consumer finance options

**Table V2-30: Key Study Results**

**BARRIERS ADDRESSED**

BARRIERS	ACTORS AFFECTED	BARRIER DESCRIPTION	PROGRAM SUCCESS IN REDUCING BARRIERS
<b>Information or Search Costs</b>	Consumers	Consumers are typically unaware of the existence of high-efficiency appliances; consumers cannot easily identify high-efficiency appliances in ads or on the showroom floor.	NA
<b>Performance Uncertainties</b>	Consumers	Consumers perceive a substantial difference in price between standard and high-efficiency products, but anticipate a small or unknown difference in operating cost.	NA
<b>Asymmetric Information and Opportunism</b>	Consumers	Consumers may question the veracity of the appliance salesperson.	NA

**Table V2-31: Key Study Results**

**MARKET EFFECTS MEASURED**

DESCRIPTION OF EFFECT	KEY RESULTS	HOW MEASURED
None Measured	NA	NA

**Table V2-32: Key Study Results**

**EXISTING DATA USED**

DESCRIPTION	COLLECTION METHOD	COLLECTION PERIOD
DOE study	In-person intercept interviews of ~300 consumers in appliance stores in Milwaukee, San Francisco, Tampa Bay, and Washington, D.C.	1996

**Table V2-33: Key Study Results**

**NEW DATA COLLECTED**

DESCRIPTION	COLLECTION METHOD	COLLECTION PERIOD
Interviews with 147 shoppers and 12 sales representatives	In-person intercept interviews in Los Angeles Circuit City stores	December 1996
2 focus groups with 10 and 8 participants, respectively	Focus group participants recruited from list of consumers who had purchased energy-efficient refrigerator in previous 12 months	March 11, 1997
Sales staff interviews with 13 sales representatives and 4 department managers	In-person interviews in 7 Los Angeles Circuit City stores	March 1997

**COMPARISON WITH SCOPING STUDY FRAMEWORK**

**Market Effects**

This study was essentially a market characterization study for a pilot program, which was subsequently discontinued. SCE's cover memo listed a number of market effects by actor that could form the basis for developing testable research hypotheses about program impact. However, given the short duration of the program and the qualitative nature of the evaluation, no market effects were actually measured or documented.

**Market Barriers**

SCE's cover memo identified the following barriers as being addressed hypothetically by the program:

- **Information or Search Costs:** Consumers are typically unaware of the existence of high-efficiency appliances as an option to standard efficiency units; consumers cannot easily identify high-efficiency appliances in advertisements or on the dealer's showroom floor.
- **Performance Uncertainties:** Consumer perception of the value-added "energy efficiency" price-performance relationship is blurred. That is, consumers perceive a substantial difference in price between standard and high-efficiency products, but anticipate a small or unknown difference in operating cost.

- **Asymmetric Information and Opportunism:** Consumers may question the honesty of salespeople, suspecting that they are trying to sell an expensive and feature-rich appliance in order to increase their sales commissions.
- **Product Unavailability:** In response to competitive pressures, retail dealers might not stock the higher-priced, high-efficiency models. Low-volume or low-market share models cost the retailer more due to higher wholesale acquisition cost, and higher inventory and flooring costs due to slower turnover rates. Higher costs can lead to lower profits and hence, a reluctance among retailers to stock high-efficiency products.

Evaluation findings indicate that the first three hypothesized barriers actually exist in the marketplace and are potentially key.

### *Information or Search Costs*

Evidence of this barrier stems from customers' identification of sales staff as important influences in the purchase process, coupled with sales staff perceptions that all newly-made refrigerators are energy-efficient.

### *Performance Uncertainties*

Evidence of the existence of this barrier stems from lack of awareness among focus group participants of the levels of actual energy savings they were experiencing, associations among some focus group participants of energy efficiency and increased frequency of breakdowns, and the fact that customers lack conceptual tools to evaluate performance, as indicated by their general unfamiliarity with the notion of payback.

### *Asymmetric Information and Opportunism*

Evidence of the existence of this market barrier was mixed. On the one hand, focus group participants frequently mentioned sales representatives as strongly influential in the buying decision. Intercept interviewees also rated showroom information, along with personal contacts, as their preferred source of consumer advice. On the other hand, one focus group attendee suggested that sales representatives emphasize a particular brand because they are "getting spiffed." When asked about reliability of information sources, intercept interviewees ranked salespeople fourth, behind *Consumer Reports*, the utility company and the EnergyGuide label.

### ***Product Unavailability***

The report provided no clear evidence of "Product Unavailability" as a significant market barrier. The study did not collect or analyze data showing sales volumes or relative stocking rates for energy-efficient refrigerators. Furthermore, customers did not report difficulties finding energy-efficient refrigerators. However, it should not be assumed that the lack of conclusive evidence of the existence of this barrier mean that the barrier did not exist.

### **Sustainability And Lastingness**

This issue was not addressed in the evaluation.

### **Comparison To Other Market Transformation Frameworks**

Since the study was essentially a baseline market characterization study, comparison to any particular market transformation framework is somewhat limited.

### **Recommendations For Modifications To Scoping Study**

The study was conceived and implemented outside of the Scoping Study framework, with no reference to the Scoping Study other than the utility's cover memo. The study provided no recommendations for modifying the Scoping Study and we find that no recommendations for modifications based on this study are warranted.

## **STRENGTHS AND WEAKNESSES OF METHODOLOGIES**

### **Strengths and Weaknesses of Evaluation Design**

#### ***Strengths***

- As noted previously, this study was essentially a market characterization study for a pilot program that was subsequently discontinued. The short duration and limited scope of the program, combined with the qualitative nature of the evaluation, provided little opportunity to quantify market effects. As the SCE project manager wrote in his cover memo: "The study's principal objective was to provide a basis for evaluating the viability of the program pilot. Because the study was conceived outside the (Scoping Study) paradigm, its limitations as a market effects study are severe." With these limitations in mind, we believe the overall evaluation design was quite adequate to accomplish the evaluation's stated objectives.

- The study methodology essentially consisted of collecting survey data, tabulating results, and reporting quantitative and qualitative responses. Different data collection approaches and market actors produced consistent results.
- The study asked similar questions of customers and sales representatives. This strategy provided a good opportunity to compare directly customer responses with sales representatives' perceptions of customer opinions on such factors as purchase decision factors and effectiveness of different marketing pitches. Study results also were compared with findings of a separate DOE-sponsored study. The two sets of findings appeared generally consistent.

### ***Weakness***

- Two minor methodological and reporting issues emerge from our review. The first stems from Table 10 (page I-17), which lists factors influencing purchase of an appliance. These factors are not all orthogonal. Low operating costs and electricity consumption are closely related, as are capacity/size and physical size. If similar categories were combined, the order of importance would change. The second issue stems from the method of reporting customer responses to queries about how much extra they would pay for an \$800 refrigerator that would save \$50 per year in utility bills. Only the average of customer responses was reported (\$120). Reporting the full distribution of responses via a graph would have given the reader a more complete impression of customers' price sensitivity relative to energy efficiency.

### **Comparison to Economic Framework**

Study findings appear to be generally consistent with an economist's concept of consumers as boundedly rational market actors seeking to maximize their personal utility function. However, no attempt was made to situate the study explicitly within an economic conceptual framework.

## **STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES**

Data collection consisted of:

- Baseline customer intercept interviews with 147 shoppers and 23 sales representatives, all in Los Angeles-area Circuit City stores during December 1996, conducted prior to introducing the ENERGY STAR<sup>®</sup> logo.
- Two customer focus groups conducted with refrigerator purchasers. Group 1 had five women and five men. Group 2 had four women and four men. Participants were

recruited from a list of consumers who had purchased an energy-efficient refrigerator within the last 12 months.

- Sales staff interviews with 13 sales representatives and four department managers from seven Los Angeles-area Circuit City stores during March 1997.

## **Assessment of Data Collection Procedures**

### ***Strength***

- The data collection procedures suffered the limitation of providing primarily qualitative information. However, in the context of the evaluation's stated objectives, the procedures were entirely appropriate. We noted no obvious flaws in the data collection techniques described in the report.

### ***Weakness***

- Collection of appliance sales data was contemplated but abandoned because the data proved more difficult to obtain than anticipated. This evaluation did not include a manufacturer survey, on-site inspections, a retailers survey, or a general consumer market research survey. (It was anticipated that these data collection efforts would have been carried out had the program been continued beyond the pilot phase.)

## **Assessment of Data Completeness**

In this study, the focus was on Circuit City in Los Angeles. Intercept interviews were conducted at various Circuit City locations, and focus group participants were drawn from Circuit City customers who had purchased an energy-efficient refrigerator. Focus group participants reported shopping at Circuit City because "they could expect to make their purchase at the lowest market price." Thus the focus on Circuit City may have limited results to value-conscious shoppers.

A primary concern regarding data completeness, particularly for the intercept interviews, is whether those interviewed are representative of the larger population of Circuit City shoppers or of the general Los Angeles area. For example, the evaluation reported that men made up the majority of the interview sample (61.2%). The study would have benefited from a comparison of intercept interview respondents to the general population distribution of key economic and demographic indicators for the study area. The study also might have benefited from a comparison of demographic characteristics of intercept respondents to those of all Circuit City shoppers. To obtain data for all shoppers, the research team probably would have had to devote a staff person to record approximate age, sex, and race of all people exiting store without conducting interviews.

## SUSTAINABILITY AND LASTINGNESS

Given the short duration of the program and the qualitative nature of the evaluation, this issue could not be addressed.

## OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION

### Strengths and Weaknesses of the Program as a Market Transformation Program

The study would appear to indicate that a full-scale program modeled on the pilot would have significant potential as a market transformation program. However, an important question that was not addressed in the study or in SCE's cover memo is why the program was cancelled.

The study itself has considerable value as a source document for future market characterization program planning efforts targeted at energy-efficient refrigerators for use in residential applications. In addition to providing evidence of several key market barriers, the study provided a number of findings that should prove useful for designing, fielding and evaluating future market transformation efforts:

- Consumers in the market for major appliances generally do not regard energy efficiency as a product feature for which they will shop. Brand, size, convenience features and low purchase price appear to be more salient considerations affecting consumer choice. Energy efficiency is a tie-breaker, all else being equal. This finding suggests a need to associate energy efficiency with factors that are important to consumers such as low operating costs, high quality and improved reliability.
- Consumers and retailers are generally reluctant, or find it difficult, to differentiate between standard and high-efficiency appliances. Retailers in particular tend to promote all appliances in the present market as "efficient."
- Although consumers have a basic understanding of energy efficiency, they often fail to make the all-important link with associated benefits. Again, brand, size and low purchase price appear to be more important considerations.
- Energy Guide/ ENERGY STAR<sup>®</sup> labels, when properly placed, have moderate information value. At the very least, labels serve as a stimulus for inquiry on the part of the consumer. Customers reported the ENERGY STAR<sup>®</sup> logo as being easy to use without in-depth analysis. The influence of such material can be enhanced considerably by well-informed and cooperative sales personnel. This finding suggests that labeling efforts as part of a comprehensive program have definite merit.



- New refrigerator purchases did not necessarily mean that the old ones were out of commission. This finding indicates it may make sense to couple refrigerator recycling programs with programs promoting high-efficiency refrigerators.
- *Consumer Reports* often was named as the most reliable information source. This finding suggests a strategy for reducing asymmetric information barriers if *Consumer Reports* can be persuaded to conduct comparison tests of energy efficiency and write about them.
- Experience in the showroom was, along with personal contacts, the preferred source of consumer advice. A shift in attitude toward energy-efficient appliances often was the result of interacting with the sales representative in the showroom, who explained paybacks. Thus, sales representative training is crucial for addressing bounded rationality barriers.
- Some sales associates sold extended warranties by claiming that new refrigerators will not last as long as standard models. Furthermore, energy efficiency can be associated with either higher or lower quality in the consumer's mind. This finding indicates that performance uncertainty needs to be addressed for the sales associates and the customers.
- Utility information was considered reliable. In the wake of deregulation, this finding suggests either that efforts to promote energy efficiency would benefit from continued utility involvement or that a concerted effort needs to be made to develop a replacement information source with the same degree of credibility.
- Sales representatives liked rebate programs and were convinced that it helped them move product. This finding suggests it may be overly simplistic to think that rebates and incentives have no place in market transformation programs.
- Customers prefer energy efficiency stated in terms of dollars saved per year.

In addition to recommendations based on the report findings listed above, SCE, in its cover memo, provided several recommendations that are generally applicable:

### ***Sales Personnel Training Program***

- Recognize that a "one-shot" approach to training may be insufficient.
- Implement a sales training program that will grant a "certificate of completion" only after proficiency with program material has been demonstrated. Mere attendance of the course should not be sufficient.

- Produce a training video to supplement the formal training program and mitigate the problem of employee turnover.

### ***Program Implementation***

- Monitor placement of in-store point-of-purchase material for compliance.

### ***Evaluation***

- Employ "mystery shopper" techniques to assess the effectiveness of the sales training program.

### **Potential for Future Use of New Market Transformation Evaluation Techniques Tested**

No new market transformation evaluation techniques were tested as part of this evaluation.



*Mogdal & Associates*

## 2.8 CTAC MARKET EFFECTS STUDY

### STUDY OBJECTIVES AND PROGRAM DESCRIPTION

The CTAC Market Effects Study was conducted by Hagler Bailly Consulting for Southern California Edison (SCE). The study was conducted between spring and winter 1997. The research team was led by Dr. Patricia Garber and Kathleen McElroy of Hagler Bailly Consulting's San Francisco, California office. The report is organized into four chapters with extensive appendices.

The Customer Technology Application Center (CTAC) offers a combination of information services such as demonstration projects, showcases and seminars targeted at all customer sectors and trade allies in the SCE service territory. The information services are provided free of charge. SCE hypothesized that the services would result in five market effects:

- Increased customer demand
- Changes in vendors' stocking and promotional practices
- Changes in manufacturers' production, shipping, pricing and promotional practices
- Increased product variety and availability and decreased prices
- Increased market adoption.

The authors mapped market barriers to market effects. To demonstrate causality associated with CTAC's influence on market effects, they interviewed users and trade allies to assess whether there was evidence that CTAC had led to reductions of market barriers.

SUMMARY TABLES

**Table V2-34: Summary of Study Features**

<b>Title:</b>	CTAC Market Effects Study
<b>Project Number:</b>	3504
<b>Sponsoring Utility:</b>	Southern California Edison
<b>Contractor:</b>	Hagler Bailly Consulting
<b>Sector:</b>	All sectors
<b>End-Use Elements Examined:</b>	Lighting and HVAC
<b>Program Year(s):</b>	1990-1997
<b>Program Intervention(s):</b>	Combination of information services such as demonstration projects, showcases and seminars

**Table V2-35: Key Study Results**

**BARRIERS ADDRESSED**

<b>BARRIERS</b>	<b>ACTORS AFFECTED</b>	<b>BARRIER DESCRIPTION</b>	<b>PROGRAM SUCCESS IN REDUCING BARRIERS</b>
<b>Information Costs</b>	Consumers	Costs of identifying energy-efficient products or services, or of learning about energy-efficient practices	Significant reductions for CTAC seminar participants
<b>Performance Uncertainty</b>	Consumers	Difficulties in evaluating claims about future benefits made from many energy-efficient investments and activities	Significant reductions for CTAC seminar participants
<b>Information Asymmetry</b>	Consumers	More and better information possessed by sellers who have an incentive to provide misleading information	Significant reductions for CTAC seminar participants
<b>Bounded Rationality</b>	Consumers	Inconsistencies between decision-makers' actions and articulated goals, based on habits, customs or rules of thumb	Limited reductions for CTAC seminar participants

**Table V2-36: Key Study Results**

**MARKET EFFECTS MEASURED**

DESCRIPTION OF EFFECT	KEY RESULTS	HOW MEASURED
Increase in market demand for and adoption of energy-efficient measures	67% of CTAC participants purchasing or upgrading lighting equipment selected energy-efficient alternatives; 62% of CTAC participants purchasing or upgrading HVAC equipment selected energy-efficient alternatives; no consensus among trade allies that increased consumer awareness of energy efficiency is translating into increased demand.	CTAC participant interviews; Trade ally interviews
Changes in vendors' stocking and promotional practices	Study noted continuing barriers but no effects.	Trade ally interviews
Changes in manufacturers' production, shipping and promotional practices	Limited evidence of manufacturers' increasing their promotion of energy-efficient equipment, despite continuing barriers.	Trade ally interviews
Increase in the availability and variety of energy-efficiency measures	Diversity and quality of energy-efficient lighting products have improved significantly in recent years; product availability a continuing issue for HVAC equipment.	Trade ally interviews
Reductions in prices of energy-efficiency measures	Prices have come down for energy-efficient lighting but not HVAC equipment.	Trade ally interviews

*Market effects noted are more properly called market changes. There is no link to CTAC program intervention.*

**Table V2-37: Key Study Results**

**NEW DATA COLLECTED**

DESCRIPTION	COLLECTION METHOD	COLLECTION PERIOD
20 in-depth customer interviews with CTAC users (lighting & HVAC)	In-person interviews	1997
2 focus groups with CTAC users (1 lighting, 1 HVAC)	Focus groups	November 1997
175 interviews with users	Telephone surveys	November 1997
48 interviews with trade allies (50% lighting, 50% HVAC)	Telephone surveys	1997

## COMPARISON WITH SCOPING STUDY FRAMEWORK

The authors of the CTAC Market Effects study were able to use the Scoping Study framework as the basis for their analysis of CTAC. The study, however, did not produce a market study. Rather, it focused on the users of CTAC and the effectiveness of the lighting and HVAC seminars on changing users' behavior. There was no characterization of the market, although there are implicit assumptions throughout the report about the market as a whole and CTAC's role in it.

### Market Effects

Measurement of market effects in this study relied on interviews with 48 trade allies randomly selected from those with significant business in the SCE service territory. They were asked their perceptions of changes in the market over the last five years, the source of those changes, anticipated changes in the market over the next five years, and the source of anticipated changes.

The trade allies provided evidence that market changes had occurred over the last five years. The authors attributed the market effects to CTAC; however, the trade ally evidence primarily supported the premise that the hypothesized market effects occurred in the marketplace. We do not find that the attribution of these effects to CTAC is supported by the trade ally interviews.

The reliance on trade ally interviews to measure market effects of the CTAC program, we believe, in part reflects a failure to distinguish between market effects and market changes. The difference between these two outcomes was noted in the Hydraulic Services Market Effects study<sup>6</sup> where market change was defined as “change in some characteristic of the market for an energy-related product, service or practice.” In contrast, market effects were “a change in the structure of a market or the knowledge, attitudes or the behavior of participants in a market that is reflective of an increase in the adoption of energy-efficient products, services, or practices and is causally related to market interventions(s).”<sup>7</sup>

Market changes are general “changes in the marketplace that come about because of reductions in market barriers not associated with an intervention or due to technological and other changes that effectively alter the market without specifically reducing barriers.”<sup>8</sup> Market effects must be attributable to a reduction in market barriers caused by an intervention.

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<sup>6</sup> Conlon, T. and G. Weisbrod, *Hydraulic Services Market Effects Study*, RLW Analytics, Inc., 1998. p. 5-3.

<sup>7</sup> Eto, et al. 1996, p. 9.

<sup>8</sup> Eto, et. al 1996, p. 9.

In addition to a failure to distinguish between market effects and market changes, as will be noted below in a discussion of the evaluation design, we found the study to be more of an effectiveness study than a market effects study. By focusing on customer users of CTAC, the study provided evidence that the actors using CTAC experienced a reduction in perception of market barriers leading to energy-efficient purchases. However, these purchases do not constitute market effects because there are so few of them. And since the trade allies did not credit CTAC activities for market changes, no market effects were demonstrated.

## Market Barriers

The authors of the CTAC study mapped market barriers addressed by CTAC to expected market effects from the CTAC activities. They used a subset of market barriers identified in the Scoping Study and developed questions to determine if customers who had participated in CTAC activities had experienced any reduction in market barriers. The four market barriers they examined were:

- Information costs
- Performance uncertainty
- Information asymmetry
- Bounded rationality.

The process of translating market barriers to questions and of interpreting the responses appears to work very well. Interpretation of the barriers, however, was not always straightforward. For instance, the authors focused on the potential for misleading information resulting from an asymmetric information barrier, although they might well have focused on the different knowledge and skills of sellers versus buyers that lead to asymmetric information.<sup>9</sup> The authors of the CTAC Market Effects Study also noted that barriers of information costs, performance uncertainties and asymmetric information are sometimes indistinguishable from bounded rationality.<sup>10</sup> As we noted in our other study reviews, the nomenclature leaves room for interpretation, making comparisons difficult.

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<sup>9</sup> Garber & McElroy, 1998, p. 3-16, 17.

<sup>10</sup> Garber & McElroy, 1998, p. 3-18.



## Sustainability and Lastingness

We have two concerns about how the authors interpreted the concept of sustainability. First, we wonder how they defined evidence of sustainability. Second, we question the conclusions they drew about sustainability.

The authors stated that sustainability is achieved if there is evidence that:

- The program intervention caused permanent changes in how consumers search for, select or consider energy using-equipment, and
- Private market actors will step in and continue to fulfill the function or service provided by the program intervention.

These measures gauge long-term effects as defined by the Scoping Study, but they may or may not reflect the long-term goals of CTAC. Specifically, if CTAC were not structured to help private market actors take over the activities, that would not be a valid measure of sustainability, but rather a serendipitous result of the intervention. On the other hand, since CTAC was designed to influence the process used to search for, select or consider energy-using equipment, the first criteria is a valid measure of sustainability.

The question of what is a valid measure of sustainable market effects is not specifically addressed in the Scoping Study. However, when conducting evaluations, one must refer to the goals and objectives of the effort and determine what sustainable effects are likely to emerge. Given this study's focus on seminar effectiveness, a more likely measure of sustainable market effects might be evidence that trade allies are bringing customers to and encouraging them to attend CTAC activities. Such a finding would have suggested that the effects of CTAC would continue to grow and that the trade allies were finding value in CTAC as a supplement to their sales practices. However, even this type of finding would not have been a strong indicator of sustainable market effects that persist after the intervention is removed. A finding of sustainable changes in promotional practices resulting from CTAC intervention would have been required to prove long-term market effects beyond those indicated by the immediate users.

A related, but separate, concern is the authors' conclusion regarding sustainability. In the Scoping Study, Eto, et al. review utility programs using their framework and present some conclusions. It is clear from their efforts that sustainability is not an easy conclusion to reach, yet the authors of the CTAC study struggled to conclude that the programs' effects were sustainable while at the same time offering caveats regarding that conclusion.

We believe that a test of sustainability should be fairly rigorous, but will inherently reflect how the evidence of sustainability is framed. In this study, the requirements for evidence were extremely difficult to meet. Had they been different, sustainability could have been more easily demonstrated. The lesson in this is that the ability to evaluate sustainability is enhanced if

program designers define both the market effects they hope to accomplish as well as how those effects might look after the intervention is removed. The process of defining these sometimes is called developing an exit strategy or transition strategy.

### **Comparison to Other Market Transformation Frameworks**

This issue is not applicable to this study.

### **Recommendations for Modifications to Scoping Study**

The Scoping Study framework functions well. However, confusion arises in its application. We believe there should be an emphasis on the difference between market changes and market effects. Market effects must be attributable to the intervention. Market changes must be defined as those alterations in the marketplace that cannot be attributed directly to the intervention.

Sustainability is treated almost as an afterthought in Chapter 2 of the Scoping Study, yet we have found it to warrant much more consideration.

Setting forth the exit strategy for when a market transformation effort would be deemed ready for transition to the private market, or defining the basis upon which long-term effects will be measured sets the parameters for drawing conclusions about sustainability. As market transformation programs are designed, defining these criteria should be part of the process of setting program goals and objectives and not left to the evaluators to assume. This will make measurement of the goals and objectives more rational and valid relative to the program intent.

## **STRENGTHS AND WEAKNESSES OF METHODOLOGIES**

### **Strengths and Weaknesses of Evaluation Design**

#### ***Strength***

- The strength of the evaluation design was the reliance on high-quality qualitative data. The depth of information obtained using a qualitative data collection strategy for the customer and trade ally interviews provides a wealth of material about the structure and characteristics of the lighting and HVAC markets. Unfortunately, these data were not used to develop a comprehensive assessment of the market structure, though they could have been.

#### ***Weaknesses***

We identified four major weaknesses with the evaluation design.

- The population of CTAC users was listed as 140,000. The research study noted that a list of 560 customer users of CTAC was used as the sample base for the 175 customer surveys. However, there was no indication of what proportion of the CTAC 140,000 visitors actually were customers and therefore what the interviews with customers represent. The authors revealed that customer users of CTAC may be as few as 25% of the total visitors. An analysis of the 140,000 users of CTAC would have improved our understanding of the purpose and effectiveness of the center.
- A related weakness concerns the trade allies sample. The report did not indicate the size of the trade ally population from which the 48 contacts were drawn. Of further concern is that in our conversations with the study's authors, they noted that trade allies also were significant users of CTAC. Yet the sampling of trade allies was drawn from the southern California region as a whole, and no effort was made to sample from trade ally users.
- Related to the first weakness—of not knowing the proportion of users who are actually customers—we also cannot determine the merit of or the problems caused by not including nonparticipants. If the proportion of CTAC users who are customers is quite low, and if they represent a small percentage of similar customers served by SCE, then inclusion of nonparticipants would not make sense. However, this is never discussed or explained.
- The most serious problem concerns the focus on program participants. The study chose to focus on customer users of CTAC and trade allies from the general southern California market. The survey of customers focused on the effectiveness of the seminars in reducing the barriers the CTAC seminar participants faced when attempting to purchase energy-efficient equipment. This can be seen as consistent with the Scoping Study framework by positing that the reduction of market barriers from an intervention will lead to market effects. However, it is critical to note that by focusing on the users, the results focus only on the market effects for users and not for or within the market as a whole.
- Meanwhile, the trade ally research was designed to look at market-level market effects yet found none. This component of the research demonstrated that trade allies did not attribute the market changes that have occurred to CTAC, but rather to other efforts by the utilities and the marketplace in general. If customers represent about 25% of the users of CTAC, then this finding from the trade ally research could have been anticipated and should have been reflected in a methodology that would have been consistent with CTAC usage patterns. If trade allies use CTAC, it would have been more effective to focus on market effects on trade ally CTAC users, rather than drawing a sample only from the market as a whole.

We find that the study design provided a weak measure of market effects attributable to CTAC activities because it chose a mixed focus. It appears that CTAC will take a long time to have a broad market effect, if ever. However, by failing to focus on the same level of effects on various participants, the study did not convincingly support the claimed conclusions about market effects.

### **Comparison to Economic Framework**

The study made no attempt to pose a new framework or to explicitly rely on the economic framework that forms the foundation of the Scoping Study.

## **STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES**

### **Assessment of Data Completeness**

#### ***Strength***

- The quality of the data collected from the customers and from the trade allies is excellent. Given the narrow focus of the research, data completeness is adequate. We wish that these data had been used to develop a more complete picture of the market characteristics of the southern California commercial lighting and HVAC markets. We sense that sufficient data are present to do this, but note that it was lacking from the study.

#### ***Weaknesses***

- As good as the qualitative data are, as discussed above, the evaluation design leaves the reader looking for data from other sources: trade allies who used CTAC, other users of CTAC besides customers, and nonparticipating customers if the focus were to be on the market as a whole, rather than just users. Had the evaluation design clearly focused on users or on the market as a whole, data completeness would have been more satisfactory.
- Finally, it appears that a significant set of data was ignored in the analysis. We would have preferred an analysis of the sign-in sheets used to generate the lists of users. Also, we would ask several questions: How many people actually use CTAC? Which professions do they represent? How often do they come to the center and what types of activities do they use? Does usage of CTAC spread within firms or is it focused on a single user from a firm? What happens when a user of CTAC changes jobs? How do

repeat visits to CTAC affect market decisions by CTAC users? Evidence supporting or refuting claims of market effects could have been drawn from such an analysis.

## **Assessment of Data Collection Procedures**

### ***Strength***

- The data collection procedures were consistent with industry standards. An unusual, but effective, strategy was used to solicit customers for interviews, focus groups and surveys. A master list of customers who had used CTAC was used as the basis. Customers were screened first for the in-depth interview. If they were unable to do the interview, they were asked to participate in a focus group. If they were unable to do that, they were asked to be available for a telephone survey. At that point the customers were put in the pool of possible contacts for the telephone survey. Given the difficulty in finding the right person for commercial sector surveys, this approach seemed to work well.

### ***Weaknesses***

- Although the authors provided a full sample disposition for the 560 customers in the survey sample base, they did not provide the sample disposition for the population used to recruit customers for the in-depth interviews and the focus groups. We assume that the sample base was larger than 560, but this never was mentioned. Sample disposition reports should be standard practice for any field data collection effort.
- Similarly, there was no discussion of the screening process used for trade allies nor a sample disposition table for those interviews. It would be quite useful to know the population and base sample sizes when judging the veracity of claims for market effects.

## **SUSTAINABILITY AND LASTINGNESS**

### **Criteria Examined for Sustainability**

The study examined sustainability in two ways:

1. The telephone survey of customers included questions regarding the extent to which the customer continued to refer to CTAC seminar materials in energy equipment decision-making. Sixty-four percent of the surveyed customers said that they still refer to the material and 85% said that the information they learned in CTAC

activities had “not faded from memory.” No other direct measure of sustainability for customers was used.

2. In the trade ally survey, the authors asked the trade allies to qualitatively assess whether the market changes they had observed over the previous five years would continue into the next five years.

When the authors found evidence from the in-depth interviews, focus groups and customer surveys that the market barriers that track to the market effects were reduced by CTAC activities, the authors then attempted to link the market changes reported by the trade allies to CTAC.

### **Critique of the Evaluation’s Evidence and Conclusions with Regard to Sustainability**

The authors indicated that a measure of sustainability is not easily provided in the context of a “one-time retrospective study.” Rather they stated that measurement of lastingness and sustainability require “using a measurement and tracking approach that CADMAC and other interested parties can accept as reasonable.”<sup>11</sup> We do not agree. One-time measurement could test for sustainability, as long as the focus of the research is clear.

Either of the two measurement criteria could have been sufficient to declare sustainability, if the evaluation design had supported this approach. The first criteria mentioned by the authors could provide a reasonable and acceptable measure of the sustainability of the CTAC services by the CTAC users providing we knew that the 175 surveyed customers were representative of all CTAC users or even all SCE customers who are also CTAC users.

For the second criteria, the qualitative assessment of sustainability of market changes reported by trade allies could be a reasonable and acceptable measure of sustainable market changes providing we knew that the 48 trade allies were representative of all trade allies in the southern California commercial lighting and HVAC markets. However, there was no indication from the trade ally interviews that CTAC activities had but the remotest impact on these market changes.

The problem in the analysis comes in linking the two results. Again, the analysis of the data collected should reflect the research design. The design here focused on users and tried to link them to the market. The conclusions about sustainability must reflect the source. Essentially we interpret the study as demonstrating that CTAC information services were sustainable for the customer users who were interviewed, and that sustainable market changes have occurred in the lighting and HVAC markets as evidenced by the trade allies interviews. However, we do not find

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<sup>11</sup> Garber & McElroy, 1998, p. 3-2.

any demonstration of sustainable market effects from CTAC information services in the market as a whole.

## **OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION**

### **Strengths and Weaknesses of CTAC as a Market Transformation Program**

CTAC may be an excellent market transformation vehicle or a poor one. Unfortunately we do not know the answer based on the market effects evaluation. It may be an excellent market transformation vehicle because users of CTAC do in fact appear to make more purchases of energy-efficient equipment after participating in CTAC activities and do refer to and use CTAC materials in making those decisions. However, there is no indication that CTAC is increasing its circle of users, although they could. Nor is there any indication that CTAC is influencing trade allies, although they could and discussions with the authors suggest that they do.

The main benefit for market transformation program design lies in the detailed data provided in the appendix. These include summaries of results from interviews with customers and trade allies. These data could be mined to develop a market characterization study of the commercial lighting and HVAC markets in southern California.

### **Potential for Future Use of New Market Transformation Evaluation Techniques Tested**

No new methods were tested. What is clear from this evaluation is the need to define the focus of the program and the evaluation. In some cases the user is an appropriate focus. This will occur when a market transformation program is focused on individual behaviors such as information centers and training programs. However, within the program there must be a theory of how the individual behaviors are translated into market effects. Then an evaluation can measure the success of that process.

The CTAC effort was based on a theory of market effects that assumed that individuals would learn and gain information, then make better decisions. The theory requires that increasing numbers of customers and trade allies are gaining that information. The evaluation would have provided a more effective measure of market effects if it had traced the process.

## 2.9 COMMERCIAL AND INDUSTRIAL (C&I) ENERGY EFFICIENCY PROGRAMS

### STUDY OBJECTIVES AND PROGRAM DESCRIPTION

Quantum Consulting conducted a study of two of Southern California Edison Company's (SCE's) commercial and industrial (C&I) energy efficiency programs. These were the C&I Energy Management and Hardware Rebate Program and the Energy Management Services Program. These are energy-efficient equipment rebate and audit programs for SCE's C&I customers.

The study focused on the market effects of five technologies. These five technologies are fluorescent lighting, packaged air conditioning systems, motors, adjustable speed drives (ASD) and energy management systems (EMS). The evaluation team studied the market effects of these two programs on these technology groups using a combination of survey techniques and regression analyses.

The study was designed to assess how the program induced changes in the following four areas:

- Customer actions and attitudes
- Manufacturer product mix and practices
- Distributor/contractor attitudes and practices
- Engineering/design firm attitudes and practices.

The report's format for the report was quite different than that of all the other market effects studies. The format used a presentation style on a landscape print, with no page numbers provided on the facing pages, while material was included there a significant percentage of the time. Encouraging innovation as the new field of market transformation analysis is created is important. However, this format did not work well with the material presented. That needed to be presented to make the study a complete market effects study.



**SUMMARY TABLES**

**Table 2-38: Summary of Study Features**

<b>Title:</b>	Evaluating the Market Effects of Southern California Edison's Commercial and Industrial Energy Efficiency Programs
<b>Project Number:</b>	3505/3506
<b>Sponsoring Utility:</b>	Southern California Edison
<b>Contractor:</b>	Quantum Consulting Inc.
<b>Sector:</b>	Commercial/Industrial
<b>End-Use Elements Examined:</b>	Fluorescent lighting, packaged air conditioning, motors, adjustable speed drives (ASDs), and energy management systems (EMSs)
<b>Program Year(s):</b>	NA
<b>Program Intervention(s):</b>	NA

**Table 2-39: Key Study Results**

**BARRIERS ADDRESSED**

<b>BARRIERS</b>	<b>ACTORS AFFECTED</b>	<b>BARRIER DESCRIPTION</b>	<b>PROGRAM SUCCESS IN REDUCING MARKET BARRIER</b>
		None identified as significant	

**Table 2-40: Key Study Results**

**MARKET EFFECTS MEASURED**

DESCRIPTION OF EFFECT	KEY RESULTS	HOW MEASURED
<b>Customer Effects</b>	More (but not significantly) energy efficient installations self-reported in Edison territory; tax forms corroborate; Significant higher response for importance of energy efficiency; Significantly higher level of familiarity with EE lighting among future replacers in Edison territory than other territories; Somewhat lower overall mean barrier level, but not significant; Higher response for “too many resources required”	Comparison to Georgia Power and Louisiana Power and Light service territories
<b>Designer Effects</b>	Higher proportion of EE lighting specified	Comparison to Georgia Power and Louisiana Power and Light service territories
<b>Customer Effects</b>	Significantly higher percent of EE installations in Edison territory; Larger difference between future and past replacer barriers; No significant difference in perceived barriers	Comparison to Georgia Power and Louisiana Power and Light service territories

**Table 2-41: Key Study Results**

**EXISTING DATA USED**

DESCRIPTION	COLLECTION PERIOD
Comm. Energy Use Survey (n= 3987)	
Customer Attitude Survey (n= 892)	
Customer Attitude Survey (n= 1815)	
Comm. Energy Use Survey (n= 4800)	
Comm. Energy Use Survey (n= 2113)	
Indstrl. Energy Use Survey (n= 759)	
Comm. Energy Use Survey (onsite)(n= ~700)	
Comm. Impact Evaln. (n= 415)	
Segment'n Study (n= ~1500)	
Comm. Energy Use Survey (onsite) (n= ~500)	

**Table 2-42: Key Study Results**

**NEW DATA COLLECTED**

DESCRIPTION	COLLECTION METHOD	COLLECTION PERIOD
Customers - Canvas Surveys (n = 2000)	Phone survey	Unknown
Customers - Replacement/Attitude Data (n = 300)	Phone survey	Unknown
Contractors/Distributors - HVAC (n= 50)	Phone survey	Unknown
Contractors/Distributors - Lighting (n= 50)	Phone survey	Unknown
Contractors/Distributors - Motors/ASDs (n= 50)	Phone survey	Unknown
Design/Engineering Firms (n = 50)	Phone survey	Unknown

## COMPARISON WITH SCOPING STUDY FRAMEWORK

### Market Effects

The C&I Energy Efficiency Program Study examined four market effects and a set of market barriers for the following:

- C&I customers
- Manufacturers
- Distributors/contractors
- Engineering/design firms.

The evaluation made creative use of regression analysis techniques and factor analyses to study attitudes, barriers and ultimate market impacts. Although these techniques do not provide stand-alone proof of the effects of SCE's two C&I programs, they support other evidence as to its value. Another successful element of this study was the decision to survey trade allies and contractors in regions outside of SCE's service territory to better understand the impact of the program on the marketplace.

The study included a list of potential market effects that focus on changes in attitudes, product mix and practices of the groups above as a result of SCE's two C&I programs. While the Quantum team set ambitious goals for this study, it was not entirely successful. Part of the reason was that the research questions were too large, and were not linked by cause-and-effect in a convincing manner.

### Market Barriers

The elimination, or reduction, of market barriers is a critical element of any program aimed at market transformation. The analysis performed by Quantum Consulting is predicated on key assumptions, made at the outset, as to which market barriers were important to the technology groups in the study. The list of market barriers was developed based on the following process:

- Expert judgment
  - The evaluation team used its expert judgment and industry track record to develop an initial list of market barriers that should be included in this study.
- Literature review

- This professional judgment was augmented by a review of the literature on market barriers for these technology groups.
- Pre-test
  - The purpose of the pre-test was to learn more about hypothesized barriers and craft specific barrier questions.

In the opinion of the reviewers, the analysis of barriers could have been strengthened using more rigorous analytical techniques such as focus groups or one-on-one interviews. This would have enabled the evaluation team to incorporate input from key stakeholders in a way that helped from the frame the overall analysis rather than simply fine-tune questions that were established *a priori*. Ultimately, the evaluation team posed a set of generic questions pertaining to market barriers that were asked for all technologies. This approach precluded any possibility that individual technologies might have unique barriers or that new information could shape the analysis. However, the technique utilized here is quite common among the market effects studies and may reflect their general level of maturity or a lack of funds to conduct the analysis in this step-by-step approach.

The market barrier questions involved statements which customers in the surveys were asked to score on a 1-10 scale, from “strongly disagree” to “strongly agree.” Each question was aimed at understanding a specific market barrier. The study did not provide a list of the 14 statements that were asked. It would have been useful to have had this information mapped to the hypothesized market barrier that it was intended to measure. Basic disclosure of this nature not only provides clarification to the reader, but it furthers the art of market transformation evaluation.

A clear understanding of market barriers is critical to be able to understand causal relationships and market effects of programs. Yet, the evaluation only reported results for each of the specified barriers in an Appendix (pp. 94-163). This information would have been much more useful in the main body of the report, accompanied by an interpretation regarding market transformation potential.

### **Sustainability and Lastingness**

Sustainability and lastingness of market impacts are critical to any real understanding of market transformation. It is a shortcoming of the study that this issue has not examined in more than a cursory fashion.

### **Recommendations for Modifications to Scoping Study**

The Scoping Study did not explicitly link market barriers and market effects, though it did imply

such a link. As the Scoping Study is used in the future, examining all the links in the process, theoretically and in measurement will be essential.

## **STRENGTHS AND WEAKNESSES OF METHODOLOGIES**

### **Strengths and Weaknesses of Evaluation Design**

The objective of the evaluation was to assess four very broad hypotheses, each pertaining to a specific group -- customers, manufacturers, distributors/contractors and engineering/design firms. Specifically, the evaluation was designed to answer the following questions:

- How have SCE's programs changed customer actions and attitudes?
- How have SCE's programs changed manufacturer product mixes and practices?
- How have SCE's programs changed distributor/contractor attitudes and practices?
- How have SCE's programs changed engineering/design firm attitudes and practices?

The market study explored these four questions for five technology groups: energy-efficient lighting, air conditioning, motors, adjustable speed drives (ASDs) and energy management systems (EMS).

Market effects for each technology group were measured through the use of comparison groups using self-reported data on efficiency purchases. This involved comparing the efficiency of purchases in each of the five equipment categories for the following groups of C&I customers:

- Audit-only participants (in SCE's service territory)
- Nonparticipants (in SCE's service territory)
- Purchases in a territory in which no programs were offered promoting these measures (Georgia Power)
- Purchases in territories with audit-only programs (Louisiana Power & Light, NYSEG).

The study was designed to simulate the market in the absence of SCE's two programs. The overall framework built on earlier industry analyses that estimated program impacts by studying specific populations (in this case, nonparticipating SCE customers) and specially selected comparison groups. Using this approach, the net market effect can be calculated as the difference in efficiencies of equipment in two groups--that purchased in areas served by SCE (outside

SCE's programs) and that purchased by a comparable set of customers in territories in which no such programs are offered.

### ***Strengths***

The main strengths of this analysis approach do not pertain to the surveys or data collection, but the modeling that took place after the fact.

- The evaluation team made innovative use of regression analysis techniques to gauge attitudes. Although such regressions do not constitute proof of market effects, they offer corroborating evidence of such impacts. This approach is noteworthy and warrants examination in future studies, though the results in this study are quite weak.
- Factor analysis of market barriers provided interesting insight into how customers perceive market barriers. It was used successfully by the evaluation team to study equipment costs (broadly defined) and acquisition of operating cost. It also provides real insight into customer issues such as trustworthiness with equipment distributors and manufacturers. This kind of analysis could be used to inform subsequent research concerning equipment design and marketing.

### ***Weaknesses***

- The overall analyses posed very broad questions and, as such, defied straightforward analysis and measurement. Indeed, persuasive answers did not emerge from the analytical framework used by the evaluation team. The evaluation design could have been improved by simplifying the questions and setting out to study measurable processes that answer related (and equally relevant) questions. For example, the evaluation team could have assessed market effects by researching the path between a set of hypothesized barriers and ultimate measure adoption. As it was, the evaluation did not link market barriers and actions. This linkage is a key element in providing evidence of program causality of the market effects. To their credit, however, the study authors did recognize the need for a market characterization, a better understanding of the Edison territory and the comparison areas, and a pre and post-program tracking system to measure causality (pg 2-13).
- A large body of literature in the demand-side management evaluation field points out the self-selection biases that exist in examining the actions of participants versus program non-participants. Using nonparticipants to represent the market effects (excluding direct program participation) for all SCE customers should be expected to produce a downwardly biased estimate of market effects. This issue and the likely

direction of the bias were not recognized or discussed in this study, a critical shortcoming in the methodology and discussion.

- The attitude prediction model opposite page 2-6 appears to include endogenous variables. Though not shown in the report (as would be recommended), the appendices provide statistics that show poor model performance. There is no discussion of this, the alternative models attempted or justification supporting this model.
- Excluding those responses of zero variance has no effect on the final factor analysis measurements. Yet, it makes these responses equivalent to nonresponses. Given this, a discussion concerning potential nonresponse bias would have been useful.

## **STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES**

### **Assessment of Data Completeness**

#### ***C&I Customers***

For the customer surveys, the evaluation team canvassed 2,000 SCE nonparticipants, 1,000 in the audit-only service territory and 1,000 in the area in which no program was offered. From this group, samples that replaced equipment were drawn. Customers were screened so that the resultant sample was confined to customers who replaced one or more of the five equipment groups. The final samples included 300 SCE nonparticipants, 150 audit-only customers (from a non-SCE service territory) and 150 no-program customers (from a non-SCE service territory).

#### ***Trade Allies***

The evaluation team surveyed sets of contractors/distributors and design/engineering firms. This included 50 contractors/distributors in the SCE territory and 50 in other service territories. Three groups of contractors/distributors were surveyed. These were those who specialized in HVAC, lighting and motors/ASDs. Similarly, two groups of design/engineering firms were surveyed: one group of 50 located in the SCE territory and another group of 50 in other service territories.

#### ***Strengths***

- The data used in the analysis was complete insofar as survey information was successfully collected on samples within the three target groups – customers, distributors/contractors and engineering/design firms – within SCE’s service territory and outside of it.



- The study included a large screening in order to properly survey only those customers that made replacements (have been in the market being examined). Many studies have been unwilling to perform this expensive step. However, doing so significantly improves the quality of the study, allowing actual behavior to be examined rather than just attitudes or hypothetical intentions.
- The Quantum team selected comparison groups through a logical process that involved consideration of climate (cooling degree days/year), C&I programs and Greenness Voting Index (from the League of Conservation Voters). However, theory and reality soon departed when no suitable matches were found. The evaluation team selected Georgia Power Company as the “no program” service territory due to its size, customer mix, CDD and absence of DSM programs. The audit-only groups selected were Louisiana Power & Light (due to similarity in CDD) and NYSEG (due to comparability to SCE in terms of rates). However, because NYSEG has very different weather than SCE no analysis of HVAC was performed for this territory.
- The SCE nonparticipant sample was selected using criteria that was carried over from earlier evaluation studies. The sample was stratified by building type, rate class and kWh consumption. High kWh usage C&I customers were sampled at a higher rate, with some deletions of customers who have been historically over-surveyed. The comparison groups were matched to the SCE nonparticipant sample as closely as possible, with information on Standard Industrial Classification Codes from Dun and Bradstreet, and assumptions regarding usage and rate classes. This is a reasonable procedure, although there are doubts as to how well the evaluation team actually was able to match customers in the comparison groups to the SCE nonparticipant group. There also was no discussion providing clear justification that the potential benefits of this approach outweigh those of using a simpler sampling method for SCE customers that could have been replicated for non-SCE customers.
- The contractor and trade ally interviews in comparison areas generally was innovative, and largely successful. This facilitated a more solid examination of market barriers and comparison of program to non-program areas.

### *Weaknesses*

- The report’s authors noted, quite correctly, that the analysis would have been enhanced by a market characterization and a better understanding of other service areas. This also would have allowed the analysis to make a stronger case for causality.
- It appears that there was little or no screening regarding specific measures that customers in the various samples replaced. Had this been done, it would have been possible to sample a predetermined number of customers who purchased equipment

in each of the five categories. Instead, the analysis was based on broad sample quotas determined by the characteristics of the three territories. Even after-the-fact equipment replacement numbers are not available in the main body of the report, as equipment replacement rates are broad averages. Consequently, it is not clear how statistically robust the results are for each measure group. The aggregate information that is provided is of minimal value.

### **Assessment of Data Collection Procedures**

The data collection procedures appear to meet industry standards.

## **SUSTAINABILITY AND LASTINGNESS**

### **Critiques of the Evaluation's Evidence and Conclusions with Regard to Sustainability**

As noted above, sustainability of market impacts is critical to any real understanding of market transformation. This study did not, unfortunately, examine the issue in more than a cursory fashion. In fact, sustainability was mentioned only once, in passing, in a discussion of designers and engineers. This discussion stated that designers and engineers pointed out in the surveys that new codes for energy efficiency are evidence of the permanence of change. They believed that it would be fickle to expect change to be customer-driven. They pointed out that their profession historically has recommended what their clients want. Energy efficiency is not (and probably never will be) of paramount importance to every decision-maker for a C&I building. Few market effects were found in the study. Given this, the lack of testing for sustainability is somewhat less problematic.

## **OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION**

### **Strengths and Weaknesses of Program as Market Transformation Program**

There are a number of strengths and weaknesses of the program that warrant its consideration as a prospective market transformation model. Any future program should incorporate the following lessons from this study:

- It appears that less complex technology may have greater informational market barriers than highly complex technologies (EMS and ASDs) where the decision-maker tends to be more sophisticated.

- Hidden costs appear more important to lighting decisions than to EMS, ASDs or motors. The Quantum team hypothesized that this might have been due to the sophistication and/or confidence of key decision-makers.
- It is reasonable to expect that collecting data from customers on the efficiency level of equipment needs to have on-site verification to document efficiencies, or at least paperwork verification such as a fax invoice or equipment specifications.
- The strongest case of market effects was found for lighting, where some evidence of effects in each element of the market chain was observed.

### **Potential for Future Use of New Market Transformation Evaluation Techniques Tested**

Future market assessment studies should consider the following issues and/or lessons from this study:

- Any future market assessment study that relies on comparison groups outside of SCE's service territory should perform a market characterization to better understand causality.
- Contractor and trade ally interviews in both the program area and non-program areas can provide valuable information that might not be available.
- Subsequent studies need to establish clearer linkages between specific market barriers and actions taken. This may be accomplished using focus groups or other research techniques that explore specific questions in greater depth.
- The study author's use of regression techniques to quantify attitudes was an interesting addition. This might work well in future market studies.
- Future market assessment studies must explore the issue of sustainability explicitly; it was glossed over in this study.
- Possibilities of selectivity in the survey sample need to be addressed in future studies.
- It would be useful if future studies explored unexplained phenomena. For example, replacement rates in this study were found to be higher in the no-program and audit-only areas than at SCE. This should have been addressed; at least with hypotheses as to why this might be the case.

## 2.10 HYDRAULIC SERVICES MARKET EFFECTS STUDY

RLW Analytics, Inc. conducted the market effects study of Southern California Edison’s (SCE) Hydraulic Services Program in 1997. This study, led by Tom Conlon of RLW Analytics and Glen Weisbrod of Economic Development Research Group, was organized as follows:

- Findings of program effects
- Customer survey results
- Market player interview results
- Market transformation assessment.

The Hydraulic Services Program is an extremely long-standing (over 80 years) information program providing services to agricultural and municipal water pump end-users. The program provides pump-testing services at no cost to the participants. This testing produces information that is expected to influence maintenance procedures that improve the energy efficiency of the pumps, and increase the purchase of more energy-efficient pumps. The program was originally designed as a marketing and customer service program. As was noted in the market effects study, this has implications for the current measurement of market effects, as market barriers were not previously identified or targeted.

### SUMMARY TABLES

**Table V2-43: Summary of Study Features**

<b>Title:</b>	Hydraulic Services Program Market Effects Study
<b>Project Number:</b>	3507
<b>Sponsoring Utility:</b>	Southern California Edison
<b>Contractor:</b>	RLW Analytics, Inc.
<b>Sector:</b>	Agriculture
<b>End-Use Elements Examined:</b>	Pumps
<b>Program Year(s):</b>	1911-1997
<b>Program Intervention(s):</b>	No-cost pump testing services

**Table V2-44: Key Study Results**

**BARRIERS ADDRESSED**

<b>BARRIERS</b>	<b>ACTORS AFFECTED</b>	<b>BARRIER DESCRIPTION</b>	<b>PROGRAM SUCCESS IN REDUCING MARKET BARRIERS</b>
<b>Information Search/ Hassle Costs</b>	Customers	Costs of acquiring new information regarding pumping energy efficiency	Reduced costs to customers of collect-ing general and site-specific information
<b>Performance Uncertainties/ Hidden Costs</b>	Customers	Risks perceived by customers in adopting new practices or technologies	Reduced customer uncertainty
<b>Asymmetric Information Availability</b>	Customers	Dealers or manufacturers have more information on product features and alternatives than customers.	Reduced indirectly
<b>Bounded Rationality</b>	Customers	Customers do not address equipment mal-functions or practice predictive maintenance even though doing so would be cost-effective.	Reduced
<b>Organization Practices</b>	Customers	Predictive maintenance, priority pumping and cost-benefit analysis are not part of the institutional practice; competitive bidding processes ignore or undervalue benefits of energy efficiency.	Reduced
<b>Financing</b>	Customers	Lack of internal or external means to finance additional investment that could return savings in the longer term	None
<b>Externalities</b>	Customers	Lack of public incentive mechanism to subsidize incremental costs of purchasing higher efficiency equipment that produce public benefits	None
<b>Other Mis-Pricing</b>	Customers	Mispriced water constitutes barrier to energy and water efficiency.	None
<b>Misplaced Or Split Incentives</b>	Customers	Cities have no incentive to invest in energy effi-ciency since savings accrue to the general fund rather than the pumping operations budget.	None
<b>Ability to Separate Product Features</b>	Customers	Ability to mix and match components of varying efficiency precludes standard system for classifying overall long-term pump efficiency; energy-efficiency ratings do not account for differences in life-cycle savings due to quality of materials and construction.	None

**Table V2-45: Key Study Results**

**MARKET EFFECTS MEASURED**

DESCRIPTION OF EFFECT	KEY RESULTS	HOW MEASURED
Reduced time or cost of collecting information	Reported by 24% of all participating customers	Participant customer surveys
Reduced hassle of getting pumps tested	Reported by 23% of all participating customers	Participant customer surveys
Indirect information flows to nonparticipants	General increased awareness of energy efficiency but not increased pump testing	Interviews with SCE staff
Reduced doubt and uncertainty when making purchases	Reported by 28% of participating water supply customers and 16% of participating agricultural customers	Participant customer surveys
Reduced information disadvantage with dealers and suppliers	Reported by 27% of participating water supply customers and 0.6% of participating agricultural customers	Participant customer surveys
Reduced dealer information advantage	High ratings for program effects on customer knowledge of pump efficiency choices, contractor follow-up and maintenance accuracy in matching pump products to user needs	Dealer surveys
Helped customers document complaints to manufacturers	80% of manufacturers reported program increased complaints from customers that pumps do not operate per specifications	Manufacturer surveys
Testing-driven pump repairs occurred in cases where they typically would not, despite the energy savings and cost-effectiveness benefits	Over 50% of dealers' repair work resulted from an SCE pump test	Dealer surveys
Large incidence of predictive maintenance	20% of water supply participants and 4% of agricultural participants reported that the program changed their attitudes about technologies and business practices; 62% of participant water suppliers reported that they always or usually practice predictive maintenance	Participant customer surveys
Changes in business practices	23% of water supply customers and 3% of agricultural customers felt the program had changed the way they are organized or do business	Participant customer surveys

**Table V2-46: Key Study Results**

**EXISTING DATA USED**

DESCRIPTION	COLLECTION PERIOD
SCE pump test database: 28,156 tests for 664 "top" customers	1990-1997
US Industrial Electric Motor System Market Assessment (Xenergy)	1997
Pump Plant Efficiency Tests ( <i>Irrigation Journal Magazine</i> )	1995
SCE equipment saturation survey	1992
Electric Motors-Markets, Trends, and Applications (EPRI)	1992
Texas irrigation pumping plant efficiency testing program (Texas Agricultural Extension)	1995
SCE program impact evaluation	1996
Energy Efficient Motor Systems (ACEEE)	1992
Field Determination of Agricultural Pumping Plant Electric Motor Efficiencies (Center for Irrigation Technology, 1994)	1994
Cost of Pumping Irrigation Water in Central Arizona (Arizona Agricultural Experiment Station)	

**Table V2-47: Key Study Results**  
**NEW DATA COLLECTED**

DESCRIPTION	COLLECTION METHOD	COLLECTION PERIOD
7 water agency customers	In-person at trade show	1997
7 dealers, contractors, or vendors	In-person at trade show	1997
10 largest national water pump manufacturers	Telephone	1997
10 banks or credit institutions	Telephone	1997
7 SCE staff; 8 TX and AZ utility staff	In-person and telephone	1997
2 private pump test service providers	In-person at trade show	1997
95 participating agricultural and municipal water agency customers	Telephone	1997
19 major pump dealers	Telephone	1997
10 major regional distributors	Telephone	1997
10 water agency regulatory personnel	Telephone	1997
9 recognized pumping industry experts; 9 consulting engineers to municipal water agencies	Telephone	1997

## COMPARISON WITH SCOPING STUDY FRAMEWORK

### Market Effects

In many ways, the Hydraulic Services Study referred to and used the same terminology as the Scoping Study. There are, however, a few important areas of divergence. The first is that the Hydraulic Services Study placed much greater emphasis on the term “market change.” The authors defined market change as any kind of observable and measurable change in the market; market effects were defined as those market changes that were attributable to the program. The Study authors used this distinction to help ensure that these two are not confused, which is easily and often done. This distinction is consistent with the Scoping Study’s definition of market effects, where market changes also are discussed.<sup>12</sup> Nonetheless, the presentation style of the definitions in the Scoping Study did not emphasize defining market change as an important

<sup>12</sup> Hydraulic Services Study, p. 9.



element of the framework.<sup>13</sup> The Hydraulic Services Study did provide this additional emphasis that can be used to improve future market transformation studies. Yet, though discussed as important in the study's first chapter, this concept was not actually used in the analysis or the derivation of the market transformation discussion in Chapter 5.

The Hydraulic Services Study examined 29 hypothesized market effects. These were grouped by market actor:

- Customer-Level Effects
  - Direct participant effects
  - Indirect participant spillover effects
  - Indirect nonparticipant spillover effects
- Dealer/Contractor-Level Effects
- Manufacturer/Distributor-Level Effects
- Other Market Player Level-Effects
  - Financial intermediaries
  - Regulatory parties
  - Independent pump contractors

This program provided pump testing. The testing information was expected to influence maintenance procedures, thereby increasing the energy efficiency of the pumps already in use and the purchase of more energy-efficient pumps. The Hydraulic Services Study examined the pump-testing marketing. We believe that it also would have been helpful if the authors had discussed the link to energy efficiency. A reduction in market barriers and subsequent market effects would be required to demonstrate the value of the program. The ultimate market effect for this program is not an established pump-testing market. An established but unsupported pump-testing market would prove market transformation of the pump-testing market but not of the hydraulic-pumping market. This needs to be explicit and could have been supported by citing prior impact evaluations.

In addition, it would have been helpful to have learned from the study whether all pump maintenance and repair and new pump purchases were within one market or two distinct

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<sup>13</sup> The Hydraulics Services study claimed that the concept of market change was not included in the Scoping Study (p. 5-3). However, this is incorrect. The concept was in the Scoping Study, but was not emphasized or used much to create a systematic approach to change versus program-induced effect.

markets. These market(s) then should have been related both forward (to the energy-efficiency gains) and backward (to the influence from pump-testing information).

## Market Barriers

The Hydraulic Services Study authors chose to group the market barriers in general categories, supported by their citation of market barrier refinements recommended by Herman et al.<sup>14</sup> Their five categories are:

- Informational barriers
- Behavioral barriers
- Structural barriers
- Pricing-related barriers
- Product/service feature-related barriers.

These categories were mapped to the Scoping Study list of market barriers.<sup>15</sup> The 29 hypothesized market effects then were mapped to their related market barriers in Exhibit 5-2. In general, we agree that this approach – of reducing the list of categories and mapping to categories – facilitates the identification and understanding of market barriers.

Nonetheless, some members of the Summary Study team disagreed with the use of the term “uneconomic behaviors” by the authors of the Hydraulic Services Study to describe bounded rationality. This term is in contrast to many developments in the field of economics over the last 10 years. Not selecting an item with the lowest life-cycle costs (positive benefit/cost ratio) may be a rational economic decision in light of opportunity costs and budget constraints, transaction costs and preferences (utility curves). Examination of benefit/cost ratios as an explanation of why certain investments “should” occur often ignores the importance of opportunity costs in a resource-constrained environment. With a broad interpretation of utility curves, there are no irrational economic decisions, only misunderstood opportunity costs, utility curves and transaction costs. We may not agree with an individual’s perceptions or the tradeoffs they feel are beneficial as seen in their utility curves, but that does not make them wrong.

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<sup>14</sup> Herman, P., S. Feldman, L. Hescong, and D. Mahone. (1996) *Residential New Construction Market Characterization*. Prepared for: Southern California Edison Company, and Pacific Gas & Electric Company, December 6, 1996. (CADMAC report no. TRR66.52.H2).

<sup>15</sup> Hydraulic Services Study, pp. 5-14.

## **Sustainability and Lastingness**

The discussion of sustainability criteria<sup>16</sup> is consistent with the one in the Scoping Study and generally summarizes the concept of sustainability. In essence, it posits that shifts in regulations are structural changes that likely will be permanent, while customer attitudes and perceptions can be lasting but may change as other customers or market actors enter the market, and no program effort exists. In between these two are shifts in product offerings and stocking practices, which may be reversed but are more likely to be maintained, as the market entry for these market actors is slower than on the customer side.

## **Recommendations For Modifications To Scoping Study**

Although the Hydraulic Services Study did not fully expand on its distinctions between market changes and market effects, it is a useful addition to the Scoping Study framework. Emphasizing market change as differentiated from market effect can offer a more systematic approach to measuring market effects as a two-step process:

- Measure market changes (measured changes in market barriers)
- Determine which market changes were induced by the program or attributable to the program.

Grouping the market barriers from the Scoping Study may help make them more understandable and usable.

## **STRENGTHS AND WEAKNESSES OF METHODOLOGIES**

### **Strengths and Weaknesses of Evaluation Design**

Many aspects of the evaluation design were effective. The selection of the comparison area in Arizona and the rationale for its selection, and sufficient empirical support for this selection were provided. Much of the study is qualitative, yet sufficient evidence is provided for the conclusions.

The primary weakness in the evaluation design is the lack of surveys with nonparticipants. We understand that the decision not to survey nonparticipants was due to the study's limited budget. Initial work included using interviews with distributors to measure the market for both participants and nonparticipants. Yet, these do not sufficiently account for nonparticipant experience.

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<sup>16</sup> Hydraulic Services Study, pp. 2-11.

We believe that a market effects study requires an examination of the entire market, not just participants, unless the study proves that the participants constitute almost all of the market in question (almost 100% penetration) or participants are in some way transforming the market for all others in the market. We think this issue should have received greater consideration in the design and early analysis of the study.

This weakness was reduced in the final report since write-ups and discussions were added between the draft and final reports of surveys of nonparticipants conducted in 1992 and 1996. However, the number of nonparticipating pump customers that could be identified for the 1992 survey was small. The attempt to use these data to the maximum was laudable.

### **Comparison to Economic Framework**

Even with the added discussions of earlier nonparticipant surveys, the impression remains that the study examined “market effects” on participants rather than on the market as a whole. The goal should always be to examine the entire market. If this is not possible, or the only effects are program effects on participants or market transformation of only the participants, this distinction should be made very clear. For example, Chapter 5, which presents the Hydraulic Services Study’s market transformation assessment, should have clearly described which market effects relate to participants only and which to the market as a whole. This also means that the market barrier discussion should precede the market effects discussion. Then the study can discuss which market barriers were reduced, eliminated or circumvented for participants only and which changed in the market as a whole. A summary table that shows reduced or removed market barriers for participants and for the market as a whole also would be helpful.

## **STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES**

### **Assessment of Data Completeness**

As discussed in the review of the methods used, one of this study’s greatest strengths is the selection of the comparison area. The comparison area sampling also was well designed and highly defensible. The comparison information would be better if the Study had utilized the differences in the benefit/cost ratio of performing pump testing for predictive maintenance reasons in California versus Arizona, since energy prices differ so dramatically between the two states.

The greatest weakness in the data is the lack of nonparticipant data in the Hydraulic Services Study. Exclusion of SCE’s nonparticipating customers limits the Study’s ability to make service-territory-level comparisons, measure true market effects and determine likely lastingness.

## **Assessment of Data Collection Procedures**

As stated earlier, we believe that the study design we prefer first characterizes the market and identifies the market barriers and then designs the market effects study. The Hydraulic Services Market Effects Study finds that product unavailability was not a market barrier. Had the authors known this from having completed a market characterization study, they would have realized that interviews with distributors and manufacturers would not be an economical investment of study funds. Future market transformation evaluations probably will provide this information from an initial market assessment and characterization that is developed for use in market transformation program planning. Market assessment and characterization studies should be used to guide the prioritization of study issues for evaluation and market transformation measurement.

A more in-depth examination of product availability also could have included more information about the availability of pump testing. It is unclear whether the lack of a cadre of professionals capable of providing high-quality pump tests in Arizona was one of the major reasons that fewer tests were performed in Arizona than in California.

## **SUSTAINABILITY AND LASTINGNESS**

As stated earlier, the study's sustainability criteria<sup>17</sup> are consistent with the Scoping Study's in that they posit that new regulations cause structural changes that usually are permanent. Shifts in customer attitudes and perceptions can be lasting but must be reviewed against whether the barrier may return when different customers or market actors enter the market and when there is no program effort. Shifts in product offerings and stocking practices may be reversed but are more likely to be maintained, since market entry by new distributors or manufacturers is far slower than customer market entry.

## **Critique of the Evaluation's Evidence and Conclusions with Regard to Sustainability**

The Hydraulic Services Study estimated that approximately 50% of the pump testing would continue to occur even without the existence of a program.<sup>18</sup> An important fact to consider in this sustainability analysis is that 60% of SCE-area nonparticipants report pump testing through non-SCE sources. This datum would not be available if the earlier nonparticipant surveys had not been used in the final analyses.

The study assumed that customer attitudes could degrade without continued support and with the movement of new customers into the market. The study also estimated that pump testing in

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<sup>17</sup> Hydraulic Services Study, pp. 2-11.

<sup>18</sup> Hydraulic Services Study, pp. 2-12.

the absence of the program would persist at 34% of premises and 40% of energy savings. It also stated that these percentages would decrease over time.

The study did seem to prove that the niche of pump testing for adjudicated basins had achieved sustainable market transformation. The authors noted that water masters, who are the regulatory authorities of adjudicated water basins, now require pump testing to validate water meter readings, and predicted that this would continue if the program were closed.

We believe that an examination and discussion of the program's role in training a cadre of pump-test professionals who can provide third-party test results, and create a functional market in the absence of the program, could be an important market transformation component. However, the study did not address this possibility, although it did report that since 60% of SCE-area nonparticipants had their pumps tested and only 17% of Arizona customers received pump testing, it appeared that a functional market has been created. Development of a self-sustaining pump-testing market could be a critical element for sustainability in this sector.

An important part of assessing sustainability is the ability of the entire chain to reach the ultimate goals. We believe that the goals of a market transformation pump-testing program should be to develop a pump-testing market that also boosts the markets for pump maintenance and for purchases that improve energy efficiency. Instead, this report's sustainability criteria and findings relate to pump testing, not the ultimate desired energy savings. This link needs to be made.

## **OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION**

### **Strengths and Weaknesses of the Program as a Market Transformation Program**

As an information resource, the pump testing program has many elements often incorporated in a market transformation effort. Implementing the recommendations included in the executive summary of the final report would elevate this effort to a market transformation program. These recommendations are to:

- Implement the effort consistently statewide.
- Support the national effort for having standards for “high-efficiency” pump components, development of design assistance tools for comparing pump models and data collection for market penetration estimates.
- Design new intervention strategies to address remaining market barriers: access to credit and competitive municipal bidding practices.

- Develop a measurement and evaluation (M&E) plan for barrier and indicator measurement, as well as one that includes nonparticipant analyses.

We also recommend adding the following:

- Outreach efforts to increase cumulative participation to over 25% of premises and 75% of energy usage.
- Expansion of a private pump-testing market to replace utilities as part of an eventual exit strategy.
- Improve links in the Monitoring and Evaluation plan between the assessment of the pump-testing market and the ultimate effects on high-efficiency pump operations through maintenance and purchases of higher efficiency pump components (motors, pumps, etc.).

### **Potential for Future Use of the New Market Transformation Evaluation Techniques Tested**

This study attempted to increase our knowledge of the market and market effects by using a cost-effective strategy that incorporated prior survey results. However, some of this effort occurred after the evaluation design and initial analysis were conducted.

We believe that the process, criteria, measurement and selection of a comparison area were well done in this study. We also feel that authors of future studies might want to use this construct when considering comparison methodology, which is an appropriate method for examining preferences with a long history.

Much of the study was of a qualitative nature. The use of this qualitative information within a structured framework, such as the Scoping Study, provided a solid set of results and actionable information.

One of the items we have learned from examining this study is the importance of distinguishing the difference between effects of information programs on participants and true market effects. That is, the goal should always be to examine the market as a whole. If this is not possible, or the only effects are program effects on participants including longer-term spillover among participants, then this distinction should be made very clear. A summary table showing reduced or removed market barriers for participants and the market as a whole would be helpful.

## 2.11 HOME ENERGY FITNESS PROGRAM MARKET EFFECTS EVALUATION

### STUDY OBJECTIVES AND PROGRAM DESCRIPTION

The Home Energy Fitness (HEF) Program Study was conducted by AAG & Associates for Southern California Gas (SCG). The study was conducted in late 1997 and early 1998 on the operation of the program between 1993 and 1997. The research team was led by Andrew Goett. The report was organized into six chapters with several appendices.

The stated goal of this study was “to determine the extent to which the HEF program has produced sustained changes in the market for efficient gas technologies and in the behavior of residential customers beyond the direct impacts . . . changes that would not have occurred in the absence of the promotion and delivery of the program services.” (p. vi)

The HEF Program provides home energy audits and recommendations to residential customers about cost-effective natural gas efficiency measures and practices. The program is directed at those customers with above-average gas usage, who live in single-family homes, in colder climates, and who have used gas for many years. Initially the target group consisted of customers living in colder climate zones who had had gas service for more than 10 years. For the most part, customers have, only been offered the opportunity to participate just once. Over time the target group has been expanded to include newer customers and those living in warmer zones. Since 1993, this program has been conducted strictly via mail. Customers are recruited through a mass mailing.

Customers become participants when they complete a mail-in survey. Their responses are run through a computer program that models the customer’s energy use. Audit results and recommendations are sent to the participants. Prior to 1993, the program operated differently. Many of the audits were made on-site during normal service calls and, apparently, often without customers’ knowledge. The recommendations often were extensive and frequently were accompanied by an offer of a rebate to help customers implement them. In 1993, SCG changed the program considerably to make it more effective and cost-effective. The new features included: mail-only operation; a reduction in the number of recommendations per audit, augmented by a canned handbook of tips to save energy; and elimination of rebate offers.

SCG hypothesized that the services would result in one market effect: improved customer awareness and attitudes toward efficient gas use.



## SUMMARY TABLES

**Table V2-48: Summary of Study Features**

<b>Title:</b>	Home Energy Fitness Program Market Effects Evaluation
<b>Project Number:</b>	3701
<b>Sponsoring Utility:</b>	Southern California Gas
<b>Contractor:</b>	AAG & Associates
<b>Sector:</b>	Residential
<b>End-Use Elements Examined:</b>	Whole building
<b>Program Year(s):</b>	1994 (includes some 1993 participation)
<b>Program Intervention(s):</b>	Information

**Table V2-49: Key Study Results**

### MARKET EFFECTS MEASURED

DESCRIPTION OF EFFECT	KEY RESULTS	HOW MEASURED
Increased customer awareness and change in customer conservation practices	Moderate change and acceleration of adoption Effect of change on energy use evident only in first year after participation; savings do not persist	Comparison of participant and nonparticipant survey responses and analysis of bills

**Table V2-50: Key Study Results**

### NEW DATA COLLECTED

DESCRIPTION	COLLECTION METHOD	COLLECTION PERIOD
Market effects considered	SCG program personnel interviews	NA
Changes in supply practices, distribution channels	Supplier interviews	NA
Program recall, program-related actions, customer attitudes, energy-efficiency installations/practices, demographics	Participant and nonparticipant interviews and surveys	December 1997

## COMPARISON WITH SCOPING STUDY FRAMEWORK

The authors of the HEF Market Effects study indicated that they were aware of the Scoping Study by mentioning it in their report. However, the HEF study authors did not really use the framework as the basis for their analysis of the HEF program.

Judging by their choice of research questions and discussion topics, the authors seemed to have a clear understanding of market characterization. They did not, however, use a market characterization to address the rationale for the program. The statistics included in the study to characterize the market reflected SCG's entire residential customer base rather than the program's target population. In addition, the report did not introduce or use the concept of market barriers by examining what might be inhibiting adoption of more efficient natural gas appliances in single-family homes. The stated program strategy implied at least one market barrier: customers' lack of awareness of their energy use and options available to them. The authors implied that if customers were more aware, they would adopt more energy-efficient practices. And while there was a statement of SCG's underlying basis for the program as a tool for increasing the efficiency of natural gas use, there was little discussion of how the HEF program fit into the existing market. The study did not list the set of market participants, although these can be picked out from the discussion. The aspect of the market the authors did explore well in their market characterization was distribution channels. They identified the key market actors in the supply and distribution chain, allowing them to draw conclusions about market effects on both the demand and supply sides of the market.

## **Market Effects**

The authors provided a clear working definition of market effects. "Market effects are reductions in energy consumption in the SCG service territory beyond program-related gross savings of participants." (p. I-2) With its focus on energy impacts, this definition is considerably narrower than that envisioned by the authors of the Scoping Study. Discussions with the study team's leader, Andrew Goett, clarified their intent to measure both effects directly stemming from program participation and those beyond the program. He said they sought to measure sustained energy consumption effects (in the persistence analysis) and increases in energy conservation awareness and behavior (in the survey analysis).

The study referred to SCG's attempt to cause "changes in awareness and knowledge" among customers about their gas bills as falling within the definition of market effects spelled out in the Scoping Study (pg. III-7). As the authors noted, however, meaningful assessment of this market effect was prevented because less than 30% of the survey respondents could recall the program. They reported on stated differences between participants and nonparticipants but were unable to attribute the attitudinal differences or actions to the program since so few of the participants could recall the program.

By focusing on changes in energy usage, rather than alterations in the structure of the market that might not show up as net energy reductions (e.g., purchases of energy-efficiency equipment and other lifestyle changes), the authors could not gauge program-related market effects. Instead of measuring changes in decisions and actions that the Scoping Study stressed, the HEF study authors emphasized changes in energy use that might have been caused by the program or other factors.

## **Market Barriers**

This study made no specific reference to market barriers. Implicitly, SCG believed it needed to get more and better information into the marketplace. Interviews with SCG personnel responsible for the 1993 HEF program indicated a belief that if customers better understood their gas use, they would choose more energy-efficient appliances and practices. This suggests a link between market barriers and effects. This lack of awareness that the program aimed to address fits into the Scoping Study market barrier typology as “information cost.” Overall, however, the study did not base its market effects analysis on the measurement of market barriers reduction, which is at the heart of the Scoping Study framework.

The would-be benefit of using a market barriers framework was exemplified by the treatment of supplier behavior. The study pointed out that the program was not designed to influence suppliers, and the interviews did not reveal any effects on their behavior. Indeed, the study’s review committee scaled back a more extensive analysis of the supply market that had been proposed because reviewers did not believe there would be any market effects. Use of hypothetical market barriers as a premise for testing might have led the study team to rule out the existence of supply-side market barriers with cause. Their conclusion that no supplier market effects occurred would have been the same. But the reason would have been found in the lack of barriers. As a result, the authors probably would not have recommended that the program reach out to and try to influence suppliers since they would have had evidence that there was no market barrier for the program to reduce.

## **Sustainability and Lastingness**

The authors focused on the lastingness of the energy impacts. In keeping with this type of analysis of DSM impacts, they used the term “persistence.” The report suggested that would be a suitable way to assess the program’s sustainability. However, we do not believe that it is an appropriate measurement of sustainability. Sustainability, in the Scoping Study framework, refers to a shift to and continued commitment among (the same or other) customers after the reduction or elimination of the program. In the Scoping Study parlance, sustainability refers to future actions, not continued effects from a past action.

When we discussed this with the study's author, he pointed out that, since the goal of the program was to increase customers' awareness and knowledge about opportunities to reduce gas usage, it was essentially a "pure market transformation" program, presumably in contrast with DSM-style incentive programs. In that sense, any effects would have been market transformation. The findings from the persistence analysis indicated that changes in awareness did not cause sustained reductions in gas consumption. The study concluded, and we agree, that the program has not had lasting effects.

### **Comparison to Other Market Transformation Frameworks**

This topic was not addressed by the authors. By design, this evaluation had a retrospective focus; its goal was to see if energy impacts had materialized. With this very specific focus and an approach well designed to measure the energy impacts, it was not truly a market transformation evaluation. Rather it was a DSM evaluation with some market transformation labels attached.

### **Recommendations for Modifications to Scoping Study**

The authors did not really adhere to the Scoping Study framework. Nor did they appear to challenge or modify it. The retrospective, energy-impact focus of this study does not provide much basis for us to suggest modifications of the Scoping Study from this application.

## **STRENGTHS AND WEAKNESSES OF METHODOLOGIES**

### **Strengths and Weaknesses of Evaluation Design**

#### *Strengths*

- Penetrations of key gas appliances were clearly presented. However, it was not clear if this information was intended to serve as benchmark indicators of the pre-program baseline.
- The factor analysis used to compare the participant and nonparticipant attitudes in 1997, and also to compare them against customer attitudes in 1991 (prior to the program year/features evaluated) was interesting. As the authors stated, it was not clear if the findings reflected actual changes or were attributable to the differences in data collection between the years. If the authors had been able to control these data sources, they might have produced useful indicators of market barrier reductions.
- The authors did an excellent job of trying to leverage data and results from earlier studies. In particular, they used a 1992 delivery chain study in the market

characterization, and even designed the customer attitudinal battery so that they could compare their results with those from the 1992 study, and thereby measure the program's market effects.

### *Weaknesses*

- The market characterization described the residential sector as a whole but said nothing about the market actually targeted by the program: customers with above-average gas usage, who live in single-family homes and have had continuous gas service for more than 10 years.
- The market characterization told us nothing about the dynamics of the market that would inhibit adoption of energy-efficient measures and practices, i.e., market barriers.
- The market characterization did not tell us as much as it might have because, in most cases, it did not identify when the data were collected relative to the introduction of the program year evaluated (page II-4 indicated a high-efficiency furnace penetration rate of 7% in single-family homes but does not indicate when this measurement was made).
- Allowing that the penetration data presented in the market characterization comprise a baseline, the study would have been far stronger if it had been designed to include measurement of post-program penetration for the same key appliances.
- It appears that a comparison of survey responses about conservation measures installed by participants and nonparticipants was used to measure indirect market effects (effects outside the program by participants and nonparticipants). The survey, however, made no attempt to create any causal link between the program and these actions. As a result, any inference about the effect of the program is unsubstantiated.
- The study sought to measure market effects by comparing participants and nonparticipants. Thus, rather than estimating the sum of indirect and direct program effects, the study estimated the difference.
- The persistence analysis did not measure lastingness of market effects. With the Scoping Study authors' (and our) view of markets as "on-going systems" (Scoping Study, p. 10), an effect of a singular event (e.g., installation of a measure) cannot by definition be a lasting market effect. Merely taking the measure, even if the measure is used for its expected life, does not prove that any market barrier has been reduced in a lasting fashion. Therefore, even if its effects can be measured, they cannot be taken as an indicator of sustainability of a market effect.

## Comparison to Economic Framework

The study made no attempt to pose a new framework or to explicitly rely on the economic framework that forms the foundation of the Scoping Study.

## STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES

### Assessment of Data Completeness

#### *Strength*

- The study made a laudable effort to use data from other studies. We support and encourage the leveraging of secondary data. Since the study did not document many of these other sources or the date of their data collection, it is somewhat difficult to assess how much these data contributed to the body of knowledge and assessment of market effects. Discussions with the author indicated that some of these data were used to try to compare pre-HEF and post-participation attitudes.

#### *Weaknesses*

- Survey responses were not linked to the dates reported actions were taken. Therefore, the results were difficult to interpret. Because of this, we believe that the conclusions about market effects lack credibility.
- The study suffered from a lack of recall among participants regarding their participation. This is more a reflection of the program's delivery mechanism than a problem with the evaluation. While the recall rate was very low, it is not unprecedented for information-only programs. Programs that don't require a financial investment by customers often have a low recall rate.

### Assessment of Data Collection Procedures

#### *Strengths*

- The authors carefully selected their samples and diligently compared the demographics of the participant and nonparticipant groups. The nonparticipant group from each program year was selected to match the characteristics of that year's participants. For energy consumption analyses, like the persistence analysis conducted here, some might view this prematching as appropriate. For a market effects study, this might be less so. In fact, had the data been available, it might have been better to use the pool of customers who were sent offers but did not return them

as the nonparticipant sample group. Unfortunately, the authors could not have done this because there were no records of offers sent, only records of offers that resulted in participation.

- The authors showed excellent foresight in fielding some open-ended interviews to help the larger fixed-question surveys.
- The number of survey responses obtained from both participants and nonparticipants was quite large. This allowed for about 750 responses from each group to be used in the survey analysis.

### ***Weaknesses***

- The documentation of the survey responses and regression analysis made it virtually impossible to pin down the number of participants and nonparticipants in the population (i.e., the size of the pool the samples were said to reflect) of targeted customers or the number of data points used in the analyses. Supplementary documentation provided by the author revealed that the study team completed 1,497 market effects surveys and had about 1,100 customers (participants and nonparticipants) in the regression analysis.
- The attempt to compare the results from the 1992 preprogram survey that might have served as “baseline” responses and the 1997 survey apparently was prevented by differences in the way the two surveys were fielded. The former was a mail survey and the latter a phone survey. Since the authors put considerable effort into trying to make the surveys comparable, we wonder why they did not secure this comparability by maintaining consistency in the fielding. On the other hand, the authors might have faulted their ways excessively. Perhaps the findings would have been the same regardless of the differences in collection procedure. Unfortunately, we cannot know.

## **SUSTAINABILITY AND LASTINGNESS**

### **Criteria Examined for Sustainability**

This study reviewed participants’ energy use one, two, and three years after participation via a DSM-styled persistence analysis. There was some discussion of the relationship between persistence and sustainability. The following is one example: “These estimates of longer-term impacts are used... to determine the degree to which the program has caused significant, sustainable changes in the market for efficient gas measures and practices.” (p. V-2)

## **Critique of the Evaluation’s Evidence and Conclusions with Regard to Sustainability**

We argue that the persistence analysis using participants from a single program year proved nothing about the sustainability of possible market effects. Even if participants’ bills stayed lower (other things being equal) more than one year after they participated in the program, especially since this program was still operating, evaluators could not predict how much energy participants would use if there were no program. And it says nothing about whether other customers had adopted energy conservation measures. The authors seemed to suggest this. Basically, they reported that they found first-year impacts among participants (suggesting but not proving that they took some actions related to the program) and no evidence of any other effects. However, they also reported that they found no evidence of sustainability or market transformation. Thus, while we might disagree with some parts of their approach, we do support their conclusions.

## **OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION**

### **Strengths and Weaknesses of HEF as a Market Transformation Program**

The biggest, and possibly fatal, weakness of HEF as a market transformation program is that people who were considered “participants” did not remember actually participating in the program. This seemed to be true whether they had participated one year ago or five years ago. Furthermore, since so many of the few who could recall anything about the program said they had already planned to make the changes recommended by the program, the program appears to have little promise as a market transformation tool. There could be two reasons for this: (1) the program is not addressing the actual market barriers inhibiting adoption or (2) the market might already be transformed (if the “recallers” truly stated their prior intent to implement recommendations). We recommend performing a market characterization to identify impediments to achieving greater adoption of the practices that SCG seeks.

### **Potential for Future Use of New Market Transformation Evaluation Techniques Tested**

The study did not introduce new methods. Instead it chose those that have been used extensively for DSM program evaluation: participant and nonparticipant post-program survey analysis and pre/post, cross-sectional billing analysis.

Factor analysis could be used effectively to evaluate attitude differences between program participants and nonparticipants and differences between pre-program and program periods to determine whether specific market barriers have been reduced or eliminated. To do this, the evaluators would need to be able to control the data collection (e.g., both the substance of and method for asking relevant questions) to ensure comparability of the responses and produce meaningful results. We believe this should be incorporated in future evaluation design.





*Mogdal & Associates*



*Megdal & Associates*

## 2.12 RESIDENTIAL MARKET EFFECTS STUDY: SDG&E AND SCG'S RESIDENTIAL NEW CONSTRUCTION PROGRAMS

### STUDY OBJECTIVES AND PROGRAM DESCRIPTION

The Residential Market Effects Study, completed in June 1998, was conducted for Southern California Gas and San Diego Gas & Electric by RER. This study's specific objectives included the following:

- Characterize the demand for energy-efficient gas equipment and building shells in the residential new construction (RNC) market
- Characterize the RNC market structure and identify key RNC market participants, decision-making processes, and influences
- Identify market barriers to more energy-efficient residential building design, thermal shell measures, and/or gas space and water heating equipment
- Assess the extent to which RNC programs have reduced or eliminated market barriers and the sustainability of these effects in the future.

The study was designed to address five key questions:

- What changes in the market shares of the covered technologies had taken place over recent years?
- To what extent had utility programs influenced these changes in market shares?
- What market barriers were diminished by the programs in question?
- Which program features contributed to the mitigation of market barriers?
- To what extent were these impacts of program stimuli long-lasting?

Since first-year impact studies had been done for both utility programs in question, this study made no attempt to replicate those evaluations but, instead, focused on assessing the permanence of those impacts.

SDG&E's Residential New Construction Program ran from the latter part of 1990 through 1994 and targeted new home builders. The program used financial incentives and advertising to encourage builders to install energy-efficient measures and appliances that exceeded Title 24

building standards by a minimum of 5%. Incentives targeted space heating, space cooling and water heating. In 1991, an aggressive promotional campaign targeted builders through direct mail, trade and professional journals, and presentations to building trade associations.

SCG’s High Efficiency New Home Program began in 1990 and continued through 1993. The program provided incentives to builders for constructing new homes that exceeded Title 24 standards. Specific measures targeted in 1992 and 1993 included furnaces, water heaters and wall insulation. In 1994, the program was marketed as the Energy Advantage Home program. In addition to financial incentives, the program included informational and training workshops for builders. The list of targeted measures was expanded considerably. In 1995 SCG dropped the financial incentive portion of the program and continued only the information portion. After that point, efforts focused on informing builders, lenders and real estate brokers of the California Home Energy Efficiency Rating System (CHEERS) and the availability of energy-efficient mortgages.

**SUMMARY TABLES**

**Table V2-51: Summary of Study Features**

<b>Title:</b>	Residential Market Effects Study
<b>Project Number:</b>	3702 / 3904
<b>Sponsoring Utility:</b>	Southern California Gas Company; San Diego Gas & Electric Co.
<b>Contractor:</b>	RER
<b>Sector:</b>	Residential New Construction
<b>End-Use Elements Examined:</b>	Whole building
<b>Program Year(s):</b>	SDG&E: 1990–1994, SCG: 1990–1997
<b>Program Intervention(s):</b>	Incentives, advertising, workshops

**Table V2-52: Key Study Results**

**BARRIERS ADDRESSED**

BARRIERS	ACTORS AFFECTED	BARRIER DESCRIPTION	PROGRAM SUCCESS IN REDUCING MARKET BARRIER
<b>Split Incentives</b>	Consumers	Builders (the primary decision-maker) and consumers (the primary market driver) have different incentives in their market transactions	None
<b>Asymmetric Information</b>	Consumers	Builders (the primary decision-maker) and consumers (the primary market driver) have different levels of and sources for information.	None

**Table V2-53: Key Study Results**

**MARKET EFFECTS MEASURED**

DESCRIPTION OF EFFECT	KEY RESULTS	HOW MEASURED
Increased builders' and other decision-influencers' product awareness	Southern California participants appear to be significantly more aware of these options than Southern California nonparticipants and (with a couple of exceptions) builders in the control area. The programs also seem to have increased awareness levels of architects.	Comparison of participant and nonparticipant survey results

**Table V2-54: Key Study Results**

**EXISTING DATA USED**

DESCRIPTION	COLLECTION PERIOD
Extensive literature review	
CEC Post-Occupancy Residential Survey Data	1990–1994
SDG&E and SCG Program Records	1990-1997
RER Study Database	1994
Title 24 Compliance Forms from building departments in SCG/SDG&E area	NA

**Table V2-55: Key Study Results**  
**NEW DATA COLLECTED**

DESCRIPTION	COLLECTION METHOD	COLLECTION PERIOD
5 Gas Heating Manufacturers	Phone Interview	?
5 Gas Water Heater Manufacturers	Phone Interview	?
4 Window Manufacturers	Phone Interview	?
5 Gas Heating Distributors	Phone Interview	?
5 Gas Water Heating Distributors	Phone Interview	?
5 Window Distributors	Phone Interview	?
5 Builders and Developers (program, 30; control, 15)	Phone Interview	?
Architects (program, 9; control, 5)	Phone Interview	?
Title 24 Consultants (program, 9; control, 2)	Phone Interview	?
HVAC Contractors (program, 8; control, 4)	Phone Interview	?
Plumbing Contractors (program, 4; control, 2)	Phone Interview	?
Building Inspectors (program, 9; control, 2)	Phone Interview	?
Sales Agents (program, 30; control, 15)	Phone Survey	?
Realtors (program, 10; control, 0)	Phone Survey	?
Lenders (program, 10; control, 5)	Phone Interview	?
Consumers – Participants (program, 556; control, NA)	Mail Survey	?
Consumers – Nonparticipants (program, 608; control, 301)	Mail Survey	?
12 Government Staff (program, NA; control, NA)	Phone Interview	?

**COMPARISON WITH SCOPING STUDY FRAMEWORK**

The study presented its analysis framework from the perspective of welfare economics. From this perspective, the performance of markets could be assessed in terms of efficiency and equity. While the Scoping Study explicitly excludes equity considerations from its discussion, the difference in focus had little practical impact on the analysis because it did not address equity

issues. (An evaluation of program contributions to social equity was presumably outside the study scope.)

### **Market Effects**

The evaluation of market effects in this study was firmly rooted in the Scoping Study in that the evaluation began with a set of market barriers and then tested a set of hypotheses about the programs' effects on those barriers.

### **Market Barriers**

Drawing on welfare economics theory, the study equated market barriers and market failure and described them as being the differences between social and private costs and benefits. The existence of market failures was given as the general rationale or justification for market intervention.

The study applied the Scoping Study taxonomy of market barriers as the basis for developing hypotheses of market effects. Market barriers investigated in this study included product unavailability, organizational practices, performance uncertainties, information costs, hassle costs, asymmetric information, bounded rationality and split or misplaced incentives.

### **Sustainability and Lastingness**

Since the study did not find any significant market effects, it did not have an opportunity to address the issue of sustainability in a meaningful way.

### **Comparison to Other Market Transformation Frameworks**

The study did not propose a framework as an alternative to that of the Scoping Study. Rather, it adhered closely to the Scoping Study framework.

### **Recommendations for Modifications to Scoping Study**

The study recommended no changes.

## STRENGTHS AND WEAKNESSES OF METHODOLOGIES

### Strengths and Weaknesses of Evaluation Design

The study focused on the following measures: gas space heating, gas water heating, windows and ceiling and wall insulation.

The study involved three major elements:

- Development of efficiency baselines for the measures covered by the study
- Characterization of the residential new construction market
- Interviews with market actors to test a series of hypotheses about the market transformation effects of residential new construction (RNC) programs.

To gauge program impacts on the adoption of energy-efficient technologies, the study tracked changes in measured market share and efficiency levels over time. The time-series analysis was valuable, given that the hypothesized changes the study sought to measure occurred over time. Nevertheless, the study encountered significant limitations in the analysis of efficiency levels because no data spanned a preprogram time period. Inadequate data prevented the evaluators from establishing any baseline for windows or from drawing any definitive conclusions about the program's impacts.

In characterizing the market, the study relied on survey data from the SDG&E and SCG service areas and from a comparison service area consisting of the Austin/San Antonio corridor. The market characterization made it clear that builders were linked to nearly every key market actor on both the supply and the demand side. They were the primary decision-makers in most aspects of residential new construction.

Several regions in the Southwest were considered as a possible comparison area. The authors selected the Austin/San Antonio corridor based on similar patterns of new home starts and weather conditions, and the fact that there was very little DSM activity pertaining to gas equipment in new homes in that area. Criteria for selecting a comparison area appeared reasonable. To its credit, the study also noted ways in which the selected region was less than perfect as a comparison area.

In testing market effects hypotheses, the study relied on survey data from the SDG&E and SCG service areas and from a comparison service area, the Austin/San Antonio corridor. The study tested market effects hypotheses in two ways: by comparing attitudes, perceptions, and behaviors of participants and nonparticipants from the program area, and by comparing attitudes, perceptions and behaviors of California residents to those of Texas residents. Both approaches



relied on a cross-sectional comparison to test hypotheses about temporal effects. This strategy was dictated by the lack of time-series data regarding attitudes, perceptions and behaviors. The use of two methods to “triangulate” hypothesized effects mitigated the potential for bias from relying on a single method. Reliance on participant/nonparticipant comparison tends to underestimate program effects while reliance on cross-area comparisons can produce either upward or downward bias, depending on how the areas are not comparable. (The City of Austin’s DSM programs include extensive new home rating programs. However, the proportion of customers in the comparison group is unknown and would cause a downward bias in measured effects.)

### **Comparison to Economic Framework**

The study referred frequently to welfare economics. It also closely adhered to the Scoping Study framework, which was firmly rooted in economic theory.

## **STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES**

### **Assessment of Data Completeness**

Baselines were developed from four primary sources:

- California Energy Commission’s Post-Occupancy Residential Survey Project
- SDG&E and SCG residential new construction DSM program records
- RER Study Database from the analysis of the 1994 SCG Energy Advantage Home Program
- Title 24 compliance forms obtained from building departments throughout the SDG&E and SCG service areas.

The market characterization and assessment of market effects were developed from a series of in-depth telephone interviews and structured telephone and mail surveys to the market actors shown in the table below.

**Table V2-56: Market Characterization**

**MARKET ACTOR SURVEYS**

<b>MARKET ACTOR</b>	<b>CA UTILITY SERVICE AREA</b>	<b>CONTROL AREA</b>	<b>TOTAL</b>
<b>Equipment Manufacturers</b>			14
<b>Equipment Distributors</b>			15
<b>HVAC Contractors</b>	8	4	12
<b>Plumbing Contractors</b>	4	2	6
<b>Architects</b>	9	5	14
<b>Title 24 Consultants</b>	9	2	11
<b>Builders and Developers</b>	30	15	45
<b>Building Inspectors</b>	9	2	11
<b>Real Estate and Sales Agents</b>	40	15	55
<b>Lenders</b>	10	5	15
<b>Government Staff</b>			12
<b>Consumers-Participants</b>	556		556
<b>Consumers-Nonparticipants</b>	608	301	909

Sources for developing sample frames seemed thorough, and capable of supporting representative sample.

Data sources used to develop the measure baseline were documented thoroughly. Perhaps equally valuable, from the perspective of future evaluations, the study documented those sources that proved *not* to be useful in developing the baseline.

**Assessment of Data Collection Procedures**

The study was impressive in its use of secondary sources. In particular, the study demonstrated the viability of obtaining Title 24 information from city building departments but also provided an illuminating discussion of the obstacles associated with this data collection strategy. From this discussion, it is clear that the resource requirements of this strategy should not be underestimated and the sampling plan should be flexible.

Our primary concern with the data collection procedures relates to the phrasing of questions in the phone surveys. In general, the evaluators tended to ask people directly about their behavior (e.g., whether the program had caused it, whether they would ever change it) in ways that seemed too direct to determine what actually underlay their decisions. Social psychology research suggests that once a person has adopted a particular behavior (or attitude) he or she will ascribe the source of the behavior to oneself rather than to other causes. Thus analysis based on direct questions would tend to overestimate the importance of the individual in the behavior and underestimate the importance of other factors, such as program interventions. A less direct line of questioning, using setup questions and questions focused on the decision process, would be less vulnerable to bias.

## **SUSTAINABILITY AND LASTINGNESS**

Since the study found little evidence of market effects, there was little basis for discussing their sustainability.

### **Criteria Examined for Sustainability**

Since the study identified no significant market effects, sustainability was not an issue.

### **Critique of the Evaluation's Evidence and Conclusions with Regard to Sustainability**

There were none.

## **OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION**

### **Strengths and Weaknesses of Residential New Construction as Market Transformation Program**

Although there was some evidence of partial market transformation attributable to these programs, the overall transformation effects of the programs appeared to have been minimal. Based on the analysis, RER developed a number of recommendations for improving RNC programs. Future programs should focus on interactions between the builder and the consumer, which tends to drive the actions of all other actors. In doing so, split incentives and asymmetric information almost certainly will remain the most significant barriers RNC programs must overcome to transform the market for high-efficiency equipment and shell measures.

## Potential for Future Use of New Market Transformation Evaluation Techniques Tested

The study provided a valuable market characterization of the residential new construction sector as a whole. It also provided a useful case study for using the Scoping Study as the basis for evaluation design: the study explored the entire market in depth, considered how various types of market barriers affected this sector, developed hypotheses about effects the programs might have had on identified barriers, and then constructed a data collection and analysis approach to test those hypotheses.

The study recommended that estimates of baseline efficiencies for gas measures continue to be refined and suggested that building inspectors might be the best choice for baseline data collection. The study also provided a word of caution about the difficulty of mitigating split incentives barriers and the challenges of promoting energy-efficient new home construction in a region dominated by mild weather. Overcoming split incentives, the authors suggested, means convincing consumers of the value of paying more for energy-efficiency features and then convincing builders that consumers are willing to pay more. Changing consumer attitudes will require better information via existing primary channels (e.g., lenders and builders' sales representatives), expanded use of secondary channels (such as mass media), and greater emphasis on the whole range of benefits energy-efficient measures provide (such as enhanced comfort and reduced maintenance).



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# **MARKET EFFECTS SUMMARY STUDY**

## **Final Report**

### ***APPENDIX B: INDIRECT COSTS AND BENEFITS PILOT STUDY***



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FINAL REPORT  
MARKET EFFECTS SUMMARY STUDY

## APPENDIX B

<b>INDIRECT COSTS AND BENEFITS PILOT STUDY .....</b>	<b>B-1</b>
STUDY OBJECTIVES AND PROGRAM DESCRIPTION.....	1
SUMMARY TABLES .....	1
COMPARISON WITH SCOPING STUDY FRAMEWORK.....	3
Market Effects.....	3
Market Barriers.....	4
Sustainability and Lastingness.....	4
Comparison to Other Market Transformation Frameworks .....	4
Recommendations for Modifications to Scoping Study.....	4
STRENGTHS AND WEAKNESSES OF METHODOLOGIES.....	5
Strengths and Weaknesses of Research Design.....	5
Comparison to Economic Framework .....	6
STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES.....	6
Assessment of Data Completeness.....	6
Assessment of Data Collection Procedures .....	6
SUSTAINABILITY AND LASTINGNESS .....	6
OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION.....	6
Potential for Future Use of New Market Transformation Evaluation Techniques Tested.....	6

# INDIRECT COSTS AND BENEFITS PILOT STUDY

## STUDY OBJECTIVES AND PROGRAM DESCRIPTION

The Indirect Costs and Benefits Pilot Study of SDG&E's commercial lighting program was conducted by Barakat & Chamberlin, Inc., Shel Feldman Management Consulting and MACRC International, Inc. in the fall and winter of 1996. The study team was led by Patrica Herman and Dr. Sami Khawaja of Barakat & Chamberlin's Oakland, California office. The report contains four chapters with extensive appendices.

The Indirect Costs and Benefits Pilot Study differs from the other studies we are summarizing in this report. It was not specifically designed to be an evaluation, nor was it expected to follow the framework put forth in the Scoping Study. Rather it was to determine if it is possible to value information market effects that might emerge from market transformation programs, specifically the removal of misperceptions and misinformation.

To accomplish this task, the authors conducted a pilot study to value the indirect costs and benefits (ICBs) associated with a commercial lighting program.

## SUMMARY TABLES

**Table B-1: Summary of Study Features**

<b>Title:</b>	Indirect Costs and Benefits Pilot Study of SDG&E's Commercial Lighting Program
<b>Project Number:</b>	3901
<b>Sponsoring Utility:</b>	SDG&E
<b>Contractor:</b>	Barakat & Chamberlin
<b>Sector:</b>	Commercial
<b>End-Use Elements Examined:</b>	Lighting
<b>Program Year(s):</b>	1995
<b>Program Intervention(s):</b>	



**Table B-2: Key Study Results**

**BARRIERS ADDRESSED**

<b>BARRIERS</b>	<b>ACTORS AFFECTED</b>	<b>BARRIER DESCRIPTION</b>	<b>PROGRAM SUCCESS IN REDUCING MARKET BARRIER</b>
<b>Hassle Costs</b>	Customers	Making proposals to senior management.	NA
<b>Performance Uncertainty</b>	Customers	Occupant or tenant complaints about the new lighting. The technology may not perform as expected.	NA
<b>Irreversibility</b>	Customers	Energy costs or equipment costs may come down.	NA
<b>Irreversibility</b>	Customers, retail/ restaurant/ grocery businesses	Newer, better equipment may become available.	NA
<b>Hidden Costs</b>	Retail/restaurant/ grocery businesses	Need to redecorate or rewire.	NA
<b>Transaction Costs</b>	Retail/restaurant/ grocery businesses	Increased responsibilities for disposal of hazardous wastes.	NA

**Table B-3: Key Study Results**

**MARKET EFFECTS MEASURED**

<b>DESCRIPTION OF EFFECT</b>	<b>KEY RESULTS</b>	<b>HOW MEASURED</b>
O&M Cost Reductions	Reduction in need for bulb replacement leads to fewer labor hours for installation.	Not stated
O&M Cost Reductions	Longer bulb lives of compact fluorescent bulbs versus standard bulbs result in avoided replacement equipment costs.	Not stated
O&M Cost Reductions	Delamping results in fewer lamps to replace.	Not stated

**Table B-4: Key Study Results**

**EXISTING DATA USED**

DESCRIPTION	COLLECTION PERIOD
Utility O&M cost reduction estimates	1995

**Table B-5: Key Study Results**

**NEW DATA COLLECTED**

DESCRIPTION	COLLECTION METHOD	COLLECTION PERIOD
One group of 9 program participants employed by office facilities	Focus group	1995
One group of 4 program non-participants employed by mixed facility types	Focus group	1995
One group of 10 participants employed by retail and lodging facilities	Focus group	1995
70 participants and 26 nonparticipants	In-depth telephone surveys	1995

**COMPARISON WITH SCOPING STUDY FRAMEWORK**

The Indirect Costs and Benefits Pilot Study did not attempt to use the Scoping Study framework. However, we did find that certain aspects of the Scoping Study are embedded in the analysis implemented in the pilot study.

**Market Effects**

The study did not attempt to measure market effects. However, the study's premise is that indirect costs and benefits are indicators of market effects related to information. Not surprisingly, therefore, we found that the authors' methods to measure ICBs did in fact identify market effects that had occurred as a result of the commercial lighting program. The methodology for eliciting these market effects was unique to this study, yet was quite effective even though the authors did not explicitly set out to apply the Scoping Study framework or to identify specific market effects.

The methodology involved comparing expectations for costs and benefits to actual experiences of costs and benefits. We found that the expected costs tracked closely to market barriers. For those

that were reported as not experienced, the customer experienced barrier reduction or removal, resulting in a market effect.

**Market Barriers**

As noted, the authors developed a set of costs and benefits the customers might experience and then asked customers whether they had expected and experienced the cost or benefit. Five of these expected costs were labeled “unfounded fears” by the authors. These unfounded fears closely track to market barriers identified by the Scoping Study. Table A-57 displays the comparison between these “unfounded fears” and market barriers identified in the Scoping Study.

**TABLE B-6: MARKET BARRIERS IDENTIFIED IN THE PILOT STUDY**

UNFOUNDED FEARS	SCOPING STUDY MARKET BARRIERS
Making proposals to senior management	Hassle costs
Occupant or tenant complaints about the new lighting	Hassle costs
The technology may not perform as expected	Performance uncertainty
Energy costs or equipment cost may come down	Irreversibility
Newer, better equipment may become available	Irreversibility

**Sustainability and Lastingness**

This topic was not addressed either directly or indirectly.

**Comparison to Other Market Transformation Frameworks**

This topic was not addressed either directly or indirectly.

**Recommendations for Modifications to Scoping Study**

This topic was not addressed either directly or indirectly.

## STRENGTHS AND WEAKNESSES OF METHODOLOGIES

### Strengths and Weaknesses of Research Design

The research design was well conceived, although the authors note that at times the design changed as new information emerged. Specifically the original design called for a study of operations and maintenance (O&M) costs with participants and nonparticipants. Later the authors discovered that the utility's assumptions for calculating O&M costs were satisfactory. They then shifted research funds to examine willingness to pay, rather than focusing on O&M cost valuation. This shift reduced the necessity for nonparticipant responses, since the utility could not provide nonparticipants enough information to help them respond knowledgeably to the willingness to pay questions. This turned out to be fortuitous mainly because the nonparticipant response rate was very poor.

One of the strengths of the study was the use of focus groups to provide input to the survey design process. The study team conducted three focus groups with customers to identify indirect costs and benefits. These customer-generated responses were compared to those developed earlier by the team. The team then combined the information into a final list, which it included in the survey. As a result, this final list of indirect costs and benefits appears both comprehensive and easily comprehensible by customers.

We identify two weaknesses in the study, particularly concerning its usefulness to others. One is the small sample size for the willingness-to-pay analysis. The study used data from less than 70 customers for the contingent valuation, willingness-to-pay analysis. We understand that this is a pilot study, and that the authors did recommend that a sample of 286 customers be used for a full-scale study. Nonetheless, if anyone seeks to use this study to draw conclusions about ICBs and commercial lighting programs they must recognize this limitation.

The second weakness is the study's analysis process. The authors failed to clearly explain their analysis methodology at several points when they discussed investment criteria. We found one potential flaw in this analysis: The authors made the assumption, though this was never stated, that the difference between customers' actual investment in energy-efficient lighting and their stated investment criteria was a valid approximation of the value of the ICBs the customer experienced from the lighting project. This may or may not be true.

For example: Let's assume that a customer expects a five-year payback on their investment in Lighting. However, let us also assume that the up-front costs of the project result in a three-year payback to the customer. The study authors assume that the difference between five years of savings and three years of savings approximates the value of the customers' ICBs. However, the customer might have looked at the three-year payback and decided to spend the additional two years' savings on some other project, thereby giving his ICBs a value of zero. The analysis by the study authors, therefore, would overvalue the ICBs.

## **Comparison to Economic Framework**

This study fits fully within the economic framework that underlies the Scoping Study. In many ways the strategy used to conduct this study is required only in a fully economic framework where one attempts to monetize ICBs for use in a cost-effectiveness analysis. A less economically-bounded framework would not require this monetization.

## **STRENGTHS AND WEAKNESSES OF DATA COLLECTION PROCEDURES**

### **Assessment of Data Completeness**

The questions developed by the study team appear to be complete. As stated above, the authors effectively used focus groups with customers to assist in defining ICBs.

One concern is that the poor response from nonparticipants (26 completed surveys out of 800 attempted contacts) is not sufficiently explained. In particular, there is no table explaining sample disposition. Therefore, future researchers cannot learn from this study how better to approach nonparticipants, nor can they judge if the degree of nonresponse is of concern.

### **Assessment of Data Collection Procedures**

Survey participants received detailed cost information about each program's incentives. This assured that participants would be informed respondents to the willingness-to-pay questions. The analysis of differences between expected ICBs and experienced ICBs is an innovative contribution to the analysis of market barriers/effects. This technique borrows from market research gap analysis and could be very effective for market effects analysis.

## **SUSTAINABILITY AND LASTINGNESS**

This issue was not addressed in the study.

## **OPPORTUNITIES FOR FUTURE USE OF THE MARKET EFFECTS EVALUATION**

### **Potential for Future Use of New Market Transformation Evaluation Techniques Tested**

The primary lessons learned from the Indirect Costs and Benefits Pilot study are:

1. It is possible to define a set of ICBs to which customers can respond.

2. Differences between nonparticipants' and participants' experiences with ICBs suggest that the commercial lighting program did affect ICBs for participants.
3. ICBs can be monetized.
4. The value of participants' costs of funds can be calculated.
5. The resources required to develop these types of estimates require data about efficiency equipment investments comparable to those obtained from rebate program applications.

These methods will be most valuable in designing and marketing programs (1 and 2), or when it is necessary to calculate complete cost-effectiveness tests (1-5).



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