Customer Energy Efficiency Program
Measurement and Evaluation Program

BUSINESS ENERGY MANAGEMENT SERVICES (BEMS) SMALL/MEDIUM C/I MARKET EFFECTS STUDY FINAL REPORT

PG&E Study ID number: 420ms-b

June 30, 1999

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FINAL REPORT

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June 30, 1999

BEMS MARKET EFFECTS STUDY

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1. EXECUTIVE SUMMARY

This Executive Summary highlights key findings and recommendations from the Pacific Gas and Electric Company (PG&E) Business Energy Management Services (BEMS) Small/Medium C/I (commercial/industrial) Market Effects Study. The purpose of this study was to (1) systematically assess market effects to date that may have resulted in part from the BEMS program, with emphasis on program year 1998, (2) characterize market actors, structures, and processes relative to high-potential technologies, (3) establish a baseline for future market effects/sustainability assessments, and (4) provide recommendations for program refinement. The BEMS program provides mail, telephone and on-site audits, at this point targeting PG&E's small to mid-size C/I customers. These audits provide recommendations for high-efficiency investments, and corresponding savings estimates, based on information gathered directly from the customer.

In 1996, the California State Assembly Bill 1890 (AB 1890) established a uniform funding mechanism for ratepayer-funded energy efficiency programs, and charged the California Public Utilities Commission (CPUC) with overseeing the mechanism. Subsequently, the CPUC established the California Board for Energy Efficiency (CBEE) to advise it on how best to provide public purpose energy efficiency programs in California. In addition, CPUC Decision (D.) 95-12-063 calls for public spending to shift towards activities that will transform the energy market (Eto et al. 1996). Based on the utility performance award mechanisms approved in D. 97-12-103 and updated in Resolution E-3555, adopted July 23, 1998, for the 1998 energy efficiency programs, the CBEE has directed PG&E to use Public Goods Charge (PGC) funds to perform Market Baseline and Market Transformation (MT) Studies on the 1998 energy efficiency programs. The present study represents an evaluation covered under that directive. There currently is no regulatory verification plan in place for these studies. PG&E and the CBEE will use the results of these reports as appropriate to augment and refine future programs.

This assessment was expressly focused on the small to mid-size (less-than-500 kW) C/I segment, and was linked to the PG&E SmarterEnergy™ program market characterization study, and the PG&E Express Efficiency (Express) market effects study, both currently being finalized. (SmarterEnergy™ is the evolving portion of the PG&E Web site dedicated to providing energy efficiency information to market actors, and to linking customers with vendors. The BEMS-based audit recently has been added to the SmarterEnergy™ site. Express provides rebates for qualifying high-efficiency measures (see Appendix for detailed description of Express program). These two PG&E programs are being evaluated concurrent to this study.) Key findings and recommendations from Quantum Consulting's (QC's) assessment of the BEMS program are below.

1996 and 1998 BEMS participants and 1998 Express participants were selected based on having received one or more recommendations within a defined "core" group of measures and practices (through BEMS), or having made a change in one of those core measures (through Express). These core measures and practices represented the most common BEMS recommendations and Express-based changes, and included T8 installation, reflectors with

de-lamping, compact fluorescent (CFL) installation, energy-efficient central air conditioning system (CAC) installation, use of set-back thermostats, regular air conditioning system maintenance, adjustable-speed drives (ASDs) on air conditioning fans or air handlers, and use of lighting occupancy sensors.

PROGRAM THEORY PLAUSIBILITY

The BEMS program historically has had direct, measurable impacts only upon end users and not upon supply side market actors, because of its emphasis, and also because of its administrative and funding structure. While targeted supply-side market barriers exist regarding the core technologies support by BEMS, the majority of barriers regarding those technologies are faced by end users (this study focused on HVAC- and lighting-related measures and practices).

The BEMS program is designed primarily to reduce end-user barriers related to information/search cost, asymmetric information, performance uncertainty, and transaction/ hassle costs. By reducing these barriers, BEMS aims to increase and accelerate short-term demand for and adoption of high-efficiency measures, thereby reducing supply-side market uncertainty (and increasing their stocking and promotion of high-efficiency measures). Driven by positive end-user experiences with high-efficiency measures, greater supply and greater demand should converge to cause lower prices, bolstering sustained end-user demand. En route to a sustainably transformed market for these measures along small and mid-size C/I customers, positive shifts in diffusion-of-innovation and communications-related factors are expected as well.

The BEMS program could be augmented by, for instance, contemplating explicit links with supply-side actors, and also emphasizing recent links with the SmarterEnergy™ site, in which case a fresh look at program theory "plausibility" would be required. However, given the current end-user-focused role of the BEMS program, the current program theory (as outlined in Chapter 4) seems fairly straightforward, and plausible, particularly given the program's track record. At the same time, as discussed below, we believe that the recent focus on the smaller C/I customers, the link between BEMS and SmarterEnergy™, and other possible changes that might occur, may require the BEMS program to increase emphasis in certain areas.

ASSESSMENT OF MARKET EFFECTS TO DATE

As discussed in more detail in Chapter 8, QC developed a multi-dimensional design for assessing BEMS market effects. This involved comparisons of recent and earlier BEMS participants, nonparticipants in PG&E territory ("PG&E NPs"), nonparticipants in regions with Low-Demand-side Management (DSM) activity in recent years ("Low-DSM NPs"), and recent Express participants. The design controlled for business size and type, two known drivers of program self-selection, and included selected questions related to program attribution of effects, as well as cross-sectional comparisons and a "quasi-longitudinal" comparison of 1998 and 1996 BEMS participants. Data were weighted for analysis by proportion of kWh contribution in each of 12 business size/type cells.

In addition to selected end-user program attribution input, and also selected supply-side input, the market effects analysis emphasized comparison of measures related to market barriers, end-user attitudes/intentions, end-user measure changes, diffusion-of-innovation factors, and communications factors, across three separate comparison sets:

- **BEMS 1998 vs. BEMS 1996 participants**. The hypothesis was that more "desirable" responses among BEMS 1996 respondents may provide evidence that use and acceptance of energy efficiency increase following BEMS participation increases over time. The caveat to this approach is that a cross-sectional comparison of this type may indeed provide "quasi-longitudinal" insights – and/or it may reflect intrinsic differences in program participation cohorts.

- **BEMS 1998 participants vs. PG&E NPs vs. Low-DSM NPs**. The hypothesis was that a discernible pattern throughout the data, in which BEMS 1998 participants reported the most desirable responses overall, generally followed by PG&E NPs, then followed by Low-DSM NPs, could be evidence of at least indirect BEMS contribution to MT. The caveat is that, while the BEMS-versus-PG&E comparison may more definitively (but narrowly) reflect market effects, the PG&E-versus-Low-DSM comparison may reflect broader effects that are much harder to attribute to BEMS.

- **BEMS 1998 vs. Express 1998 participants**. The hypothesis was that BEMS might exhibit superior, or parity, performance relative to Express in specific indicator areas, such that insights might be drawn about the specific ways that BEMS and Express can further complement each other.

Based on responses from BEMS 1998 participants to attribution-oriented questions, BEMS has a fairly significant impact on increasing participant awareness of and openness to high-efficiency solutions. Though to a lesser degree, BEMS also has a moderate impact on participants' future decision-making approach to energy-efficient solutions. Supply-side market actors (who are not targeted by, or directly involved in the BEMS program) generally did not report that BEMS had had an impact on their own business. At the same time, they did attribute some degree of increased end-user awareness of energy-efficient solutions and criteria to BEMS.

The comparison between 1998 BEMS and Express participants did not indicate any areas where BEMS is superior to Express, and very few where they are even at parity. However, this is not at all surprising, because the Express program involves paying incentives to customers (and sometimes to supply-side market actors) to obtain energy-efficient measure installations. In contrast, the BEMS program provides valuable information to customers, but it does not involve any incentives and is not directly linked to supply-side market actors.

At least on the end-user measures included in this study, however much BEMS positively impacts end-user perceptions, attitudes, intentions, and behaviors, Express does at least as well, and consistently so. Based on the available data, it is difficult to identify any significant, incremental contributions that BEMS makes over and above Express, beyond the important function of heightening customer energy efficiency awareness and attention.

The three-way comparison among BEMS 1998 participants, PG&E NPs, and Low-DSM NPs, showed mostly mixed results. Generally, every finding that seemed to be a potential market effects indicator was cancelled by an opposite indicator on a similar measure. The one area where some consistent indications of market effects were seen was in comparisons between PG&E NPs and Low-DSM NPs. PG&E NPs exhibited significantly more confidence in the ability of energy-efficient solutions to save them money, more agreement that energy-efficient solutions are easy to use and understand, more agreement that conserving energy is an important part of being a good corporate citizen, and more "championing" of energy efficiency. The first measure relates to the mission of BEMS to reduce performance uncertainty, while the latter three relate to diffusion-of-innovation and communication factors. Also, BEMS 1998 participants were more likely than PG&E NPs to have participated in Express, substantiating the important (but passive) role that BEMS currently plays in "feeding" Express.

The most supportive indications for MT, by far, resulted from the comparison of 1998 and 1996 BEMS participants. As noted earlier, there is no definitive way to distinguish between "life cycle" and "cohort" effects with this cross-sectional comparison of two different BEMS participant cohorts. However, there were a number of market effects indicators based on this comparison, fairly well balanced across the different behavioral, market barrier, and attitudinal measure areas. Specifically, this comparison indicated the following potential downstream effects of BEMS participation:

- Greater Express participation;
- Greater use of secondary measures and practices such as set-back thermostat use and HVAC maintenance, as well as greater use of CFLs and CACs (though potentially less use of T8s, and related de-lamping / reflectors and light sensors);
- More frequent use of energy-efficiency equipment selection policies, and long-term investment (life cycle) analysis of purchase alternatives;
- Lower market barriers relating to performance uncertainty, transaction / hassle cost, asymmetric information, and bounded rationality;
- Greater confidence that energy-efficient investments will save them money; and
- Greater agreement that important non-energy benefits accrue from energy-efficient investments, and that they regularly hear about energy efficiency from business contacts.

The risk in making strong assertions supporting MT based on these data is that the observed differences may not be wholly caused by life cycle-based evolution of end-user attitudes and behavior following BEMS participation. As discussed in more detail in Chapter 8 on Market Effects, differences between 1996 and 1998 BEMS cohorts also may reflect differences in the proportion of renters in the two cohorts, and also the increasing emphasis on less-detailed, more "customer-passive" mail-in audits over time. In addition, the 1998 BEMS participants simply may have inherently different needs and priorities, and may be more demanding and / or less attractive energy efficiency prospects.

In addition to the comparison analyses, statistical models were developed to attempt to identify market effects attributable to the BEMS program. The objective of this modeling effort was to identify correlations between customers' energy efficiency adoption behavior and their firmographics, perceptions of barriers, attitudes and other decision-making policies. Through this analysis, we would ideally be able to identify: the types of firmographics are consistent with customers that tend to adopt energy efficiency measures; which barriers have been reduced or eliminated among customers adopting energy efficiency measures; and what types of attitudes and decision-making policies are common among customers adopting energy efficiency measures.

By isolating specific characteristics that are correlated with energy-efficient adoptions, we can identify if market effects are present by comparing these characteristics among selected groups of customers. For example, if we find that a specific attitude is correlated with energy-efficient adoptions, and customers in PG&E's service territory are much more likely to display this attitude than customers in Low DSM States, then we can infer some market effects have occurred. Overall, our findings were as follows:

- Market effects are most evident when we focus our analysis on the paths to measure adoption. The greatest evidence of market effects occurs among customers that adopt measures as a result of an energy audit, and among customers that both adopted and participated in BEMS. We see more positive attitudes towards energy efficiency among these customers, and fewer stated barriers to adoption.

- Furthermore, we see some evidence of market effects among BEMS participants, in general. Perhaps the strongest evidence is the significance that BEMS participation has in predicting measure adoption. In addition, we found these customers to have strong intentions to install energy-efficient measures in the future.

An important aspect of all three comparison sets was that, in each set, BEMS 1998 participants were more likely than their counterparts to rent space, and therefore to have correspondingly greater cost-justification and payback concerns. This finding suggests that the one market barrier that may increase significantly as BEMS is targeted to smaller businesses is split incentives (as also noted in the SmarterEnergy™ market characterization study).

In summary, results are mixed regarding the degree of MT – incremental market effects - that can be attributed to the BEMS program. Follow-up analysis that also controls for the own/rent variable will provide more insight. In addition, a focused analysis emphasizing customers who participated in both BEMS and Express can refine understanding of the incremental effects of BEMS. Tracking multiple participant cohorts over time also will provide invaluable insights into the mix of cohort versus life cycle effects observable in the data. Tracking individual attitudes, intentions, and behaviors (through a panel approach) would be particularly powerful in this regard.

RECOMMENDATIONS

The BEMS program has a targeted function intended to complement the functions of other programs in the portfolio of PG&E MT tools. Its role is to provide customers with useful

information about energy efficiency, to increase customer confidence in energy-efficient practices and measures, and to support energy-efficient investments both through and outside the Express program (which is much more oriented to incenting customer action). QC's recommendations regarding the BEMS program are a mix of content- and process-related suggestions, as well as ideas for refining the market effects measurement process over time.

QC's recommendations are as follows:

- Conduct supplemental analysis of BEMS 1998-versus-BEMS 1996 research that controls for own/rent characteristics.

- Conduct targeted explanatory modeling analysis to better understand the drivers and correlation of market effects indicators that appear to be present in the preceding comparison set.

- As noted above, contemplate "panelizing" the process of tracking BEMS market effects, including multiple participant cohorts, so that effects can be isolated as definitively as possible.

- Conduct research and develop a strategy in support of re-packaging and positioning BEMS results to building owners when small and mid-size C/I customers rent space.

- Aggressively leverage BEMS' new presence on SmarterEnergy™, by using that medium to cultivate one-to-one dialogues with site visitors, generate more audits, and gain permission to follow up on audit recommendations and reinforce customer follow-through on those recommendations.

- Likewise, PG&E should reinforce the new opportunity represented by the BEMS-based audit on SmarterEnergy™, by highlighting the Web site in BEMS materials.

- While it was not a dominant barrier, access to financing was one of the more prevalent barriers based on end-user ratings. Based on comparable results from the concurrent SmarterEnergy™ evaluation, PG&E should consider explicit links between the BEMS program and output, and financing sources. The link between BEMS and SmarterEnergy™ can provide a natural conduit to this "enabling" information.

- While administrative complications may exist, to the extent possible BEMS should link BEMS directly to Express and qualified Express supply-side participants. Again, SmarterEnergy™ has the potential to serve as a natural (if not exclusive) mechanism for doing so.

- PG&E should consider development of a predictive model to classify less-than-500-kW customers, at least probabilistically, into "own" and "rent" categories. Available customer information, along with appendable third-party data, could be used to develop this model, which in turn can be used to target the audit to the most interested and appropriate customers (though, of course, it would remain available to all customers). There are no guarantees about the degree of predictive success of such

a model, but we believe initial exploration would be very worthwhile, provided PG&E is able to use this kind of targeting information from a regulatory perspective.

- The on-site interviews have been used less often in recent years, because of their higher cost relative to mail and telephone audits. Also, previous impact evaluation of the BEMS program indicates that the greatest program impacts were associated with on-site audits (though this is probably a function of how on-site audits were targeted to specific customer types). With this background, QC suspects that an analysis of BEMS cost-effectiveness across the different survey types, controlling for any evident targeting effects, would be worthwhile, since there was a shift toward greater use of mail-in audits from 1996 to 1998.

- As discussed, subsequent tracking of attitudes and behaviors among these same cohorts, and analysis that controls for own/rent and audit form, would be particularly powerful in separating out life cycle-based market effect indicators from cohort effects, own/rent effects, and audit form effects.

In conclusion, the BEMS has been a useful complement to the Express program, though with limited potential to provide significant "stand-alone" MT value. However, potential for real synergy exists by forging more explicit links between BEMS and Express, SmarterEnergy™, and vendor and financing solutions, and by developing a strategy for combating the split incentives barrier in this customer stratum. Pursuing some or all of these approaches could enable PG&E to measure significant market effects, attributable at least in part to BEMS, in the next phase of the program's existence.

2. INTRODUCTION

This section presents the BEMS program description and purpose, and discusses BEMS participation trends since 1996. The BEMS program description and study purpose are presented first. BEMS participation trends are then discussed.

BEMS PROGRAM DESCRIPTION AND STUDY PURPOSE

The BEMS program conducts mail, telephone and on-site audits among PG&E's small to mid-size C/I customers. Mail audits utilize the Business Edge tool. The Business Edge tool is designed to assess a business' energy usage. Customers answer general questions regarding facility type and size, heating and cooling equipment, water heating equipment, water use, lighting equipment, refrigeration, office equipment, waste removal and recycling, and mail the survey back to PG&E. Telephone audits and on-site audits utilize the Business Energy Survey Tool (BEST). BEST is a computer-based survey, designed to assess a business' energy use. BEST collects more detailed information on measure counts and energy efficiency specifics. The purpose of the on-site audit is to establish a relationship with the decision-maker at the business and meet the customer's need to reduce and/or control energy costs. The on-site audit professional gathers inputs and provides prescriptive recommendations regarding energy-efficient changes, along with estimates of savings. Budget reductions have resulted in a declining proportion and number of on-site audits in the past several years. In contrast, mail and telephone audits provide recommendations and savings estimates based solely on inputs gathered directly from the customer. Copies of the Business Edge tool and BEST are located in Appendix C.

The purpose of this study is to provide 1) a systematic analysis of attributable market effects to date, as well as 2) a characterization of market actors, structure and processes, 3) a baseline market assessment for future market effects/sustainability measures, and 4) strategic recommendations for BEMS going forward.

BEMS is linked to SmarterEnergy™ in terms of its informational mission and high-potential measures, and it is linked to Express in terms of supporting, "enabling", and feeding prospective energy-efficient adopters to end-use measures through the program. The evaluation of BEMS market effects was linked to the evaluation of Express through a shared end-user survey (and data), and also by appending BEMS-related questions to the Express-oriented supply-side surveys.

BEMS PARTICIPATION TRENDS

During 1996 and 1998, nearly 18,000 audits were conducted for PG&E's small commercial customers as part of the BEMS program. Three types of audits were conducted: (1) mail audits based on the Business Edge tool, (2) phone audits based on the BEST tool, and (3) on-site audits, which also utilized the BEST tool. The primary difference between 1996 and 1998 was the reduction in resources allocated to conducting on-site audits. As is shown in Exhibit 2-1, the number of on-site audits was nearly cut in half in 1998; whereas the number of

phone audits completed was almost identical and the number of mail audits increased by about 25 percent.

The results of the audits, in terms of recommendations made, was also very similar over time. The following trends can be seen by examining Exhibit 2-1.

Mail Audits

The types of recommendations made for the mail audits was very consistent over time. T-8s, lighting controls and set back thermostats were among the most commonly recommended items. Each of these measures was consistently recommended to approximately one third of all mail participants. CFLs and CACs were each recommended to about one tenth of the mail participants. None of the other key measures studied were recommended as part of the mail audits.

The only significant difference between 1996 and 1998 was in the total number of lighting and HVAC recommendations made. In 1996 there were significantly more HVAC and less lighting measures recommended than in 1998. The distributions of 1998 is more consistent with what we would expect, with 82 percent of all mail participants receiving at least one lighting recommendation, and 62 percent receiving at least one HVAC recommendation. In 1996, however, only 59 percent of all mail participants received a lighting recommendation; whereas 83 percent received an HVAC recommendation.

Phone Audits

The types of recommendations made for the phone audits were very consistent over time for lighting measures. In both years, lighting recommendations were made to nearly every phone participant. In fact, T8s were recommended to over 85 percent of all phone participants in both years. About 15 percent of phone participants received recommendations for CFLs. Delamping and lighting controls were rarely recommended.

The types of recommendations made for HVAC measures, however, were less consistent over time. The number of HVAC measures recommended dropped over time. In 1996, 73 percent of all phone participants received an HVAC recommendation, compared to only 55 percent in 1998. There were also significant differences in the types of measures recommended. In 1996 more than half of the phone participants received a CAC recommendation, compared to only 31 percent in 1998. Set back thermostat recommendations significantly increased over time, increasing from 15 to 43 percent of the phone participants receiving this recommendation. ASDs and HVAC maintenance were rarely recommended.

On-Site Audits

Although the number of on-site audits dropped in half between 1996 and 1998, the types of recommendations remained very consistent over the same time period. In both years, lighting recommendations were made to nearly every on-site participant, with T8s being recommended to over 74 percent of all on-site participants. CFLs were the next most commonly made recommendation, reaching about 30 percent of the on-site participants in each year. The on-site audit was the primary delivery mechanism for recommending

reflectors and delamping, with this measure being recommended to 14 percent of the on-site population in 1996, and 6 percent in 1998. In both years, lighting controls were only recommended 6 percent of the time.

Among HVAC measures, both set back thermostats and HVAC maintenance were the most commonly made recommendations. Each were recommended to over 20 of the on-site participants in both years. CACs, however, were only recommended to a small fraction of the on-site participants: 2 percent in 1996 and 6 percent in 1998. ASDs were rarely recommended.

All Audits

Overall, lighting measures and practices in general were recommended over 85 percent of the time. T8s were the most commonly recommended measures, being made to over 60 percent of all participants in each year. T8 recommendations were most common among the phone and on-site audits. CFLs and lighting controls were each recommended about 20 percent of the time. Lighting controls were primarily recommended through the mail audits; whereas CFLs were frequently recommended for all audit types. Reflector installation with delamping was the least commonly recommended measure, with most recommendations for it coming from on-site audits.

HVAC recommendations dropped significantly over time, from 75 percent in 1996 to 59 percent in 1998. The most common HVAC measure recommended (being made to 29 percent of all participants) was set back thermostats. Set back thermostats were also commonly recommended in each audit type. CACs were only recommended to 12 percent of all participants; however, over 40 percent of all phone participants received a CAC recommendation. HVAC maintenance was recommended only 10 percent of the time, almost exclusively through on-site audits. ASDs were rarely recommended, and were not recommended at all through the mail audits.

Exhibit 2-1
Participation Trends

	1996 BEMS				1998 BEMS			
	Mail Audits	Phone Audits	On-Site Audits	**TOTAL**	Mail Audits	Phone Audits	On-Site Audits	**TOTAL**
Audits Completed	2,838	887	5,070	8,795	3,550	894	2,752	7,196
Recommendations Made	Number of Audits Receiving Recommendation							
T-8s	1,250	754	3,757	5,761	1,473	774	2,159	4,406
Reflectors w/ Delamp	-	16	699	715	-	3	165	168
CFLs	368	142	1,479	1,989	417	135	855	1,407
Lighting Controls	1,148	12	292	1,452	1,260	1	175	1,436
Total Lighting	1,662	843	5,008	7,513	2,894	840	2,621	6,355
CACs	287	472	114	873	457	273	164	894
Set-Back Therm.	837	129	1,052	2,018	1,042	381	687	2,110
ASDs	-	1	10	11	-	-	12	12
HVAC Maintenance	-	37	1,165	1,202	-	8	740	748
Total HVAC	2,365	649	3,615	6,629	2,184	493	1,560	4,237
Recommendations Made	Percent of Audits Receiving Recommendation							
T-8s	44%	85%	74%	66%	41%	87%	78%	61%
Reflectors w/ Delamp	0%	2%	14%	8%	0%	0%	6%	2%
CFLs	13%	16%	29%	23%	12%	15%	31%	20%
Lighting Controls	40%	1%	6%	17%	35%	0%	6%	20%
Total Lighting	59%	95%	99%	85%	82%	94%	95%	88%
CACs	10%	53%	2%	10%	13%	31%	6%	12%
Set-Back Therm.	29%	15%	21%	23%	29%	43%	25%	29%
ASDs	0%	0%	0%	0%	0%	0%	0%	0%
HVAC Maintenance	0%	4%	23%	14%	0%	1%	27%	10%
Total HVAC	83%	73%	71%	75%	62%	55%	57%	59%

FIRMOGRAPHIC PARTICIPATION TRENDS

Although there are no strict eligibility requirements for participating in the BEMS program, the program does tend to attract larger customers within certain business types. Exhibit 2-2 below presents the participation distribution across business type and size (small customers have demand less than 20 kW, and large customers have demand of at least 100 kW, but less-than-500 kW). PG&E's population distribution [from the Customer Information System (CIS)], is compared to the participation distribution, as well.

Overall, we see that the penetration of medium and large customers is almost twice as high among BEMS participants, compared to the population. Furthermore, retail customers tend to be more likely to participate than any other business type. Retail customers were also the most likely to have had an on-site audit conducted.

Larger and medium customers tend to participate in the on-site audit, as might be expected. Over time, we see that large and medium customers have participated less frequently, primarily due to the reduction in on-site audits being conducted. There appears to have been an increase, however, among large and medium customers participating in the mail audit. This too may be a result of the reduction in on-site audits.

Across business types, there has been a relatively large increase in participation among institutional customers, primarily among the mail audits.

Exhibit 2-2
Participation Trends
By Business Type and Size

		BEMS 96				BEMS 98				CIS
Business Type		Mail	Phone	On-Site	Total	Mail	Phone	On-Site	Total	Total
Office	Small	5.3%	1.8%	5.1%	12.2%	6.7%	1.9%	3.4%	12.0%	16.3%
	Medium	0.1%	0.7%	2.6%	3.4%	1.3%	0.3%	0.9%	2.5%	1.8%
	Large	0.0%	0.1%	1.5%	1.6%	0.3%	0.1%	0.6%	1.0%	0.6%
	Total	5.4%	2.6%	9.2%	17.2%	8.3%	2.2%	4.9%	15.4%	18.7%
Retail	Small	9.4%	3.7%	16.3%	29.5%	16.2%	2.6%	10.6%	29.5%	23.1%
	Medium	1.4%	0.4%	7.4%	9.2%	3.9%	0.2%	4.0%	8.0%	4.2%
	Large	0.0%	0.1%	0.9%	1.0%	0.3%	.	0.4%	0.7%	0.8%
	Total	10.8%	4.2%	24.6%	39.7%	20.4%	2.9%	15.0%	38.2%	28.1%
Institutional	Small	1.8%	0.4%	1.8%	3.9%	4.5%	0.1%	1.3%	5.9%	7.5%
	Medium	0.0%	0.1%	1.2%	1.3%	0.7%	0.1%	0.7%	1.5%	0.8%
	Large	.	0.1%	1.1%	1.2%	0.4%	0.1%	1.1%	1.6%	0.6%
	Total	1.8%	0.6%	4.0%	6.5%	5.6%	0.2%	3.2%	9.0%	8.9%
Other	Small	13.7%	2.1%	14.7%	30.6%	13.5%	6.5%	12.2%	32.2%	40.5%
	Medium	0.6%	0.4%	3.6%	4.6%	1.3%	0.5%	2.3%	4.1%	2.7%
	Large	0.0%	0.1%	1.3%	1.5%	0.3%	0.1%	0.7%	1.1%	1.1%
	Total	14.3%	2.6%	19.7%	36.6%	15.1%	7.1%	15.2%	37.4%	44.2%
TOTAL	Small	30.2%	8.1%	37.9%	76.2%	40.9%	11.2%	27.5%	79.5%	87.5%
	Medium	2.1%	1.6%	14.8%	18.5%	7.2%	1.0%	7.9%	16.1%	9.4%
	Large	0.1%	0.4%	4.8%	5.3%	1.3%	0.2%	2.9%	4.4%	3.1%
	Total	32.4%	10.1%	57.5%	100.0%	49.3%	12.4%	38.3%	100.0%	100.0%

3. METHODOLOGY

This section presents the methodology for data collection and sampling, and data weighting and analysis. Please note that this excludes supply-side data collection, undertaken by Xenergy for the market characterization summarized in Chapter 5, and shared with the Express Market Characterization and Market Effect Study. Characteristics of the supply-side market actors interviewed for this phase are summarized in Chapter 5.

SURVEY GROUPS

The target population for this market effects analysis was C/I customers less-than-500 kW. The end-user survey and analyses were targeted to this segment, with samples of interviews completed among each of the following populations:

- 1998 BEMS participants
- 1996 BEMS participants
- 1993-1998 PG&E NPs
- Low-DSM NPs (C/I customers in utility territories with low historical DSM program offerings, where a mapping scheme was used to correlate company size and type information with PG&E customer size)
- 1998 Express participants

DATA COLLECTION

- Telephone surveys were conducted in QC's CATI-equipped survey center between April 12 and June 8, 1999, among 304 BEMS 1998 participants, 323 BEMS 1996 participants, 186 Express 1998 participants, 299 PG&E NPs and 222 Low DSM NPs. The survey averaged 20 minutes in length after initial pre-testing and survey revisions.

SAMPLE

Sample for PG&E participants was pulled from PG&E Marketing Decision Support System (MDSS) program tracking database, and sample for PG&E NPs was pulled from both PG&E's Customer Information System (CIS) database and MDSS database.

For the Low-DSM NPs, sample was pulled from the Dun & Bradstreet (D&B) MarketPlace database. The goal was to construct a subset of states that has not had as much energy-efficiency program activity historically as has California, because we were trying to measure program effects (be they near-term or recent) rather than trying to establish a baseline against which future effects might be measured. There is no ideal comparison area in terms of being a clinically pure control group; however, on a relative basis, the states with low levels of recent (1990s) DSM activity provide a better point of comparative reference than do those

areas with more active programs, some of which have current MT initiatives. The historically Low-DSM states used for the out-of-state non-participant sample include Arkansas, Kansas, Louisiana, Mississippi, Missouri, New Mexico, North Carolina, Oklahoma, Pennsylvania, South Carolina, and Texas.

Sample for the PG&E customers was designed to exclude duplication across segments (with 1998 Express participants first priority, then 1998 BEMS participants, then 1996 BEMS participants, then PG&E NPs). To the extent possible based on the distribution of program participants, interviews in each of the five segments were distributed equally across each of the following 12 cells (and minimums were set where equal distribution was impractical):

- Offices – less than 20 kW, 20-99 kW, 100-499 kW
- Retail – less than 20 kW, 20-99 kW, 100-499 kW
- Institutional – less than 20 kW, 20-99 kW, 100-499 kW
- Other – less than 20 kW, 20-99 kW, 100-499 kW

A mapping algorithm was used to correlate D&B business size and type data with these 12 cells.

1996 and 1998 BEMS participants and 1998 Express participants were selected based on having received one or more recommendations within a defined "core" group of measures and practices (through BEMS), or having made a change in one of those "core" measures (through Express). These "core" measures and practices represent the most common BEMS recommendations and Express-based changes, and include T8 installation, reflectors with de-lamping, CFL installation, energy-efficient CAC installation, use of set-back thermostats, regular air conditioning system maintenance, ASDs on air conditioning fans or air handlers, and use of lighting occupancy sensors.

DATA WEIGHTING AND ANALYSIS

Each of the 60 unique sub-cells (5 segments times 12 cells) was weighted such that the distribution of less-than-500 kW interviews in each segment mirrored the kWh distribution of the entire less-than-500 kW population in PG&E territory. (In fact, this weighting scheme was similar to the results if the weighting "target" had been 1998 or 1996 BEMS participation.) In this way, the analysis of results and market effects was weighted proportionally to the demand reduction opportunities throughout the less-than-500 kW population. Also, and very importantly, this approach controlled for any variations across segments in customer size or type that might have muddied assessment of market effects – BEMS participants were in effect compared to similarly constructed "peer groups," avoiding apples-and-oranges comparisons.

4. BEMS INITIAL HYPOTHESES AND PROGRAM THEORY

Many of the early MT studies were primarily based upon combining procedures from DSM evaluations and concepts from "A Scoping Study on Energy Efficiency Market Transformation by California DSM (Demand-Side Management) Programs" (the Scoping Study).[1] As work continues in this field, improvements informed by a broader set of theoretical work are being made. Examples of this include the use of diffusion-of-innovation literature as the basis of MT measurement performed by TecMRKT Works for PG&E's *PG&E Energy Center Market Effects Study* conducted in 1998, and the use of Theory-Based Evaluation (TBE) by XENERGY, Inc. in their *Evaluation of Nonresidential Standard Program Contract Program* for the CBEE and Southern California Edison (SCE) in 1999.

This study, along with other ongoing studies being conducted for PG&E, builds upon these improvements and provides another level of improvement using both expansion and integration of these and theoretical perspectives. The advancements made herein follow the recommendations included in the Market Effects Summary Study (Summary Study):[2]

> *The Scoping Study provides an excellent framework for market effects and market transformation program design and evaluation. However, we strongly feel that the diffusion-of-innovation literature should be incorporated in efforts to measure and design market transformation programs. We also propose some slight modifications to the Scoping Study that should be kept in mind by those who use the Scoping Study and the CBEE Policy Guidelines. The changes we recommend are:*
>
> - *Emphasize knowledge of market structure and information flows that emerge from an understanding of the diffusion-of-innovation literature.*
> - *Clarify the definition of market barriers and how these concepts should be used in both program design and evaluation.*
> - *Emphasize the links between market barriers, program interventions and market effects in both program design and evaluation.*[3]

---

1 Eto, Joseph, Ralph Prahl, and Jeff Schlegel. 1996. *A Scoping Study on Energy Efficiency Market Transformation by California Utility DSM Programs*, Earnest Orlando Lawrence Berkeley National Laboratory, LBNL-39058 UC-1322, Prepared for The California Demand-Side Measurement Advisory Committee, Berkeley, CA.

2 Peters, Jane S., Bruce Mast, Patrice Ignelzi, and Lori M. Megdal. 1998. *Market Effects Summary Study, Final Report, Volume 1*, Research Into Action, prepared for The California Demand-Side Measurement Advisory Committee, Portland, OR.

3 Peters, Jane S., et al.: pp. ES-IX. "Measuring Market Transformation: The 1997/1998 California Market Effects Studies," *Leading the Retail Revolution: 1998 Edition*, Proceedings from the 9th National Energy Services Conference, Association of Energy Services Professionals, Boca Raton, FL: pp. 121-128, cite p. 126.

The theoretical foundations for MT studies bear a much greater importance than was seen in many of the quantitative impact evaluations in the DSM paradigm. These foundations guide the perspective used in types of interactions to be examined and what types of questions need to be addressed. They are a key element to crafting the "story" of how the program will create MT. Measurement of these story elements and their sequence provides an important basis for program attribution of the changes seen in the market, a more difficult proposition when conducting market studies as compared to participant studies. This is part of the reason for the third recommendation quoted above from the Summary Study. The need for the development of the story behind a program's hypothesized MT was also presented in an earlier paper by Herman et al. in 1997.[4]

The theoretical foundation for this study builds upon each of these, along with a framework for the "story" development from TBE. This is complemented by examining market barriers using categories for simplification from the Scoping Study while expanding the definitions of individual indicators to be more comprehensive of both downstream and upstream market actors. Factors from diffusion-of-innovation theory and elements of inter-market actor communication are also considered, along with hypothesized shifts or cross-sectional differences related to market barriers, in the assessment of BEMS market effects to date. This chapter presents this state-of-the-art approach to MT assessment as it was developed for the present study.

THEORETICAL FOUNDATIONS

There are two types of examinations used to create the theoretical foundations for this study. The first set examines how the market fails to operate and the elements necessary to achieve a transformed market. The second set addresses the program interventions, how these are expected to be used to create a transformed market, and how they are to be measured.

The Scoping Study, one of the pivotal theoretical foundations for MT studies, is generally based upon transaction cost economics.[5] Its emphasis is on identifying, measuring and measuring the change in market barriers, where market barriers are defined as

> *Any characteristic of the market for an energy-related product, service, or practice that helps to explain the gap between the actual level of investment in or practice of energy efficiency and an increased level that would appear to be cost beneficial.*[6]

---

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

5 An examination of the Scoping Study's basis on transaction cost economics as it relates to other MT perspectives from microeconomics, diffusion studies, and transaction flow analyses and a possible theory of integration can be found in Megdal, Lori. 1998. "Integrating Perspectives from Alternative Disciplines to Understand Market Transformation Policy in Energy Markets," *Conference Proceedings of the International Association for Energy Economics*, Quebec, Canada: pp. 417-424.

6 Eto, et al., p. 7.

One of the first theoretical expansions for this study is in re-examining the market barrier definitions from a broader transaction cost economics perspective and allowing these definitions to be expanded to better describe barriers seen by supply-side market actors. A summary of the Scoping Study market barrier definitions and the expansions developed in this study is presented in Exhibit 4-1.

Exhibit 4-1
Market Barrier Definitions and Expansions for Barriers Seen on the Supply Side

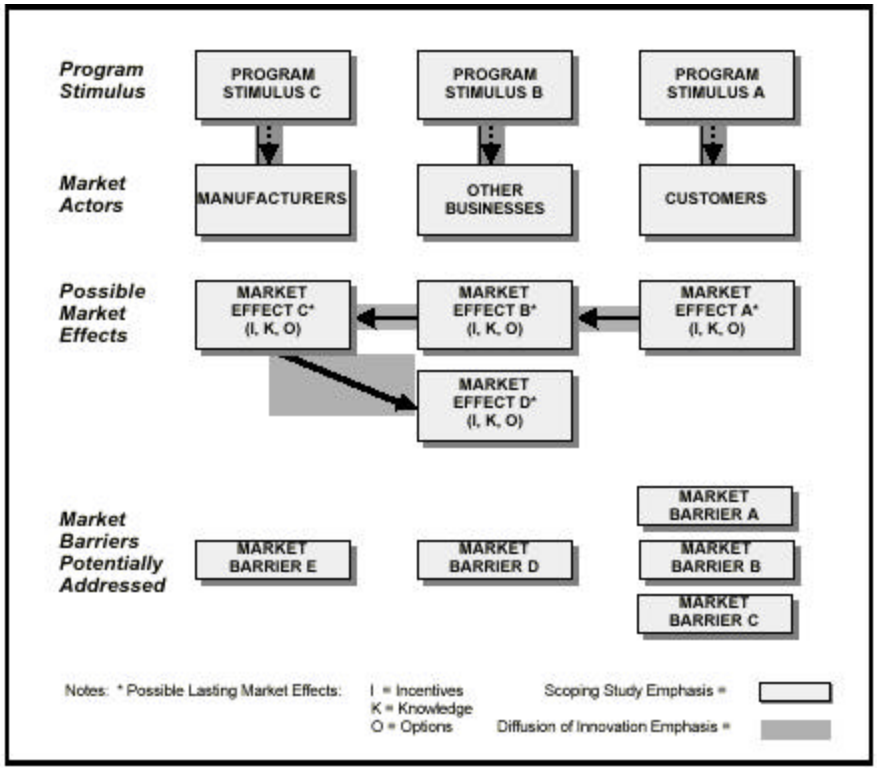
BARRIER	SCOPING STUDY DESCRIPTION	EXPANSIONS for SUPPLY SIDE
Information or Search Costs	The costs of identifying energy-efficient products or services or of learning about energy-efficient practices, including the value of time spent finding out about or locating a product or service or hiring someone else to do so.	Applicable as is.
Performance Uncertainties	The difficulties consumers face in evaluating claims about future benefits. Closely related to high search costs, in that acquiring the information needed to evaluate claims regarding future performance is rarely without cost.	Include Market Uncertainties. The difficulties supply-side market actors face in determining the cost-effectiveness of moving into a market for energy efficiency products or services, given current low levels of demand.
Asymmetric Information and Opportunism	The tendency of sellers of energy-efficient products or services to have more and better information about their offerings than do consumers, which, combined with potential incentives to mislead, can lead to sub-optimal purchasing behavior.	Similar for any smaller market actor downstream from a larger or oligopolistic market actor.
Hassle or Transaction Costs	The indirect costs of acquiring energy efficiency, including the time, materials and labor involved in obtaining or contracting for an energy-efficient product or service. (Distinct from search costs in that it refers to what happens once a product has been located.)	Applicable as is with additional hassle or transaction costs in order to establish new vendor relationships, stocking a broader menu of items, supporting a broader menu of products, training for a broader menu of products and/or more sophisticated products, and added complexities in sales and marketing efforts.

BARRIER	SCOPING STUDY DESCRIPTION	EXPANSIONS for SUPPLY SIDE
Hidden Costs	Unexpected costs associated with reliance on or operation of energy-efficient products or services - for example, extra operating and maintenance costs.	Additional provision costs such as the risk of establishing new vendor relationships, financing the stocking of a broader menu and/or more expensive stock, potential of additional call-backs for installing more sophisticated and newer products.
Access to Financing	The difficulties associated with the lending industry's historic inability to account for the unique features of loans for energy savings products (i.e., that future reductions in utility bills increase the borrower's ability to repay a loan) in underwriting procedures.	Similar if additional stock needs to be financed in a market with greater market uncertainties.
Bounded Rationality	The behavior of an individual during the decision-making process that either seems or actually is inconsistent with the individual's goals due to the individual using simplification rules for decision making.	Applicable as is.
Organization Practices or Customs	Organizational behavior or systems of practice that discourage or inhibit cost-effective energy-efficiency decisions - for example, procurement rules that make it difficult to act on energy efficiency decisions based on economic merit.	The practice of using only long-established vendors or vendors with which the firm has long-term relations.
Misplaced or Split Incentives	Cases in which the incentives of an agent charged with purchasing energy efficiency are not aligned with those of the persons who would benefit from the purchase.	Applicable as is.
Product or Service Unavailability	The failure of manufacturers, distributors or vendors to make a product or service available in a given area or market. May result from collusion, bounded rationality, or supply constraints.	Applicable as is. Unavailability may also result from market uncertainties and/or large incremental costs of switching production to energy-efficient product lines.

BARRIER	SCOPING STUDY DESCRIPTION	EXPANSIONS for SUPPLY SIDE
Externalities	Costs that are associated with transactions, but which are not reflected in the price paid in the transaction.	Applicable as is.
Non-Externality Pricing	Factors other than externalities that move prices away from marginal cost. An example arises when utility commodity prices are set using ratemaking practices based on average (rather than marginal) costs.	Applicable as is.
Inseparability of Product Features	The difficulties consumers sometimes face in acquiring desirable energy efficiency features in products without also acquiring (and paying for) additional undesired features that increase the total cost of the product beyond what the consumer is willing to pay.	Similar for any smaller market actor downstream from a larger or oligopolistic market actor. Can be a by-product of reducing transaction costs by offering fewer product lines or minimizing market uncertainties by targeting niche higher priced markets.
Irreversibility	The difficulty of reversing a purchase decision in light of new information that may become available, which may deter the initial purchase - for example, if energy prices decline, one cannot resell insulation that has been blown into a wall.	The difficulty of reversing a manufacturing re-tooling or practices decision and uncertainty that public funding support will remain until demand is high enough to remove market uncertainties.

A broader view of factors relating to MT was derived from additionally examining diffusion of innovation theory and its communications implications. The difference in emphasis between the Scoping Study and the diffusion-of-innovations literature was highlighted in the Summary Study as duplicated in Exhibit 4-2 below.

Exhibit 4-2
Emphasis Difference Between Scoping Study and Diffusion of Innovations
(Figure 1.1 from Summary Study[7])



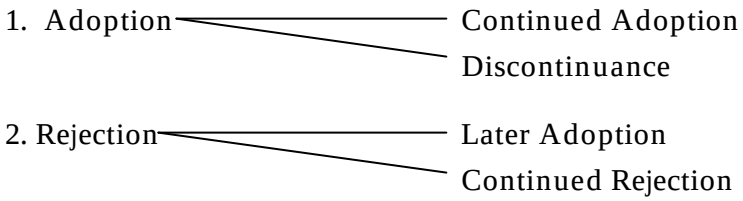
The most oft-cited summary of the diffusion-of-innovation theory is provided from Rogers' diagram as shown in Exhibit 4-3 below.

7 Peters et al., p. 38.

Exhibit 4-3
Innovation-Decision Process
(Rogers, Diffusion of Innovations[8])

COMMUNICATION CHANNELS

I. Knowledge II. Persuasion III. Decision IV. Implementation V. Confirmation



The diffusion-of-innovation literature also provides us with a list of six attributes of the product or services that influence the rate of diffusion. These rate of diffusion factors are also considered in this study as important elements in measuring factors towards MT, using a blend of end-user input and judgment based on a review of BEMS purpose and performance, and the broader landscape in which it exists. These six factors are:[9]

1. Fulfillment of need
2. Compatibility
3. Relative advantage
4. Complexity
5. Observability
6. Trialability

In addition, two communication elements in MT related to market actor feedback and communication networks are incorporated in this framework, because they are believed to be important elements of a transformed, sustainable market. These are whether "championing" of high-efficiency measures is occurring among key market actors, and whether follow-up is available and occurring, in terms of market actor interactions regarding high-efficiency measures after initial contacts and / or installation of measures.

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8 Rogers, Everett M. 1982. *Diffusion of Innovations*, 4th Edition, New York, New York: Free Press, p. 163.

9 Rogers, Everett M., with F. Floyd Shoemaker. 1971. *Communication of Innovations: A Cross-Cultural Approach,* New York: Free Press, pp. 137-157.

This completes the expansion of market barriers and MT mechanisms examined in the theoretical foundations for the BEMS program, in terms of what now, or at some later point, may be present and measurable in its market environment. This list is then grouped by categories to make it more understandable and to allow other examinations to be made more simply by category. The final list and their categories are provided in Exhibit 4-4.

Several market barriers not hypothesized to be particularly addressable by BEMS, critical to this market segment, and/or associated with the products emphasized (hidden costs, feature inseparability, and irreversibility) were de-emphasized in primary data collection. Also, by their very nature, the diffusion-of-innovation criteria of "observability" and "trialability" can be assessed judgmentally more readily than through "voice-of-the-market" input. Observability refers to the degree of public visibility a product and its corresponding benefits have; to the degree that high-efficiency measures offer greater performance they are "observable." However, the primary benefit of high-efficiency measures tends to be delivery of "adequate" product performance with lower life cycle cost, typically unobservable to all but the bill payer. Trialability refers to the extent to which a product can be tried on a low-cost or low-risk basis before full purchase commitment; generally speaking, mainstream energy efficiency measures such as those addressed in this study have low "trialability."

Exhibit 4-4
List of Market Barriers & MT Mechanisms by Category

MARKET BARRIERS	*MT MECHANISMS*
Product/Service Availability	**Feedback/ Communication Network**
Unavailable	Championing
Awareness	Follow-up available
Information costs	**Rate-of-Diffusion Factors**
Asymmetric information	Fulfillment of felt need
Decision Process	Compatibility
Transaction/Hassle costs	Relative advantage
Access to financing	Complexity
Bounded rationality	Observability
Organizational practices	Trialability
Split incentives	
Perceived Reliability & Uncertainty	
Performance & market uncertainty	
Hidden costs	
Inseparability of features	
Irreversibility	

The second level of examination looks at how the program operates to create MT. This was an integral part of the study design phase allowing the development of a program theory, an essential step under a TBE approach. TBE is a broad descriptor of an evaluation approach that has been used in a number of policy fields for some time, and is especially germane in evaluations of MT programs. According to Weiss, the central tenets behind TBE are that:

> *The beliefs and assumptions underlying an intervention can be expressed in terms of a phased sequence of causes and effects (i.e., a program theory). The evaluation is expected to collect data to see how well each step of the sequence is in fact borne out. This approach to evaluation offers a way in which evaluation can tell not only how much change has occurred but also, if the sequence of steps appears as expected, how the change occurred. If the posited sequence breaks down along the way, the evaluation can tell at what point the breakdown occurred.*[10]

A program theory, or model, provides a framework for understanding the mechanisms through which a program is anticipated to influence, and ultimately transform, the market. The model provides a basis for structuring data collection and analyzing the data to determine whether the cause-and-effect relations expected under the program in fact exist and whether they are working as expected. The model also provides the foundation for determining which processes are not working as anticipated and merit further attention and possibly revisions.

Using this approach creates the "story" that will be used as part of testing program attribution. As the entire chain in a program theory is examined, MT can be measured sequentially as it occurs and problems in program design and program implementation can be measured.

This latter benefit of the TBE approach follows from the ability of a program theory to chart the flow from intervention to outcome to further outcome and the interactions of outcomes. Measuring each step can provide information that can separate problems with the theory of causal effects (the basis of program design) from program failure to set a stage in motion. This is best illustrated in a figure developed by Weiss as given as Exhibit 4-5 below.

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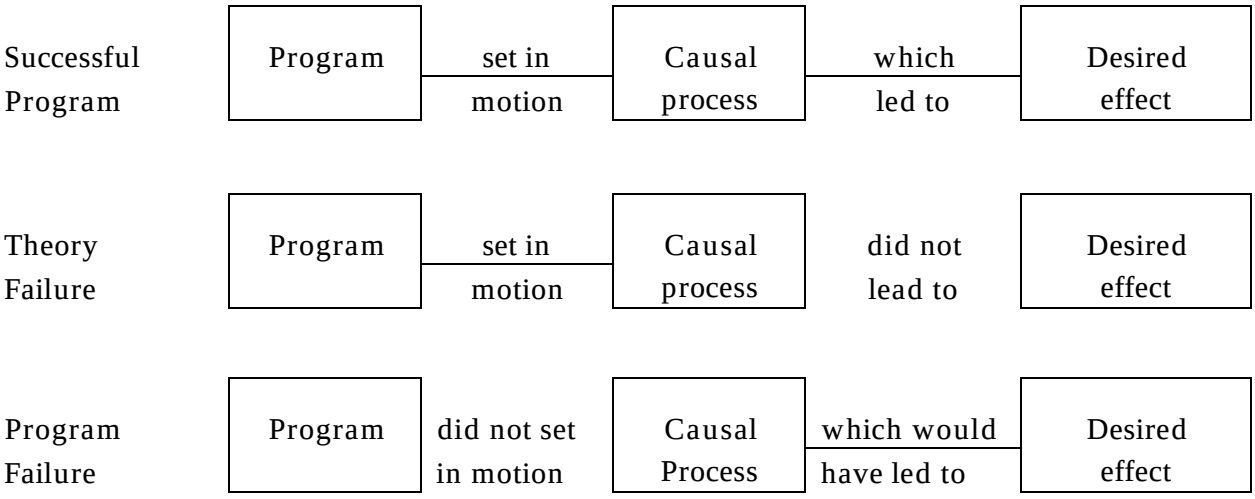
10 Weiss, Carol H., "How Can Theory-Based Evaluation Make Greater Headway?" *Evaluation Review*, Vol. 21, No. 4, August, 1997, 501-524.

Exhibit 4-5
Theory Failure & Program Implementation Failure
(Weiss, Evaluation[11])



METHODS USED TO DEVELOP INITIAL HYPOTHESES AND PROGRAM THEORY

Research in the theoretical fields examined here was conducted on a targeted basis, to solidify the use of this prior literature to form the theoretical foundations for this study (as discussed above).

This was complemented by the knowledge of prior related MT studies, as provided from the experience of the many senior key personnel working on this study. This experience included work with the following studies:

- Summary Study
- Commercial Lighting Market Effects Study: PG&E/San Diego Gas and Electric (Xenergy, Inc.)
- Evaluation of the Statewide Nonresidential Standard Performance Contract Programs: CBEE/SCE (Xenergy, Inc.)
- Market Transformation Planning Study: PG&E (Xenergy, Inc.)
- Study of Market Effects of PG&E Programs in the Supermarket Industry (Quantum Consulting, Inc.)

11 Weiss, Carol H. 1998. *Evaluation: Methods for Studying Programs and Policies*, Upper Saddle River, NJ: Prentice-Hall, p. 129.

- Compilation and Analysis of Currently Available Baseline Data on California Energy Efficiency Markets: CBEE/SDG&E (Xenergy, Inc.)

- C/I Market Effects (HVAC & Motors) Baseline Study (Quantum Consulting, Inc.)

- United States Industrial Electric Motor Systems Market Assessment (Xenergy, Inc.)

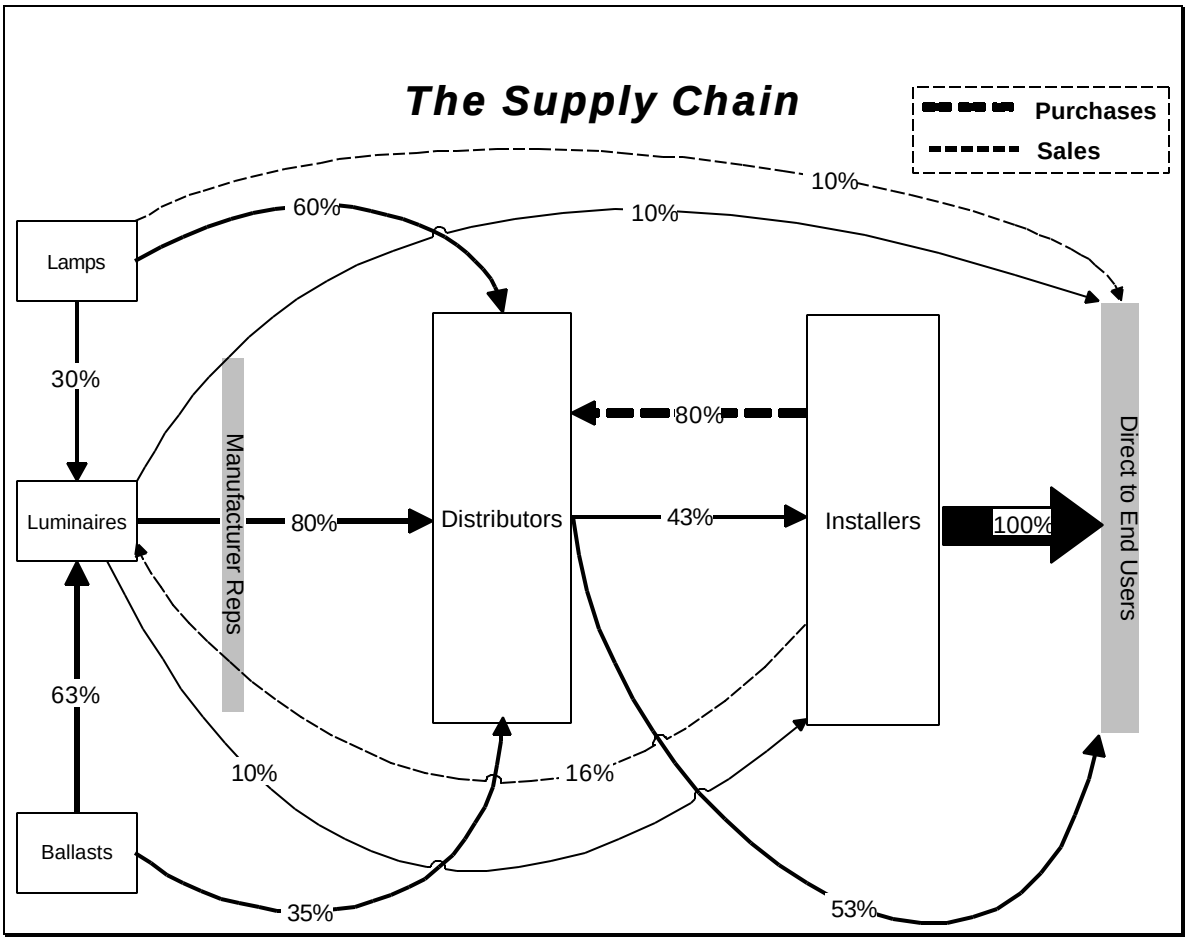
Program theory interviews among PG&E program staff were then conducted. These interviews were generally conducted with two or more senior key study personnel participating and with multiple program staff. Notes from the interviews were then circulated among key study personnel prior to the preliminary development of the program theory diagram.

All lists and diagrams were reviewed by several key study personnel as part of their development of this study's theoretical foundation. These then provided a strong foundation for the development of all the instruments used in this study.

MARKET BARRIERS, COMMUNICATION, AND DIFFUSION FACTORS

The interviews with program staff, review of program materials, and prior related studies were used to derive the hypothesized market barriers and MT mechanisms for the primary markets. A comprehensive examination of market effects in the lighting market was made in Xenergy's *Commercial Lighting Market Effects Study: PG&E/SDG&E* in 1998. Exhibit 4-6 presents the national product flow diagram for the primary lighting markets. Developing similar, natural product flow diagrams for the other key technologies addressed by BEMS – HVAC, motors, ASDs, windows and window film – was outside the scope of this project. However, Exhibit 5-7 shows comparable information for HVAC in PG&E's territory, and Exhibit 5-28 show comparable information for lighting in PG&E's territory.

Exhibit 4-6
National Product Flow in the Commercial Lighting Market
(Commercial Lighting Market Effects Study: PG&E/SDG&E, Xenergy, 1998, pp. 3-7)



The list of hypothesized market barriers and MT mechanisms derived from the theoretical foundations summary (Exhibit 4-4, above) was combined with the information from the program staff interviews and reviews of related materials. This information was then used to create a summary of these barriers and mechanisms for the three general levels of market actors in the product flow scheme: the customer, the vendor/contractor, and the distributor.

The hypothesized market barriers and MT mechanisms in the lighting market are presented in Exhibit 4-7. The packaged HVAC market's barriers and MT mechanisms can be found in Exhibit 4-8. The tables for the window film and ASD markets, and the motors market are provided as Exhibits 4-9 and 4-10, respectively.

Product unavailability is a significant market barrier for high efficiency at all levels of the chain in the motors market and the packaged HVAC market. Given the recently "raised bar" presented by EPAct motors, there are still very few high-efficiency motors produced by motor manufacturers. This creates severe product unavailability for all levels of the supply chain for high-efficiency motors. High-efficiency packaged HVAC faces product unavailability barriers

primarily because suppliers often do not perceive a sufficient level of demand for them; that is, they have market uncertainty, often linked (on the supply side) with product unavailability (on the demand side).

All of the high-efficiency markets are immature markets. As a small proportion of sales, information on high efficiency generally entails information costs for consumers; as such, information costs represent a macro-level barrier. There are many lighting vendors that offer high-efficiency equipment, which drives down information (search) costs for some end users. At the same time, these costs are still problematic for smaller customers (such as those addressed in this study) who do not have ready access to these vendors or expertise regarding these measures.

Asymmetric information is a problem for customers in the ASD and window film markets, and for small customers in the lighting market. Window film and ASDs are not required energy equipment and, therefore, are not regularly investigated by the end user. This presents consumers with a situation where they have little knowledge and are unsure of the real need for these items while vendors are promoting them. Asymmetric information, or consumer fear of vendor opportunism, can easily occur (whether or not it is objectively justified).

The large number of lighting vendors presents an alternative asymmetric information situation. In this case, the large number of vendors can present different information to the consumer, causing confusion, particularly in the case of less experienced smaller customers, and increasing fear of opportunism by the vendors.

Transaction / hassle costs are seen to some extent in all the markets examined. Selling, carrying, knowing about, and servicing high-efficiency products creates supply-side transaction costs. For end users, the greatest transaction / hassle costs are found with respect to window film and ASDs, for which there are no required, standard-efficiency counterparts. Just the consideration of these discretionary measures (as opposed to lighting, motors, or HVAC where different equipment options are considered but the product itself is required) creates hassle and transaction costs.

Exhibit 4-7
Hypothesized Market Barriers & MT Mechanisms
CFLs, T-8s, and Electronic Ballast Markets

	Customer	Vendor/ Contractor	Distributor
Product/Service Availability			
Unavailable			
Awareness			
Information costs	● * S	◗	
Asymmetric information	● S		
Decision Process			
Transaction / Hassle costs	◗ S	❍	
Access to financing	◗ * S I		
Bounded rationality	● * S		
Organizational practices	❍ I		
Split incentives	D		
Perceived Reliability & Uncertainty			
Performance & market uncertainty	●		
Hidden costs	❍ I *		
Inseparability of features			
Irreversibility			
Feedback/ Communication Network			
Championing	❍		
Follow-up available	❍		
Rate-of-Diffusion Factors			
Fulfillment of felt need			
Compatibility	❍		
Relative advantage	◗		
Complexity			
Observability			
Trialability			

Key:

●●	=	Most important barrier
●	=	Important barrier / Level impedes MT
◗	=	Moderate barrier / Moderate impediment for MT
❍	=	Low level barrier / Some impediment for MT
*	=	Macro-level across technologies / markets
S	=	More important for smaller customers
I	=	More important for institutional customers
D	=	Depends on building ownership / budgeting process for institutional customers

Exhibit 4-8
Hypothesized Market Barriers & MT Mechanisms
Packaged HVAC Market

	Customer	Vendor/ Contractor	Distributor
Product/Service Availability			
Unavailable	●	●	●
Awareness			
Information costs	●*		
Asymmetric information			
Decision Process			
Transaction / Hassle costs		❍	
Access to financing	◗* S I		
Bounded rationality	●*		
Organizational practices	●	❍	❍
Split incentives	D		
Perceived Reliability & Uncertainty			
Performance & market uncertainty	●	●	●
Hidden costs	❍ I*		
Inseparability of features			
Irreversibility			
Feedback/ Communication Network			
Championing	◗		
Follow-up available	◗		
Rate-of-Diffusion Factors			
Fulfillment of felt need			
Compatibility			
Relative advantage			
Complexity	❍		
Observability	◗		
Trialability	◗		

Key:

●●	=	Most important barrier
●	=	Important barrier / Level impedes MT
◗	=	Moderate barrier / Moderate impediment for MT
❍	=	Low level barrier / Some impediment for MT
*	=	Macro-level across technologies / markets
S	=	More important for smaller customers
I	=	More important for institutional customers
D	=	Depends on building ownership / budgeting process for institutional customers

Exhibit 4-9
Hypothesized Market Barriers & MT Mechanisms
Window Film & Adjustable Speed Drive Markets

	Customer	Vendor/ Contractor	Distributor
Product/Service Availability			
Unavailable			
Awareness			
Information costs	● *		
Asymmetric information	●		
Decision Process			
Transaction / Hassle costs	● S	❍	
Access to financing	◗ * S I		
Bounded rationality	● * S I		
Organizational practices	❍		
Split incentives	D		
Perceived Reliability & Uncertainty			
Performance & market uncertainty	●●		
Hidden costs	❍ I *		
Inseparability of features			
Irreversibility			
Feedback/ Communication Network			
Championing	❍		
Follow-up available	❍		
Rate-of-Diffusion Factors			
Fulfillment of felt need	❍		
Compatibility			
Relative advantage	❍		
Complexity			
Observability			
Trialability			

Key:

●●	=	Most important barrier
●	=	Important barrier / Level impedes MT
◗	=	Moderate barrier / Moderate impediment for MT
❍	=	Low level barrier / Some impediment for MT
*	=	Macro-level across technologies / markets
S	=	More important for smaller customers
I	=	More important for institutional customers
D	=	Depends on building ownership / budgeting process for institutional customers

Exhibit 4-10
Hypothesized Market Barriers & MT Mechanisms
Motor Markets

	Customer	Vendor/ Contractor	Distributor
Product/Service Availability			
Unavailable	●●	●●	●●
Awareness			
Information costs	● *	●	●
Asymmetric information			
Decision Process			
Transaction / Hassle costs		◗	❍
Access to financing	◗ * I		
Bounded rationality	● *		
Organizational practices	● I	◗	◗
Split incentives	D		
Perceived Reliability & Uncertainty			
Performance & market uncertainty	●	●	●
Hidden costs	❍ I *		
Inseparability of features			
Irreversibility	●		
Feedback/ Communication Network			
Championing	◗	❍	
Follow-up available			
Rate-of-Diffusion Factors			
Fulfillment of felt need	◗		
Compatibility	●		
Relative advantage			
Complexity	●	❍	
Observability	◗		
Trialability	●	❍	

Key:

●●	=	Most important barrier
●	=	Important barrier / Level impedes MT
◗	=	Moderate barrier / Moderate impediment for MT
❍	=	Low level barrier / Some impediment for MT
*	=	Macro-level across technologies / markets
S	=	More important for smaller customers
I	=	More important for institutional customers
D	=	Depends on building ownership / budgeting process for institutional customers

Access to financing or budget process constraints are generally a macro-level market barrier for small and institutional customers. These customers have difficulty financing any higher initial cost item though the item may have lower life cycle costs, regardless of the technology. Small customers often have many competing requirements to fund with significant cash flow concerns to stay in operation. Not too different from this, institutional customers often face budget processes based on lowest current cost rather than lowest life cycle costs. Budget allocations often require expenditures for similar items to be the same as prior purchased items, not allowing for additional costs to purchase cost-effective, high-efficiency models.

Similarly, bounded rationality is seen across technologies. Simplifying decisions with rules that may be outdated occurs within institutional budget processes that can not easily be changed, or within small businesses overwhelmed by the large number of decisions that must be managed by their owners. The large number of lighting vendors bombarding end users with varying information and the complexity of understanding the savings available from ASDs make this situation generally worse for small and institutional customers in these markets.

The last macro-level barrier is the low-level barrier presented by hidden costs to institutional customers. Wherever maintenance or operating needs differ, institutional customers may have difficulties because their decision-making processes may include conflicting priorities and practices, and overlapping turf.

The extent to which organizational practices are a market barrier generally depends on how mature the overall efficiency market is. The greater the penetration and length of time energy efficiency has been a part of the market, the greater the likelihood that organizational practices have adapted to it. This is why organizational barriers are a small barrier in the lighting, window film, and ASD markets, but larger in the packaged HVAC market and larger still in the motors market where it is an important barrier for customers and still a moderate barrier for vendors and distributors.

The last decision process barrier is that of split incentives. This barrier involves the responsibility for the investment decision versus who pays the energy bill. This barrier depends on building ownership for small end users (or the budgeting process for institutional customers), and does not depend upon the technology or market.

Performance uncertainty is the greatest market barrier to customers in the mature markets of window film and ASDs due to the greater complexities in assessing energy savings for adopting these measures. Market uncertainty, however, is an important market barrier for vendors and distributors in the less mature markets of packaged HVAC and motors.

Motors are often stockpiled by customers to allow immediate replacements. This complicates their motor systems during the phase-in, when high-efficiency motors begin to be purchased though many existing motors are standard-efficiency models scheduled for rewinding. Given the large step for high-efficiency motors beyond the step established with EPAct motors, irreversibility then becomes a significant market barrier for consumers in this market.

Generally, the feedback and communication network factors must work well to achieve fully (i.e., sustainably) transformed markets. Yet, the absence of these factors is only a small impediment for initial MT.

Similarly, many of the rate-of-diffusion factors are not significant impediments for MT in the lighting, packaged HVAC, window film, and ASD markets. Poor market/technology profiling on any of these factors, however, does slow the rate of diffusion and is important to recognize. The immature motors market still has a large number of impediments among customers and vendors with regard to the factors that affect the rate of diffusion.

PROGRAM THEORY

Through an early review of program materials and interviews with implementers, a theory, or model was developed to describe how the interventions executed under the BEMS program are expected to influence the market. Exhibit 4-11 presents the program theory model for the BEMS program. This program provides one primary intervention, the provision of audits and information to the end user. This program is entirely targeted to the demand side of the market, and historically has been kept at "arm's length" from supply-side market actors, based on internal budgeting and administrative procedures.

There are four direct effects expected as a result of the interventions. These, in order of their expected sequencing, are:

1. Increase awareness, and lower information costs.

2. Increase investigation of high-efficiency options.

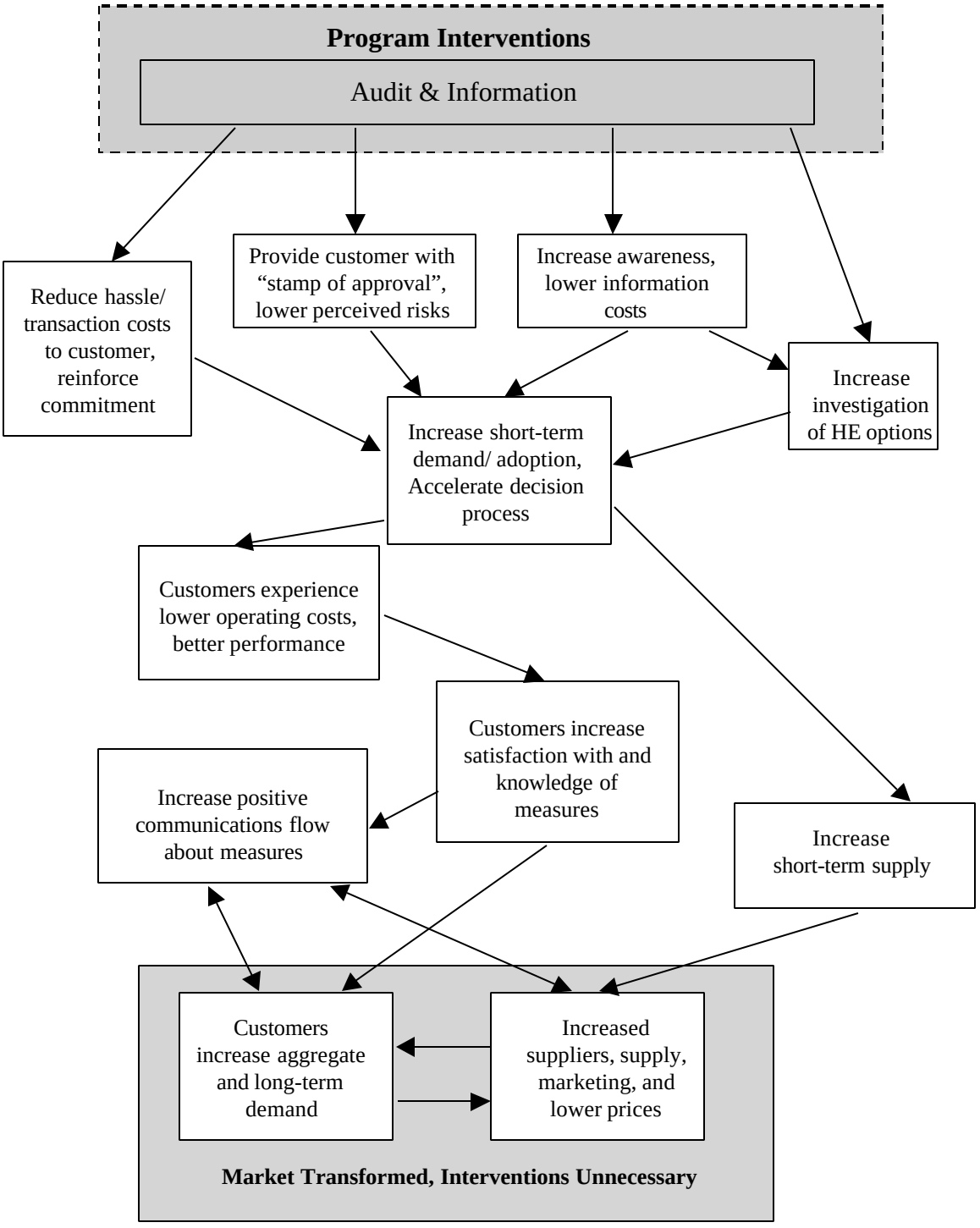
3. Provide customer with a "stamp of approval," thereby lowering perceived risks.

4. Reduce hassle/transaction costs to customers and provide reinforcement to their commitment to energy efficiency.

Each of these direct effects broadens and accelerates consideration and selection of high-efficiency measures, increasing the short-term demand.

The increase in adoption in turn increases customers' experience with high-efficiency measures and practices. Through this experience they learn for themselves of the resulting lower operating costs and better performance of the measures. This then increases customers' satisfaction with and knowledge of the measures. Satisfied customers will then be able to tell others about their positive experiences with the high-efficiency measures. This increases the positive communications flow about the measures.

Exhibit 4-11
BEMS Program Theory



The increased short-term demand also plays a large role in encouraging increased short-term supply. This in turn can lead to long-term increases in supply through an increase in the number of suppliers, the amount of high-efficiency equipment each supplier offers in the market, and lower prices due to increased economies of scale and increased competition.

Increased aggregated and long-term demand stems from customers' increase in satisfaction with the measures and the increased positive communications flow about the measures.

As in any economic market, increased supply and demand interact with each other reinforcing the gains made. This is expected, indeed required, to create the transformed market. As part of this broader process, communications flow about high-efficiency measures becomes a multi-actor feedback loop reinforcing the link between attitudes and behaviors, supporting the sustainability of MT.

PROGRAM INTERVENTIONS AND INDICATORS

The next step involves taking the market barriers and MT mechanisms and matching them with the program interventions designed to address them. This is done at the category level in order to solve the problem of overlapping market barriers and to assure a workable organization that leads to identification of the proximate and ultimate indicators to be measured for baseline and MT indications. These are presented in Exhibit 4-12.

The indicators listed in Exhibit 4-12 provided the basis and served as a checklist for the questions emphasized in this initial primary data collection effort, as well as assessed judgmentally based on a broader review of the BEMS market environment. The instruments were developed to capture the more relevant indicators at this juncture of BEMS' existence, with separate instruments for each of the different data collection audience, e.g., vendor interviews, customer surveys. Initial pre-testing of the combined BEMS/Express end-user survey did not reflect broad familiarity with high-efficiency measures, criteria, options, or providers. As a result, the survey was refined to emphasize end-user attitudes regarding energy-efficient measures and providers, as well as market barriers, diffusion-of-innovation factors, and feedback/communication factors. Also, while the BEMS program is not intended to directly impact supply-side market actors, selected questions were appended to supply-side interviews (focused on the Express assessment), in order to gauge supply-side perspectives on the impact of BEMS upon end users.

Exhibit 4-12
BEMS Program Interventions and Market Effects Indicators by Category

MARKET BARRIER TYPE/ DIFFUSION FACTOR	*PROGRAM INTERVENTION*	*HYPOTHESIS*	*MARKET EFFECTS INDICATOR*
CUSTOMER			
Awareness	Obtains customer information to create detailed energy audit with recommendations. Provides initial awareness, information, and offers solutions to high bill inquiries and energy use questions.	Reduces information costs and source of unbiased information (particularly for lighting where numerous lighting vendors contribute to asymmetric information, i.e., confusion).	End user has awareness / knowledge of differences between standard and HE equipment for: 1. CFLs, T-8s, Electronic Ballast 2. HE packaged HVAC 3. Window film, ASDs End users believe they have access to information on lighting technology, window film, and ASDs that is unbiased.
Decision Process	Provides easy-to-digest, packaged information for many HE options, reducing transaction / hassle costs and bounded rationality barriers.	Reduces costs and increases ease of considering of HE options.	End users believe HE options are worthy of consideration. End users believe they have enough information about HE measures / practices, and the benefits warrant further action. End users believe they can complete HE efforts that will significantly reduce their energy bills. End users see information provided by BEMS as a significant resource in their decision process. BEMS reduces end-user hassle costs. BEMS positively impacts end-user consideration of HE in future decisions.

MARKET BARRIER TYPE/ DIFFUSION FACTOR	*PROGRAM INTERVENTION*	*HYPOTHESIS*	*MARKET EFFECTS INDICATOR*
Perceived Reliability & Uncertainty	Provide legitimacy function, if mentioned in PG&E program then measure must both save energy and fulfill its intended function. Provide information to lower energy savings uncertainty.	Increases perception of high-efficiency measure reliability, and lowers perceived risk of poor measure performance.	BEMS participants compare favorably to NPs on questions about perceived uncertainty of HE performance, before and after measure / practice change. End users consider HE options worthy of consideration. BEMS positively impacts participant consideration of HE in future decisions.
Feedback / Communication Network	Program staff follow-up with audit participants to see if they have taken actions.	Allows participants to complete additional information and reinforces commitment. Communication and diffusion occurs from successful adopters.	BEMS participants report follow-up from program staff. BEMS participants talk to others (business associates, customers, vendors) about the program. End users have heard about program through trade organizations, business colleagues. End users have heard about measures (1-3 above) in trade organizations, from business colleagues.
Rate-of-Diffusion Factors	Advertising and marketing (should be targeted to address impediments by market).	Increases level of diffusion factor to speed diffusion.	End users report increased / greater perceived benefits and compatibility with needs, for each technology (1-3 above).

5. MARKET CHARACTERIZATION

INTRODUCTION

In this section we present a detailed characterization of the general market for commercial packaged HVAC and lighting equipment. Information in this section is drawn from three principal sources: primary research conducted for this study (consisting of in-depth interviews with contractors and distributors in PG&E's service territory and in eleven states with historically Low-DSM activity[12]); the PG&E/SDG&E Commercial Lighting Market Effects Study (Xenergy, 1998); and the PG&E C/I (HVAC & Motors) Market Effects Baseline Study (Quantum Consulting, 1998). We present information on the structure of each end-use market including estimations of the market size, descriptions and roles of market actors and distribution channels used by the market. This section is organized into the following subsections:

- End-User Market Characteristics
- Packaged HVAC Market Characterization
- Efficient Lighting Market Characterization

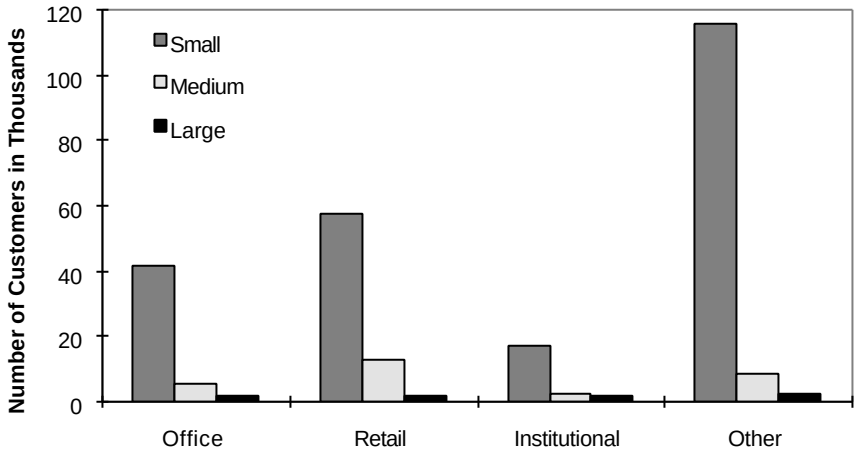
END-USER MARKET CHARACTERISTICS

In this subsection we provide information on the commercial end-user market in PG&E's service territory focusing, whenever possible, on the small/medium customer market.

We begin by presenting the number of premises and kWh consumption of small/medium customers (less-than-500 kW) in Exhibits 5-1 and 5-2, respectively. The exhibits present the population data broken into the following three size categories: small (<20 kW), medium (20 to 99 kW), and large (100 to 499 kW). As shown in the exhibits, consumption is spread fairly evenly among the three size categories but the number of premises is weighted heavily toward the smallest size customers. Customers between 100 and 499 kW make up only three percent of the small/medium population but account for 33 percent of the consumption. The smallest customers account for 86 percent of the premises but only 38 percent of consumption. Consumption is also spread fairly evenly across the four market segments used in this study (with the exception of Institutional, which is smaller than the other three segments). A disproportionate number of premises are in the Other category, indicating these premises are smaller in terms of average usage than the premises in the other three segments.

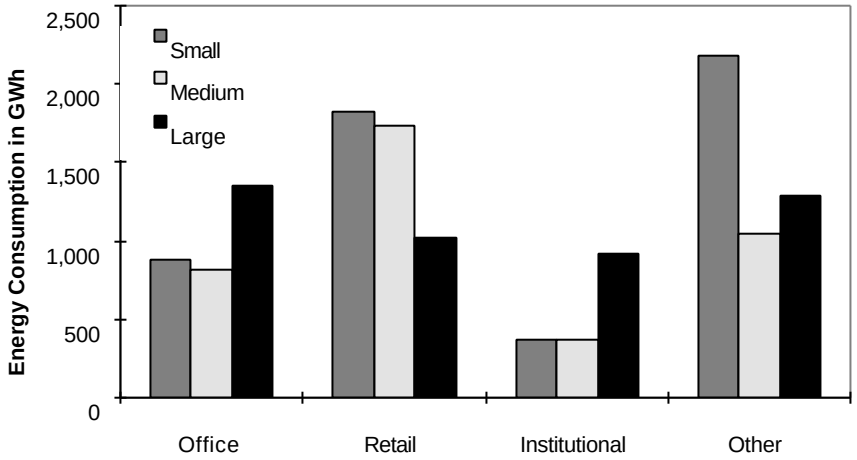
[12] The eleven states with historically low demand-side management program activity included are Arkansas, Kansas, Louisiana, Mississippi, Missouri, New Mexico, North Carolina, Oklahoma, Pennsylvania, South Carolina, and Texas. The reasons for choosing this comparison group are discussed in Chapter 3 of this report.

Exhibit 5-1
Number of Premises for Commercial Customers Less-Than-500 kW
in the PG&E Service Territory*



*Category definitions are: small (<20 kW), medium (20 to 99 kW); large (100 to 499 kW)

Exhibit 5-2
kWh Consumption of Commercial Customers Less-Than-500 kW
in the PG&E Service Territory*



*Category definitions are: small (<20 kW), medium (20 to 99 kW); large (100 to 499 kW)

As discussed in Chapter 3 of this report, our primary data collection for this study included surveys of small/medium customers that were 1998 and 1996 BEMS Participants, 1998 Express Participants, PG&E territory NPs (in both Express and BEMS), and customers in a comparison area of states with historically low levels of DSM program activity. In Exhibit 5-3 we present facility characteristics data for the PG&E territory NPs. We include information

on the facility size, ownership, and responsibility for energy bill payment and equipment decision making. The data in this table have been weighted to be representative of the kWh consumption of the PG&E population of small/medium commercial customers.

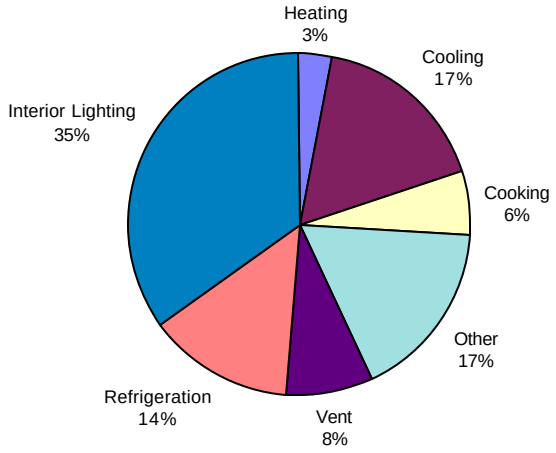
Exhibit 5-3
Summary of Small/Medium Customer Characteristics (n=299; for renters n=145)

Item and Response	Percentage
Full-time Equivalent Employees	
1 to 5	30.1%
11 to 20	13.4%
21 to 50	19.5%
51 to 100	8.8%
Over 100	10.5%
Square Footage	
Less than 5,000 square feet	31.6%
5,000 but less than 10,000 square feet	24.1%
10,000 but less than 20,000 square feet	14.9%
20,000 but less than 50,000 square feet	15.2%
50,000 but less than 100,000 square feet	7.6%
100,000 but less than 1 million square feet	5.4%
Over 1 million square feet	1.3%
Person Monitors Energy Use	
Yes	32.8%
No	66.0%
Don't know	1.2%
Ownership Status	
Own	48.2%
Rent	49.3%
Don't know	2.1%
Refused	0.3%
Bill Payment Status - Renters Only	
Pay ALL of bill - NO electric utilities in rent	90.5%
Pay SOME portion of electric utility bills	6.6%
Pay NONE of bill - ALL electric utilities in rent	3.0%
Involvement in Equipment Purchase Decisions - Renters Only	
Very active - involved in all phases & have veto power	34.5%
Somewhat active - we approve decisions & have some input	27.5%
Slightly active - we have a voice but not dominant	17.3%
Not active at all - we're part of a larger firm	7.7%
Not active at all - our firm isn't involved in HE issues	13.0%
Remodeled Since 1996	
Yes	27.0%
No	73.0%

Among all of PG&E's commercial customers, cooling and interior lighting are the largest end uses as shown in Exhibit 5-4.[13] Within the lighting end use, 63 percent of the installed capacity is fluorescent tube, 26 percent incandescent, and only one percent CFLs.

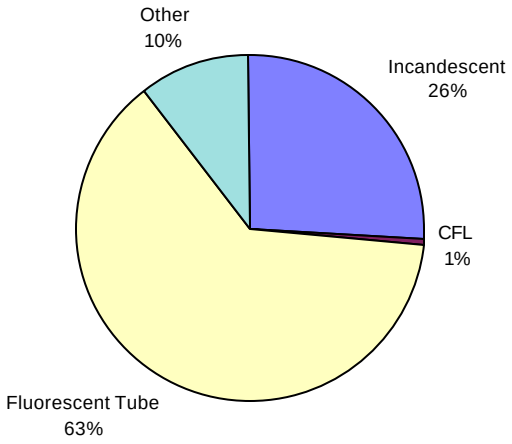
[13] Note that these data come from PG&E's latest publication of it Commercial Energy Use Survey (CEUS) published as the 1997 Commercial Building Survey Report. Data are for the entire population of commercial customers.

Exhibit 5-4
Percent of Annual Electric Sales by End Use, All PG&E Customers



Source: PG&E 1997 Commercial Building Survey Report.

Exhibit 5-5
Distribution of Installed Lighting Capacity (in kW), All PG&E Commercial Customers



Source: PG&E 1997 Commercial Building Survey Report.

The report does not present results by customer size; however, these results could be developed from the primary data as part of future research efforts on the small/medium commercial market. We expect that the end-use consumption distribution and lighting and cooling inventories will differ significantly between large and small customers.

As shown in Exhibit 5-6, PG&E's CEUS project also provides detailed information regarding the energy characteristics of the commercial cooling market. Key findings from this study include:

- Seventy-one percent of commercial square footage in PG&E's service territory was heated and 58 percent was cooled
- The penetration of cooling equipment ranged from a high of 88 percent of commercial premises in the desert/mountain climate zone to a low of 34 percent in the coastal climate zone
- Packaged electric systems accounted for 2.3 million tons of cooling capacity, or 66 percent of the territory total
- Schools, colleges, hospitals, restaurants, and offices all had at least 75 percent of premises with packaged electric cooling

Exhibit 5-6
Percentage of Premises with Cooling Capacity

Business Type	Packaged Cooling Capacity ('000 tons)	Percent with Packaged Electric	Percent with any Cooling
Colleges	54.1	74%	76%
Food Stores	54.4	59%	61%
Hospitals	88.7	86%	97%
Hotels/Motels	176.6	47%	51%
Miscellaneous	243.8	46%	47%
Offices	698.4	75%	79%
Refrigerated Warehouses	8.6	79%	80%
Restaurants	251.7	79%	80%
Retail Stores	375.4	57%	62%
Schools	246.3	78%	78%
Warehouses	124.7	63%	63%
Total	2,322,8	64%	67%

Source: PG&E 1997 Commercial Building Survey Report

PACKAGED HVAC MARKET CHARACTERIZATION

This subsection provides a characterization of the commercial packaged air conditioner market based on data from surveys with HVAC contractors and distributors in PG&E's service territory and the comparison area mentioned above.

Overview of Commercial Packaged Unit Market[14]

Nationally, there were approximately 5.35 million packaged HVAC units (CACs and air-source heat pumps) shipped in 1997, according to the Air Conditioning and Refrigeration Institute (ARI). Most packaged AC units destined for commercial customers are in the 5-20 ton size range. Domestic shipments by the manufacturers who make up the membership of the ARI are said to account for more than 90 percent of the national market.

All of the major national **manufacturers** are represented in the Northern California market and several have manufacturing/assembly facilities in the region. Despite the presence of a relatively large number of brand names, units are actually manufactured by just a handful of firms. Manufacturers of packaged units sell through a network of **distributors**, although some of those distributors are "captive" – that is, they are owned by the manufacturer and only sell a single manufacturer's products. Within PG&E's service territory there are a total of 47 firms classified as AC distributors by D&B. Distributors provide the stocking function for AC units other than the most popular models, which may also be stocked by contractors.

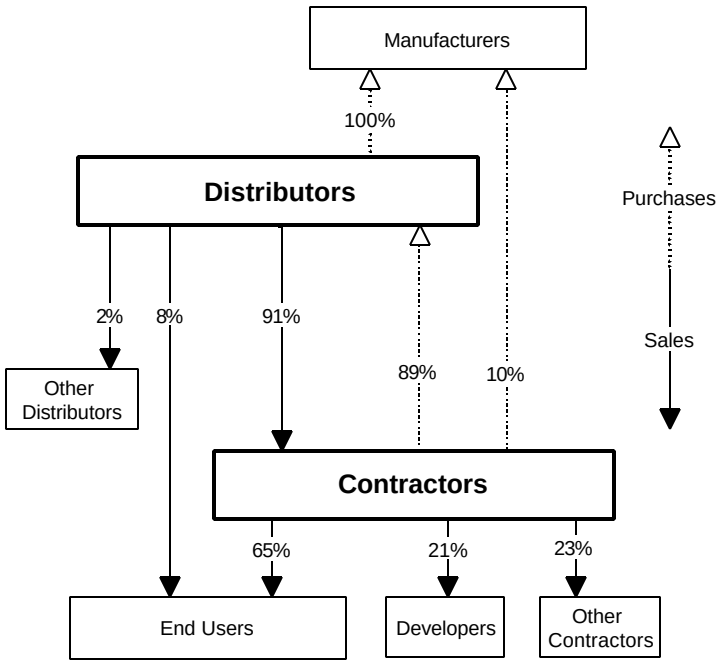
Contractors provide the retail sales function in the market for packaged commercial air conditioners. These are numerous and diverse in Northern California. We estimate that there are more than 2,000 HVAC contractors, ranging in size from one-person operations to companies with more than 50 employees in the PG&E service territory. Most of these specialize in residential installations, but even residential contractors typically do some commercial business. Forty percent of the contractors we screened for interviews, however, indicated that they do not install commercial packaged units.

Design professionals, including both consulting engineers and architectural firms, are involved in the AC market to the extent that they specify the size, type, and efficiency of equipment to be installed. A&E firms often specify equipment to be installed in the new construction market; they are less influential in the replacement market. **Energy Service Company** (ESCO) involvement in the packaged AC market generally comes about as part of a larger, comprehensive energy project. Despite the broad capabilities that ESCOs offer, their role in the market for packaged air conditioning is still relatively limited.

In Exhibit 5-7 we present a flow chart of purchases and sales within the packaged HVAC market based on our survey data. The percentages for sales and purchases shown in the exhibit do not add exactly to 100 percent, due to rounding and the presence of very small product flows to and from other sources. Note that contractors report that they buy predominantly from distributors and distributors report that they sell predominantly to contractors. Contractors report that they sell packaged HVAC units mostly to end users (65 percent), but also to developers (21 percent) and other contractors (23 percent, principally general contractors that oversee large jobs).

[14] Most of this subsection is drawn from the PG&E C/I Market Effect Baseline (HVAC/Motors) Study, prepared by Quantum Consulting for PG&E, 1998.

Exhibit 5-7
Product Flows in the Commercial Packaged HVAC Units in PG&E's Service Territory



Source: Xenergy Interviews and analysis.

Analysis of Primary Interview Results

Analysis of the HVAC equipment market information developed from our primary research is presented in the following subsections on market size, interviewee characteristics, and market trends.

Size and Composition

As discussed in Chapter 3, we stratified our HVAC contractor surveys into four size categories based on full-time equivalent employees (FTE). These four strata were aggregated into two groups for the purposes of reporting results. Contractors were broken into two size categories: large and small. We defined large contractors as those having at least 50 employees. Small contractors are defined as those with between two and 49 employees. These size categories are used throughout this report to highlight important differences between contractors. For the population captured by our surveys, we estimate that small contractors install roughly three quarters of all the commercial package units in PG&E's service territory. Large contractors, though representing only two percent of firms, account for about one-fifth of the packaged unit installations. The numbers are similar for the nation. Exhibit 5-8 shows the number of HVAC contractors and their relative significance in the packaged HVAC market as measured by the tonnage of package units they install.

Exhibit 5-8
Contractors: Description of Population*

	Other** *1 or unk FTE*	Small *2 - 49 FTE*	Large *> 49 FTE*
Raw HVAC Population			
PG&E Territory	455	1,591	31
Low-DSM States	5128	14,201	194
Entire U.S.	18359	57,179	792
Portion of sample that does not install commercial package units†	40%	39%	4%
Adjusted HVAC Population			
PG&E Territory	273	978	30
Low-DSM States	3,077	8,731	185
Entire U.S.	11,015	35,154	757
PG&E Territory			
Percent of population	23%	75%	2%
Avg number of employees	1	14	180
Avg total revenues	218,900	3,544,100	33,250,000
Percent commercial pkg units	34%	34%	35%
Commercial packaged unit revenues	1%	76%	22%

**As derived from a search of D&B's database.*

***This category is almost entirely composed of one-person businesses. Only a few are unknown. Complete interviews were conducted only with contractors in the Small and Large categories.*

† These figures are Xenergy estimates based on results from screening calls of potential interviewees.

Note that the estimates in Exhibit 5-8 do not include firms that are misclassified in D&B under SIC codes other than those we considered.

Characteristics of Interviewees

The majority of contractors interviewed (77 percent PG&E territory and 89 percent Low-DSM states) classified themselves as HVAC contractors (See Exhibit 5-9). Other contractors described themselves as design-build firms, sheet metal contractors or other types of contracting firms. Exhibit 5-10 shows the breakdown of distributors by self classification. The majority of distributors classified themselves as manufacturer's representatives (60 percent PG&E territory and 58 percent Low-DSM states). The remaining 40 percent of PG&E-area distributors described themselves as simply "distributors" while the remaining 42 percent of Low-DSM-area interviewees called themselves general industrial suppliers.

Exhibit 5-9
Contractors: Self-Reported Classification

	PG&E Territory	Low-DSM States
HVAC Contractor	77%	89%
Part of Design-Build Firm	4%	11%
Other	19%	0%
# Respondents	*26*	*18*

Exhibit 5-10
Distributors: Self-Reported Classification

	PG&E Territory	Low-DSM States
Manufacturer representative	60%	58%
General industrial/other distributor	40%	42%
Catalog/mail order firm	0%	0%
# Respondents	*10*	*12*

The average, minimum and maximum number of years contractors and distributors have been in business is shown in Exhibit 5-11. The average age of contractors was very similar between PG&E territory and Low-DSM states (28 and 30 years, respectively). Distributors were slightly older, 59 years on average for PG&E territory distributors and 43 years for those distributors in Low-DSM states.

Exhibit 5-11
Age of Businesses

	Contractors		Distributors	
	PG&E Territory	Low-DSM States	PG&E Territory	Low-DSM States
Average	28	30	59	43
Minimum	6	5	7	15
Maximum	90	100	125	70
# Respondents	*26*	*19*	*10*	*11*

The breakdown of FTE employees for contractors and distributors is shown in Exhibit 5-12. The average number of employees are shown by the small and large size strata. Total revenue estimates are shown for contractors in Exhibit 5-13 and for distributors in Exhibit 5-14. Contractor revenues are fairly consistent between PG&E territory and Low-DSM states. Nearly twice as many PG&E territory distributors reported having revenues greater than 10 million dollars (70 percent for PG&E territory versus 36 percent for Low-DSM states). Also of note was the fact that there were no PG&E territory distributors that reported having revenues under $1 million. The large size of the in-territory distributors is likely attributable

to the fact that the PG&E distributors interviewed were a non-random sample that consisted of participants in the upstream component of the 1998 Express Program.

Exhibit 5-12
Number of Full-Time-Equivalent Employees

	Contractors				Distributors			
	PG&E Territory		Low-DSM States		PG&E Territory		Low-DSM States	
	Small	*Large*	*Small*	*Large*	*Small*	*Large*	*Small*	*Large*
Average	17	167	11	194	13	79	9	45
Minimum	3	50	2	50	3	25	3	27
Maximum	44	500	27	600	20	190	23	90
# Respondents	17	9	9	10	6	4	5	6

Exhibit 5-13
Contractors: Comparison of Total Revenue

	PG&E Territory	Low-DSM States
<$1 Million	23%	26%
$1-$10 Million	50%	37%
>$10 Million	27%	32%
Don't Know/Proprietary	0%	5%
# Respondents	*26*	*19*

Exhibit 5-14
Distributors: Comparison of Total Revenue

	PG&E Territory	Low-DSM States
<$1 Million	0%	9%
$1-$10 Million	30%	45%
>$10 Million	70%	36%
Don't Know/Proprietary	0%	9%
# Respondents	*10*	*11*

PG&E territory contractors install more units per year and per job than their counterparts in Low-DSM states. Exhibit 5-15 shows that the average number of installations per year for PG&E territory contractors is 195 while contractors in Low-DSM areas reported a somewhat smaller average of 137 units per year. Although PG&E territory companies did report more units installed per job, this difference was slight (5.1 units per job versus 4.7 units per job).

Exhibit 5-15
Contractors: Units Installed Per Year and Per Job

	Installed Per Year		Installed Per Job	
	PG&E Territory	Low-DSM States	PG&E Territory	Low-DSM States
Average	195	137	5.1	4.7
Minimum	15	20	1	1
Maximum	1000	600	30	20
# Respondents	25	15	22	17

The percentage of sales that are accounted for by commercial package HVAC units is presented for contractors and distributors in Exhibit 5-16. The level of packaged unit sales was fairly consistent between both PG&E territory and Low-DSM states for both contractors and distributors. Packaged unit-related sales represented 37 and 40 percent of revenues for PG&E territory contractor and distributor sales, respectively.

Exhibit 5-16
Commercial Package Units as Percentage of Total Sales

	Contractors		Distributors	
	PG&E Territory	Low-DSM States	PG&E Territory	Low-DSM States
Average	37%	32%	40%	29%
Minimum	1%	5%	20%	1%
Maximum	90%	70%	60%	95%
# Respondents	*26*	*19*	9	11

The breakdown of package unit final destinations is presented in Exhibits 5-17 and 5-18. The largest percentage of unit sales was in the "new units in new buildings" category for both PG&E territory and Low-DSM area contractors (35 percent and 53 percent, respectively). The remaining units for both groups of contractors were fairly evenly spread across the three existing-building categories with a small handful of units going towards the "other" category. Distributor sales data is shown in Exhibit 5-18. Distributors reported a markedly larger percentage of units being sold for "planned replacement of existing units" than the contractors' reported. Like the contractors, the largest category for PG&E territory distributors was "new units in new buildings." Distributors in Low-DSM states were slightly different. They reported that "planned replacement of existing units" accounted for more unit sales than any other group (34 percent of total sales).

Exhibit 5-17
Contractors: Breakdown of Package Unit Sales

	PG&E Territory			Low-DSM States		
	Small	Large	Total	Small	Large	Total
Planned replacement of existing units	24%	26%	24%	6%	15%	7%
Emergency replacement of existing units	30%	10%	23%	27%	3%	22%
New units in existing bldgs (expansion)	13%	25%	17%	18%	13%	17%
New units in new buildings	32%	39%	35%	49%	70%	53%
Other	5%	0%	5%	0%	0%	0%
# Respondents	*17*	*9*	*26*	*9*	*10*	*19*

Exhibit 5-18
Distributors: Breakdown of Package Unit Sales

	PG&E Territory			Low-DSM States		
	Small	Large	Total	Small	Large	Total
Planned replacement of existing units	35%	29%	32%	40%	30%	34%
Emergency replacement of existing units	13%	10%	12%	36%	28%	31%
New units in existing bldgs (expansion)	18%	16%	18%	3%	11%	8%
New units in new buildings	33%	43%	37%	23%	26%	25%
Other	1%	0%	1%	0%	6%	4%
# Respondents	*6*	*4*	*10*	*5*	*6*	*11*

The major market sector for contractors was the commercial market that makes up 64 percent of business for PG&E territory companies and 55 percent for companies in Low-DSM states. Residential was the next largest market, followed by industrial (see Exhibit 5-19).

Exhibit 5-19
Contractor: Percent of HVAC Business by Market Sector

	PG&E Territory			Low-DSM States		
	Small	Large	Total	Small	Large	Total
Commercial	59%	74%	64%	48%	61%	55%
Residential	36%	23%	31%	45%	12%	28%
Industrial	5%	12%	8%	7%	23%	16%
Other	0%	0%	0%	0%	11%	6%
# Respondents	*17*	*9*	*26*	*9*	*10*	*19*

Perceptions on Market Trends

Contractors were asked to identify trends in the packaged HVAC market over the past three years. Their responses were grouped into four broad categories, including technical changes, general comments, availability of high-efficiency units, and price changes. Contractors in the PG&E territory tended to focus more on technical changes that have occurred in the industry but, in general, there was no real consensus around these trends or obvious differences when compared with the Low-DSM respondents. The most common "technical changes" for

PG&E territory contractors were increases in efficiency and increase in the use and sophistication of controls on packaged HVAC systems. The most common "general comments" were about changes in customer demand for value and lack of interest in high efficiency. Technical changes were the most cited trend for the next three years, but again, no strong consensus or differences were clear (see Exhibit 5-20). The most common "technical changes" expected in the future were increases in energy efficiency of units and increases in the sophistication and availability of controls for units (see Exhibit 5-21).

Exhibit 5-20
Contractors: Trends in the Market for Package Units over the Past Three Years

	PG&E Territory	Low-DSM States
Technical Changes:	68%	39%
Control improvement, refrigerant phase-out, Increases in efficiency, Incorporation of VSDs, Increased complexity, Standardization of components, sizes. Cheaper parts		
General Comments:	36%	28%
Owners don't care about HE, Customers want more value, Increased use of packaged units, Quality increasing/decreasing, Trend towards gas packs Improved service from vendors,		
Availability of Units:	5%	0%
Increased Availability of HE units		
Price Changes:	*9%*	*11%*
Prices are decreasing,		
No Trends:,	*5%*	*22%*
# of Respondents	*22*	*18*

Exhibit 5-21
Contractors: Trends in the Market for Package Units in the Next Three Years

	PG&E Territory	Low-DSM States
Technical Changes:	52%	23%
Control improvements, Increases in efficiency/unit quality, More use of evaporative coolers Refrigerant phase-out Cheaper parts, standardization of components.		
General Comments:	22%	8%
Customers want more value, Quality increasing/decreasing, Trend towards gas packs and larger units		
Mandated standardization:	9%	15%
State or Federal regulations		
No Trends:,	*17%*	*54%*
# of Respondents	*23*	*13*

Exhibit 5-22 presents the responses to questions concerning the most important factors considered when choosing packaged HVAC equipment for customers. Note that most commonly mentioned by PG&E territory contractors was reliability and quality of the unit, followed by monetary concerns and issues. Low-DSM states mentioned energy efficiency

most often (53 percent) followed by monetary concerns and issues (47 percent). Some of the responses that were labeled "other" were as follows: relationship with and service provided by vendor, brand name, needs of the customer, noise concerns, and ease of installation.

Exhibit 5-22
Contractors: Most Important Factors for Installations or Specifications for Customers

	PG&E Territory	Low-DSM States
Quality/reliability	58%	35%
Budget issues/price	54%	47%
Availability of unit/parts	21%	6%
Dimensions/size of unit	25%	12%
Energy efficiency	25%	53%
Other	17%	12%
# of Respondents	*24*	*17*

Contractors and distributors were also asked to rate, on a five-point scale, the importance that their customers place on each of five characteristics of packaged units. These results are shown in Exhibit 5-23. For both contractors and distributors in both the PG&E and comparison areas, reliability was rated highest. Price was consistently the second highest rated characteristic. Energy efficiency was the third highest rated characteristic among PG&E contractors and was tied for third (along with brand) among PG&E distributors. Contractors and distributors in the comparison groups both rated energy efficiency below brand and just above or equal to the unit's dimensions.

Exhibit 5-23
Packaged Unit Characteristics Ratings
(ratings on a 1-5 scale, 1=not important, 5=extremely important)

	Contractors		Distributors	
	PG&E Territory	Low-DSM States	PG&E Territory	Low-DSM States
Price	3.7	4.2	3.8	3.5
Brand	2.6	3.5	3.6	3.5
Dimensions	2.5	2.7	3.1	2.4
Energy Efficiency	3.6	2.9	3.6	2.4
Reliability	4.3	4.5	4.2	4.2
# of Respondents	26	19	10	11

EFFICIENT-LIGHTING MARKET CHARACTERIZATION

This subsection provides a characterization of the commercial lighting market based on data from surveys with electrical contractors and distributors in PG&E's service territory and from eleven states with low demand-side management activity. Recent work reported in *PG&E and SDG&E Commercial Lighting Market Effects Study* (Xenergy, 1998) presents a comprehensive characterization of the T8 lamp and electronic ballast market. To

complement rather than duplicate this earlier effort, the focus of our primary research for the current study is on the CFL market. Complementing this previous research, our surveys were kept broad enough to capture key elements of the entire efficient-lighting market. We were thus able to update a few key market indicators for T8 lamps and electronic ballasts. We also draw on this previous work to supplement our market characterization.

Overview of the Commercial Lighting Market

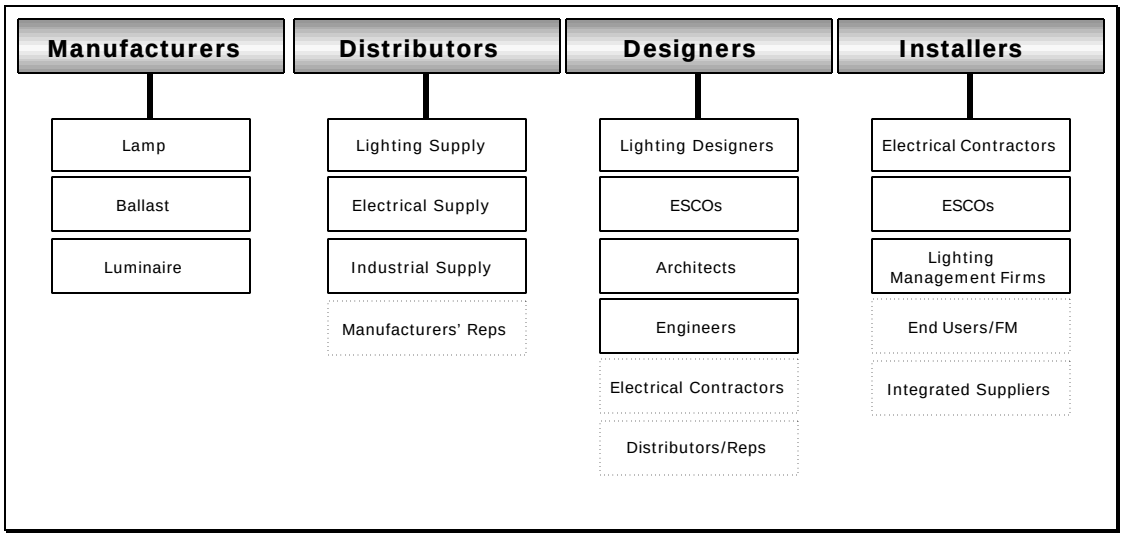
The *PG&E and SDG&E Commercial Lighting Market Effects Study* was much larger in scope than the current study. As such, this subsection summarizes the market overview developed in this previous study. Readers unfamiliar with the previous work are encouraged to review the market characterization sections of that report as background to the current study (much more detail is available in this previous report than is included in the summary that follows).

Supply-side Segmentation

The supply side of the commercial lighting market is characterized by a wide range of business models found along the supply chain. Changes both within the industry as well as through external forces have significantly altered the landscape of the commercial lighting market over the past decade, in California as well as the nation. For a variety of reasons, including rapid technological evolution, changes in utility program funding, and increasing pressures to reduce costs, the changing commercial lighting industry has forced businesses to adapt and seek new markets and submarkets. As a result of the market change and the uncertainty that accompanies it, new business models have evolved, some focusing heavily upon energy efficiency as a tool for boosting revenues.

In order to understand the structure of the supply side of the commercial lighting market, it is important to identify and understand the motivations and dispositions of its component parts. The supply-side analysis developed in the previous research (Xenergy, 1998) identified four primary segments, 13 total subsegments and five quasi-segments that did not clearly fall under the primary segments. Exhibit 5-24 summarizes the segmentation developed previously. Note that the current study adds primary research on only two of the four primary segments: distributors and installers (contractors).

Exhibit 5-24
Supply-Side Segmentation Scheme



Source: Xenergy, 1998

The solid boxes in the exhibit represent discrete subsegments that fall under the primary segment identified in the shaded box above it. The broken boxes represent quasi-segments that do not clearly fall under any one segment. For example, the End User/FM (facilities maintenance) subsegment falls under installers; however, they are not a component of the supply side (nor are they included in the primary research conducted for the current study). Integrated suppliers span all four segments, but to avoid duplication were grouped under installers. Another quasi-segment is Manufacturers' Reps. These entities have the function of acting as sales conduits for manufacturers, providing design and layout services as a sales tactic. These firms, whether independent or manufacturer-owned, do not definitively fall under any single primary segment as defined; yet they have a significant market presence and therefore merit recognition in the segmentation scheme. Finally, electrical contractors and distributors/reps fall under the designer segment because these are secondary services offered by these groups.

Although this discrete segmentation of the supply-side market is generally appropriate and useful, it is also important to recognize that many supply-side lighting firms engage in multiple levels of the supply chain.

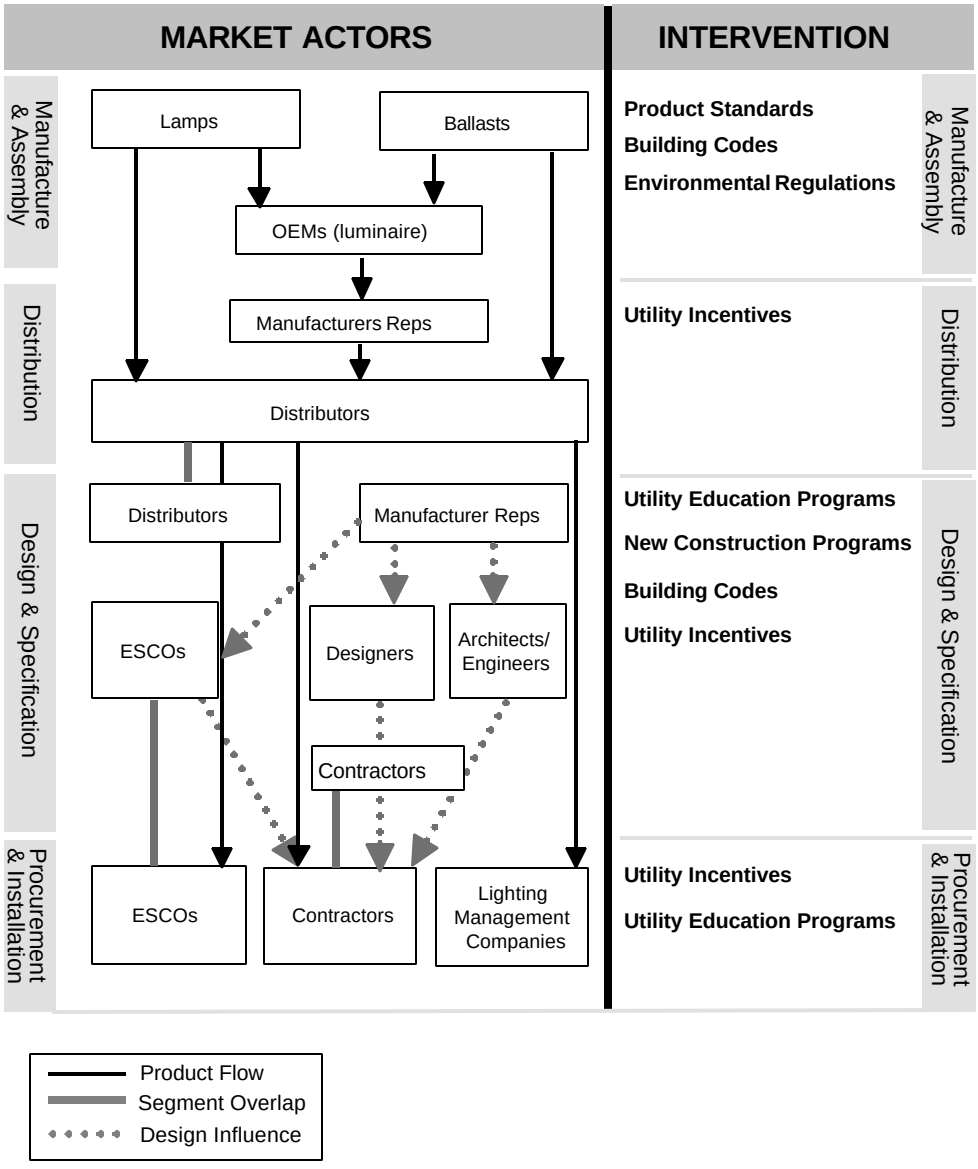
Market Influence

This subsection presents influence diagrams for major sectors of the market (again as developed in Xenergy, 1998). Exhibit 5-25 below graphically depicts the overall structure of the commercial lighting market and identifies major intervention efforts for each segment. Arrows generally indicate product flows and design influence; boxes represent major segments. Not all possible product flows and influences are shown in the diagram because we prefer to avoid the unnecessary risk of over-complication. Consequently, the diagram

represents the primary market relationships as a simplification, rather than an exhaustive depiction of all relationships we identified in our research.

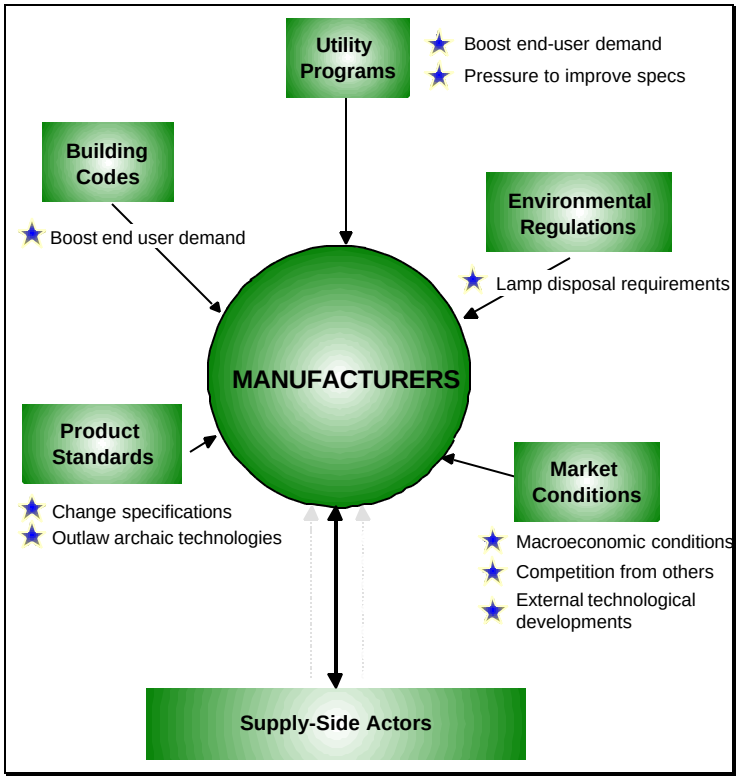
The two subsequent influence diagrams, Exhibits 5-26 and 5-27, dissect the overall market diagram into a manufacturer and design and specification diagram. These two segments of the market structure, which we deem most important to the adoption of energy-efficient technologies, illustrate the "external" pressures affecting the decision making of both groups.

Exhibit 5-25
Commercial Lighting Market and Intervention Diagram



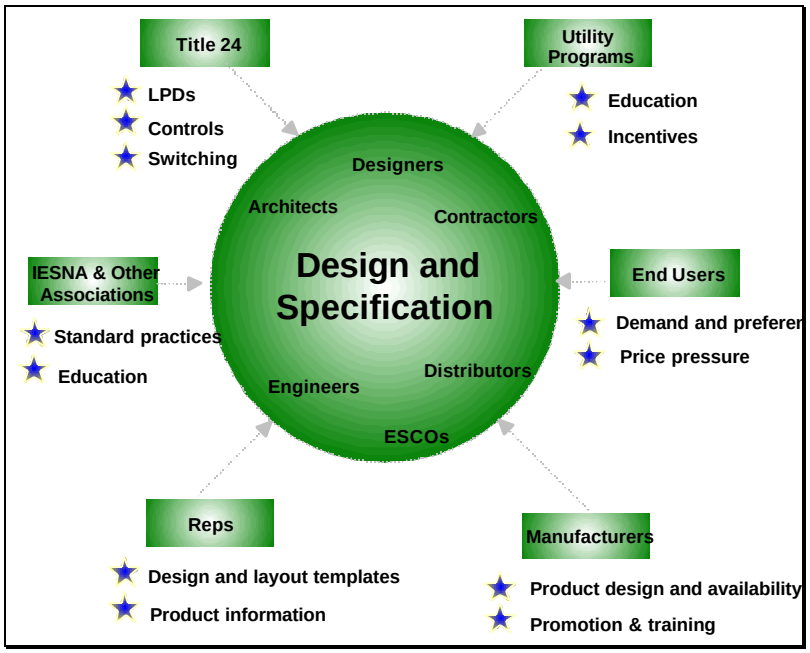
Source: Xenergy, 1998

Exhibit 5-26
Manufacturer Influence Diagram



Source: Xenergy, 1998

Exhibit 5-27
Design & Specification Influence Diagram

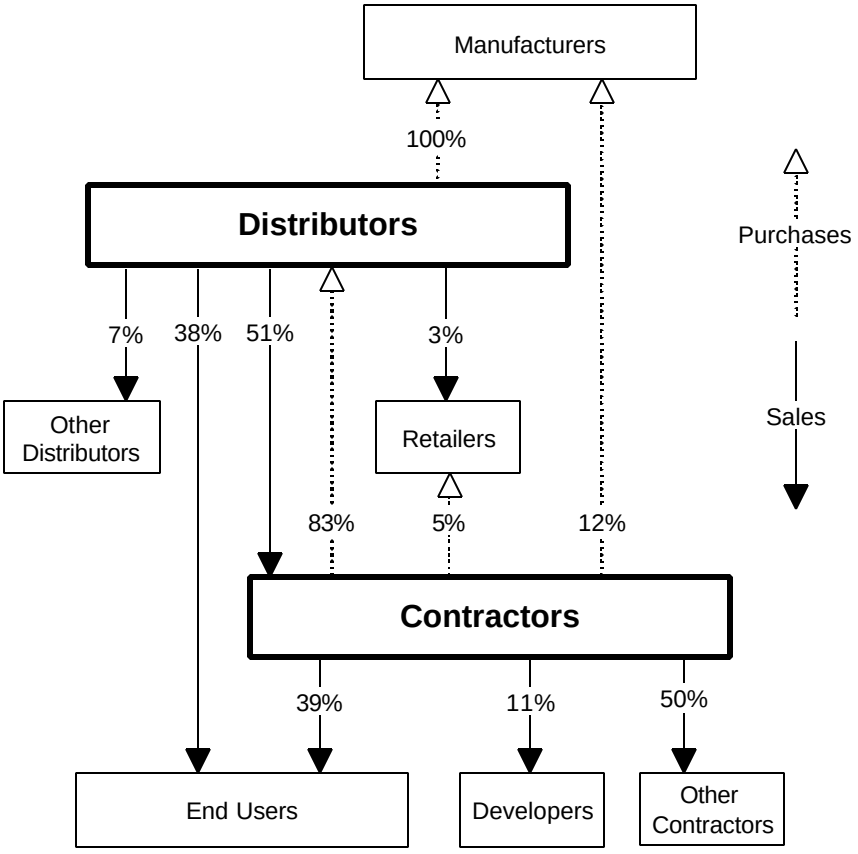


Source: Xenergy, 1998

Product Flows

Within PG&E's service territory, the majority of commercial lighting products flow from manufacturers to distributors, from distributors to contractors and then on to end users. As shown in Exhibit 5-28, distributors also sell a significant fraction of fluorescent lamps, ballasts, and fixtures directly to end users.

Exhibit 5-28
Product Flows in the Commercial Lighting Market in PG&E's Service Territory



Source: Xenergy Interviews for the current study.

Analysis of Primary Interview Results

Analysis of the efficient lighting equipment market information developed from our primary research is presented in the following subsections on market size, interviewee characteristics, and market trends.

Size and Composition

As discussed in Chapter 3, we stratified our lighting contractor surveys into four size categories based on FTE employees. These four strata were aggregated into two groups for the purposes of reporting results. Contractors were broken into two size categories: large and small. We defined large contractors as those having at least 50 employees. Small contractors are defined as those with between two and 49 employees. These size categories are used throughout this report to highlight important differences between contractors. For the population captured by our surveys, small contractors (including those with one or an unknown number of employees) account for approximately 98 percent of the firms but only about 63 percent of commercial lighting revenues throughout PG&E's service territory. Large

contractors represent only two percent of the firms but account for over a third of the revenues. The numbers are similar for the nation. Exhibit 5-29 shows the number of lighting contractors and their relative impact in the commercial lighting market as measured by their revenues from commercial lighting work. Note that the estimates in Exhibit 5-29 do not include firms that are misclassified in D&B under SIC codes other than those we considered.

Exhibit 5-29
Contractors: Description of Population*

	Other** *1 or unk FTE*	Small *2 - 49 FTE*	Large *> 49 FTE*
Lighting			
PG&E territory	958	2,346	58
Low-DSM states	4410	13,286	395
Entire U.S.	18317	57,793	1633
Portion of sample that does not install commercial lighting†	16%	9%	2%
Adjusted Lighting			
PG&E territory	803	2,133	57
Low-DSM states	3,699	12,082	389
Entire U.S.	15,363	52,554	1,609
Characteristics			
Percent of population	22%	76%	2%
Avg number of employees	1	17	263
Avg total revenues	$159,500	$1,878,600	$54,833,000
Percent commercial lighting	28%	28%	22%
Commercial lighting revenues	2%	61%	37%

**As derived from a search of D&B's database.*

***This category is almost entirely composed of one-person businesses. Only a few are unknown. Complete interviews were conducted only with contractors in the Small and Large categories.*

† These figures are Xenergy estimates based on results from screening calls of potential interviewees.

Characteristics of Interviewees

Of all the contractors interviewed, 95 percent classified themselves as electrical contractors (Exhibit 5-30). Energy service companies were intentionally avoided for this study, and none were interviewed (a number were interviewed in Xenergy, 1998 and Xenergy, 1999). Exhibit 5-31 shows the breakdown of distributor self classification. The majority of distributors classified themselves as electrical equipment suppliers (45 percent PG&E territory and 80 percent Low-DSM states). The remaining distributors described themselves variously as manufacturer representatives, catalog companies, general industrial suppliers, and lighting suppliers.

Exhibit 5-30
Contractors: Self-Reported Classification

	PG&E Territory	Low-DSM States
Electrical contractor	95%	95%
Energy service company	0%	0%
Lighting mgmt company	0%	5%
Other	5%	0%
# of Respondents	*21*	*21*

Exhibit 5-31
Distributors: Self-Reported Classification

	PG&E Territory	Low-DSM States
Catalog/mail order firm	9%	10%
General industrial supplier	18%	0%
Electrical equipment supplier	45%	80%
Lighting supplier only	9%	0%
Manufacturer representative	18%	10%
# of Respondents	*11*	*10*

The average, minimum and maximum number of years contractors and distributors have been in business is shown in Exhibit 5-32. The average age of contractor businesses was very similar for both PG&E territory and Low-DSM states (32 and 34 years, respectively). The distributor averages were 32 years for PG&E territory and 51 years for those in Low-DSM states.

Exhibit 5-32
Age of Businesses

	Contractors		Distributors	
	PG&E Territory	Low-DSM States	PG&E Territory	Low-DSM States
Average	32	34	32	51
Minimum	2	4	6	19
Maximum	77	93	75	80
# Respondents	*21*	*21*	*11*	*10*

The breakdown of FTE employees for contractors and distributors is shown in Exhibit 5-33. The average number of employees are shown by the small and large size strata. Respondents' self-report total revenue estimates are shown for contractors in Exhibit 5-34 and for distributors in Exhibit 5-35. Both contractor and distributor revenues are fairly consistent between PG&E territory and Low-DSM states.

Exhibit 5-33
Number of FTE Employees

	Contractors				Distributors			
	PG&E Territory		Low-DSM States		PG&E Territory		Low-DSM States	
	Small	*Large*	*Small*	*Large*	*Small*	*Large*	*Small*	*Large*
Average	22	202	12	324	11	71	10	41
# of Respondents	*10*	*11*	*9*	*12*	*6*	*5*	*5*	*5*

Exhibit 5-34
Contractors: Total Annual Revenue

	PG&E Territory		Low-DSM States	
	Small	Large	Small	Large
Less than $500,000	30%	0%	33%	0%
$500,000 - $5 Million	50%	9%	67%	0%
Over $5 Million	10%	82%	0%	92%
Don't know/Proprietary	10%	9%	0%	8%
# of Respondents	*10*	*11*	*9*	*12*

Exhibit 5-35
Distributors: Total Annual Revenue

	PG&E Territory		Low-DSM States	
	Small	Large	Small	Large
Less than $1 Million	17%	0%	0%	0%
$1 Million - $10 Million	67%	20%	60%	20%
Over $10 Million	17%	80%	40%	80%
Don't know/Proprietary	0%	0%	0%	0%
# of Respondents	*6*	*5*	*5*	*5*

Contractors and distributors were asked to estimate the percentage of their total sales comprised of commercial lighting products. The results in Exhibit 5-36 show that a majority of sales is equipment other than lighting for both contractors and distributors.

Exhibit 5-36
Commercial Lighting as Percentage of Total Sales

	Contractors		Distributors	
	PG&E Territory	Low-DSM States	PG&E Territory	Low-DSM States
Commercial lighting	19%	31%	47%	33%
Other	81%	69%	53%	67%
# of Respondents	*21*	*21*	*11*	*10*

Contractors were asked to allocate their commercial work between retrofits and new construction. Exhibit 5-37 shows the results to this question. New construction is a larger fraction in PG&E's territory than in the eleven Low-DSM states. Exhibit 5-38 shows the

breakdown of lighting contractor business by market sector. The commercial market is largest for all groups.

Exhibit 5-37
Contractors: Breakdown of Lighting Sales

	PG&E Territory		Low-DSM States	
	Small	Large	Small	Large
Retrofits and expansions	35%	20%	43%	35%
New construction	66%	80%	57%	65%
# of Respondents	*10*	*11*	*9*	*12*

Exhibit 5-38
Contractors: Percent of Lighting Business by Market Sector

	PG&E Territory		Low-DSM States	
	Small	Large	Small	Large
Commercial	53%	70%	74%	50%
Residential	23%	12%	19%	4%
Industrial	24%	17%	6%	28%
Other	0%	0%	0%	3%
# of Respondents	*9*	*11*	*9*	*12*

Perceptions on Market Trends

Contractors and distributors were asked to identify trends in the fluorescent lighting market over the past three years. Their responses were grouped into four broad categories, including indirect lighting, energy-efficient lighting equipment, technical improvements to lamps and ballasts, and energy conservation policy. A general difference between the perceptions of in-territory and comparison group responses can be seen in Exhibits 5-39 and 5-40. Vendors in the Low-DSM states view increased usage of efficient lighting as the dominant trend, while those in the PG&E territory point much more to technical product improvements. This is consistent with the trend, discussed in Section 6, that the Low-DSM states lagged the high penetrations of efficient lighting equipment that occurred in the PG&E territory between 1992 and 1996. It also shows that the vendors in-territory tend to be focusing on the more subtle, leading edge changes *within* each of the efficient products.

Exhibit 5-39
Contractors: Most Important Trends in the Fluorescent Market Over the Past Three Years

	PG&E Territory	Low-DSM States
Indirect lighting	8%	0%
Increased usage of efficient lighting:	38%	86%
Compact fluorescent lamps,		
T8 lamps,		
Electronic ballasts		
Technical Improvements:	50%	10%
Invention of T5 lamp,		
Improved color rendition,		
Reduced ballast noise,		
Longer lamp life,		
More variety in shape of CFLs,		
Low-mercury lamps		
Energy conservation policy:	4%	4%
EPA		
Title-24		
Other local codes		
# of Respondents	*26*	*21*

Exhibit 5-40
Distributors: Most Important Trends in the Fluorescent Market Over the Past Three Years

	PG&E Territory	Low-DSM States
Indirect lighting	7%	7%
Increased usage of efficient lighting:	29%	53%
Compact fluorescent lamps,		
T8 lamps,		
Electronic ballasts		
Technical Improvements:	36%	13%
Invention of T5 lamp,		
Improved color rendition,		
Reduced ballast noise,		
Longer lamp life,		
More variety in shape of CFLs,		
Low-mercury lamps		
Energy conservation policy:	29%	27%
EPA		
Title-24		
Other local codes		
# of Respondents	*14*	*15*

Respondents were also asked to convey their perceptions of the most important lighting industry trends that they expected to occur over the next three years. These responses are shown in Exhibit 5-41. Increased use of controls, improvements in daylighting / dimmable ballasts, advances in efficiency, and other technical advances are all cited.

Exhibit 5-41
Contractors: Trends in the Fluorescent Market Over the Next Three Years

	PG&E Territory	Low-DSM States
No significant changes	20%	47%
Increase usage of controls:	20%	12%
Occupancy sensors		
Low-voltage switching		
EMS		
Daylighting & dimming ballasts	10%	6%
Advances in energy efficiency:	35%	12%
Ballasts		
Lamps		
Technical advances:	15%	24%
Better indirect lighting,		
Very bright fluor that compete with HID,		
Smaller packages such as T5s		
# of Respondents	*20*	*17*

When asked about the importance of offering efficient lighting to their competitive position, contractors in PG&E's territory said that these products were very important in competing for customers (see Exhibit 5-42). Distributors answered completely differently. Within PG&E's territory, distributors were less convinced it offers a competitive advantage, while in the Low-DSM states, they said it was very important. One possible explanation of this is that virtually all distributors in PG&E territory now offer efficient lighting, so while an individual distributor must also offer these products to stay competitive, it does not necessarily differentiate his business from his competitors.

Exhibit 5-42
Competitive Importance of Offering Efficient Lighting Products

	Contractors		Distributors	
Importance Ranking	PG&E Territory	Low-DSM States	PG&E Territory	Low-DSM States
Very important	70%	20%	45%	80%
Somewhat important	25%	45%	18%	20%
Not very important	0%	30%	27%	0%
Not at all important	5%	5%	9%	0%
# of Respondents	*20*	*20*	*11*	*10*

6. SUPPLY-SIDE SURVEY RESULTS

In this section we present the results from questions on supply-side awareness and impressions of BEMS, drawn from questions appended to the Express supply-side interviews. These questions were asked of 26 HVAC contractors, 10 HVAC distributors, 21 lighting contractors and 10 lighting distributors in the PG&E territory.

HVAC AND LIGHTING RESULTS

Exhibit 6-1
Awareness of PG&E Energy Audit Programs
HVAC and Lighting Suppliers

		SURVEY			
		HVAC Contractor	HVAC Distributor	Lighting Contractor	Lighting Distributor
QUESTION	RESPONSE	(sample size=26)	(sample size=10)	(sample size=21)	(sample size=10)
Were you aware that PG&E provided energy audits to small and meduim sized businesses?	yes	18	8	11	7
	no	8	2	10	3

- More than half of HVAC and lighting contractors and distributors were aware that PG&E provides energy audit programs to small and medium sized businesses, with awareness slightly higher among distributors.
- Eighteen of 26 HVAC contractors were aware of the energy audit programs.
- Eight of ten HVAC distributors were aware of the energy audit programs.
- Eleven of 21 lighting contractors were aware of the energy audit programs.
- Seven of ten lighting distributors were aware of the energy audit programs.

Exhibit 6-2
Number of HVAC and Lighting Suppliers
That Obtained Business Recently
Via PG&E Energy Audit

		SURVEY			
		HVAC Contractor	HVAC Distributor	Lighting Contractor	Lighting Distributor
QUESTION	RESPONSE	(sample size=18)	(sample size=8)	(sample size=11)	(sample size=7)
In the past 3 years, has your firm obtained any business installing energy saving measures for customers based on recommendations they received from PG&E	yes	2	5	1	3
	no	13	3	10	4
	don't know	3	.	.	.

While more than half of HVAC distributors reported that they had received some business installing energy-efficient measures for customers based on a PG&E energy audit recommendation, less that half of HVAC and lighting contractors and lighting distributors made this claim. It is possible, of course, that BEMS generated business for these market actors and they did not know it.

- Five of eight HVAC distributors obtained business via an energy audit.
- Two of 18 HVAC contractors obtained business via an energy audit.
- One of 11 lighting contractors obtained business via an energy audit.
- Three of seven lighting contractors obtained business via an energy audit.

Exhibit 6-3
Effect of PG&E Energy Audit Program on Business
HVAC and Lighting Suppliers

		SURVEY			
		HVAC Contractor	HVAC Distributor	Lighting Contractor	Lighting Distributor
QUESTION	RESPONSE	(sample size=18)	(sample size=8)	(sample size=11)	(sample size=7)
Which of the following best characterizes the effect of PG&E's energy audit program on your business	very significant	.	.	.	1
	very insignificant	11	3	5	
	Neither	2	4	4	6
	NA	5	1	2	.

- While most HVAC and lighting contractors reported that PG&E's energy audit program has a very insignificant effect on their business, most HVAC and lighting distributors reported that the audit program has some effect on their business.
- Only one respondent of the 67 (a lighting distributor) reported that BEMS had a very significant impact on its business. When asked to explain why BEMS had a very significant impact on their business, this particular lighting distributor said that BEMS "has stimulated the market" and that the "contractor rebate is effective".
- When asked to explain why the audit program had a very insignificant effect on their business, one HVAC contractor stated that they do audit work themselves, and that most of PG&E's audit work is not done in their territory.
- When asked to explain why the audit program had a very insignificant on their business, one lighting contractor stated that they deal mostly with general contractors, not end-users who would be influenced by the audits.
- When asked to explain why the audit program had some effect on their business, one HVAC distributor stated that "PG&E is seen as an unbiased evaluator with high credibility."

- When asked to explain why the audit program had some effect on their business, one lighting distributor stated that the program "created awareness about energy efficiency and increased incentives to purchase efficient equipment."

Exhibit 6-4
HVAC and Lighting Supplier Self-Reported Effect
Of PG&E Energy Audit Program
On Customer Awareness of Energy-efficient Measures

		SURVEY			
		HVAC Contractor	HVAC Distributor	Lighting Contractor	Lighting Distributor
QUESTION	RESPONSE	(sample size=18)	(sample size=8)	(sample size=11)	(sample size=7)
To what extent do you think that PG&E's audits increase customer awareness, consideration and purchase of high efficiency equipment	meaningful increase	1	.	2	3
	some increase	5	.	2	2
	no increase			2	1
	n/a	12	8	5	1

- Generally, HVAC and lighting contractors and lighting distributors reported that they believe that PG&E's audit program has caused at least some increase in customer awareness and purchase of energy-efficient equipment.

- Two of 11 lighting contractors and one of seven lighting distributors reported that they believe the audit program has not increased customer awareness and purchase of energy-efficient equipment.

- One of 18 HVAC contractors, two of 11 lighting contractors and three of seven lighting distributors reported that they believe the audit program has caused a meaningful increase in customer awareness and purchase of energy-efficient equipment. HVAC distributors were not asked this question, to manage survey length within that group.

7. END-USER SURVEY RESULTS

The results of the BEMS/Express 1998 End-User Market Effects Main Survey are presented in this chapter. This survey was conducted with 304 BEMS 1998 participants, 323 BEMS 1996 participants, 186 Express 1998 participants, 299 PG&E NPs and 222 Low DSM NPs. The resulting data were weighted to the less-than-500 kW PG&E customer population, based on kWh in each of 12 business size/type categories. What follows are three different cross-sectional comparisons (BEMS 1998 vs. BEMS 1996, BEMS 1998 vs. PG&E NPs and Low DSM NPs, and BEMS 1998 vs. Express 1998) that together demonstrate the degree of support for MT to date. Differences labeled as "significant" were found to be statistically significant at the 90 percent confidence level.

BEMS 1998 VS. BEMS 1996

The purpose of this section is to compare BEMS 1998 participants to BEMS 1996 participants to see if there were any changes in measure installations and attitudes toward energy efficiency over time that can be attributed to the program. It is not surprising that BEMS 1996 participants reported more changes, given the fact that three years have elapsed since their audit occurred, compared to only a one year period for 1998 participants. At the same time, it is exactly this post-audit behavior over time that this analysis seeks to identify.

Measure Changes Since January 1996

Exhibit 7-1
Percentage of Respondents
Who Changed Measures
BEMS 1998 vs. BEMS 1996

MEASURE	SURVEY	
	BEMS98	BEMS96
Sample Size	304	323
T8	36	30
Reflector	11	15
CFL	8	21
HE CAC	13	18
Set Back Thermostat	16	34
CAC Maintenance	51	69
Lighting Occupancy Sensors	9	13
COMPOSITE INDEX	143	199

- Generally, more BEMS 1996 participants made measure changes than BEMS 1998 participants.

- BEMS 1996 participants were significantly more likely to install CFLs and set back thermostats, and significantly more likely to perform regular maintenance on their CACs.

Exhibit 7-2
Categorized Volume of Measures Changed Since January 1996
BEMS 1998 vs. BEMS 1996

		SURVEY			
VOLUME	MEASURE	Sample Size	BEMS98	Sample Size	BEMS96
1 to 25	T8		60		39
26 to 50	T8		12		35
51 to 100	T8		5		9
101 to 500	T8		20		14
500 plus	T8	74	3	83	4
1 to 25	Reflector		20		50
26 to 50	Reflector		5		21
51 to 250	Reflector		50		14
251 plus	Reflector	31	26	38	15
1 to 10	CFL		47		27
11 to 25	CFL		29		43
26 to 150	CFL		20		17
151 plus	CFL	30	4	53	13
1	HE CAC		37		47
2 to 5	HE CAC		59		39
6 to 10	HE CAC		2		8
11 plus	HE CAC	37	2	61	6

- BEMS 1998 participants were significantly more likely to install fewer T8s, such as 25 or fewer.

- BEMS 1998 participants were significantly more likely to install more than 50 reflectors after delamping.

- While BEMS 1998 participants were significantly more likely to install between one and ten CFLs, BEMS 1996 participants were significantly more likely to install more than 150 CFLs.

- BEMS 1996 participants were significantly more likely to install only one CAC.

Exhibit 7-3
Analysis of Measure Volumetrics
BEMS 1998 vs. BEMS 1996

MEASURE		SURVEY BEMS98 (sample size = 304)	SURVEY BEMS96 (sample size = 323)
T8	respondents who changed measure	36	30
	Average number of changes	81	69
	percentage of changing respondents X average number changes	2,917	2,059
Delamp	respondents who changed measure	11	15
	Average number of changes	206	91
	percentage of changing respondents X average number changes	2,270	1,359
CFL	respondents who changed measure	8	21
	Average number of changes	26	91
	percentage of changing respondents X average number changes	206	1,918
HE CAC	respondents who changed measure	13	18
	Average number of changes	3	4
	percentage of changing respondents X average number changes	41	78
ASD	respondents who changed measure	NA	NA
	Average number of changes	NA	NA
	percentage of changing respondents X average number changes	NA	NA
Sensor	respondents who changed measure	9	13
	Average number of changes	24	13
	percentage of changing respondents X average number changes	214	169

- BEMS 1998 participants installed a larger volume T8s, reflectors and lighting occupancy sensors.

- BEMS 1996 participants installed a larger volume of CFLs and CACs.

Exhibit 7-4
Efficiency of Lighting Used in Facility
BEMS 1998 vs. BEMS 1996

EFFICIENCY OF LIGHTING	SURVEY BEMS98	SURVEY BEMS96
Sample Size	304	323
high efficiency	24	25
standard efficiency	43	43
mix of high and standard efficiency	32	32

Exhibit 7-5
Efficiency of CACs
Installed Since January 1996
BEMS 1998 vs. BEMS 1996

	SURVEY									
	BEMS98					BEMS96				
	(sample size = 304)					(sample size = 323)				
	yes			no	don't know	yes			no	don't know
INSTALLED CAC	21			79	1	37			63	0
	(sample size =58)					(sample size = 103)				
	HE	SE	HE and SE	don't know		HE	SE	HE and SE	don't know	
EFFICIENCY	56	36		7		57	31		11	

- Significantly more BEMS 1996 participants (37 percent) than BEMS 1998 participants (21 percent) reported installing a CAC since January 1999.

- About the same amount of BEMS 1996 participants (57 percent) and BEMS 1998 participants (56 percent) claimed that the CAC they installed was high efficiency.

- The resulting net of high-efficiency installations here is consistent with those highlighted in Exhibit 7-1.

Exhibit 7-6
Measure's Impact on Confidence
That Energy-efficient Products Will Reduce Utility Bill
BEMS 1998 vs. BEMS 1996

		SURVEY			
MEASURE	IMPACT	Sample Size	BEMS98	Sample Size	BEMS96
	increase		51		54
	decrease		9		16
T8	same	72	40	81	29
	increase		57		69
	decrease		14		3
Reflector	same	28	28	38	28
	increase		65		61
	decrease		10		13
CFL	same	28	25	52	25
	increase		70		55
	decrease		5		4
HE CAC	same	33	24	56	41
	increase		56		63
	decrease		2		7
Set Back Thermostat	same	47	42	91	30
	increase		39		49
	decrease		9		4
CAC Maintenance	same	145	52	195	47
	increase		84		58
	decrease		6		4
Lighting Occupancy Sensors	same	17	10	30	38

- BEMS 1996 participants were significantly more likely than BEMS 1998 participants to report that using high-efficiency CACs made no impact on their confidence in the ability of energy-efficient measures to reduce utility bills.

- BEMS 1996 participants were significantly more likely to report that their confidence in the possibility of reducing utility bills by using energy-efficient practices increased after they performed regular maintenance on their air conditioning systems.

- Interestingly, while BEMS 1996 participants were significantly more likely to state that using lighting occupancy sensors had no impact on their confidence in the possibility of reducing utility bills by using energy-efficient measures, BEMS 1998 participants were significantly more likely to state that using lighting occupancy sensors increased their confidence.

Exhibit 7-7
Percentage of Respondents Satisfied with Energy Savings
And Performance of Measure
BEMS 1998 vs. BEMS 1996

		SURVEY			
MEASURE	SATISFACTION	Sample Size	BEMS98	Sample Size	BEMS96
	dissatisfied		17		0
	satisfied		40		47
T8	very satisfied	72	43	81	53
	dissatisfied		5		.
	satisfied		41		60
Reflector	very satisfied	28	53	38	40
	dissatisfied		9		4
	satisfied		24		40
CFL	very satisfied	28	67	52	56
	dissatisfied		6		.
	satisfied		29		47
HE CAC	very satisfied	33	65	56	53
	dissatisfied		5		6
	satisfied		27		39
Set Back Thermostat	very satisfied	47	68	91	55
	dissatisfied		12		1
	satisfied		46		45
CAC Maintenance	very satisfied	145	41	195	54
	dissatisfied		.		5
	satisfied		10		34
Lighting Occupancy Sensors	very satisfied	17	90	30	61

Note: Based on a scale of 1 to 10, where 1 is very dissatisfied and 10 is very satisfied (1-3 dissatisfied, 4-7 satisfied, 8-10 very satisfied).

- While 17 percent of BEMS 1998 participants reported being very dissatisfied with the energy savings and performance of T8s, no BEMS 1996 participants reported any dissatisfaction with T8s.

- BEMS 1996 participants were significantly more likely to be satisfied with the energy savings and performance of reflectors and high-efficiency CACs.

- While BEMS 1998 participants were significantly more likely to be dissatisfied with the energy savings attained via regular air conditioning system maintenance, BEMS 1996 participants were significantly more likely to be very satisfied with the energy savings attained via regular maintenance of their air conditioning systems.

- Although BEMS 1998 participants were significantly more likely to be very satisfied with the energy savings and performance of lighting occupancy sensors, there is no difference between BEMS 1998 and BEMS 1996 participants when satisfied and very satisfied responses are combined.

Exhibit 7-8
Impact of Current Energy-efficient Investments
On Future Selection of Energy-efficient Products
BEMS 1998 vs. BEMS 1996

CURRENT EE INVESTMENTS MAKE FIRM HOW MUCH MORE LIKELY TO SELECT EE OPTIONS IN THE FUTURE	SURVEY	
	BEMS98	BEMS96
Sample Size	304	323
much less likely	1	3
somewhat less likely	9	5
about as likely	14	8
somewhat more likely	31	35
much more likely	46	49

- No significant differences were reported among BEMS 1998 and BEMS 1996 participants regarding the impact of current energy-efficient investments on future selection of energy-efficient products.

- Respondents were asked to report by what percentage they believed that a business like theirs could reduce its electricity bill via implementing all of the energy-efficient products and practices that are currently available, if none had been implemented thus far. In total, 31 percent of BEMS 1998 participants and 28 percent of BEMS 1996 participants reported that they could reduce their bill by up to 10 percent, 53 percent of BEMS 1998 participants and 51 percent of BEMS 1996 participants reported that they could reduce their bill by 11 to 30 percent, and 16 percent of BEMS 1998 participants and 21 percent of BEMS 1996 participants reported that they could reduce their bill by more than 30 percent.

Program Participation

Exhibit 7-9
Percentage of Respondents Who Participated in BEMS
Or Other Audit Program Since January 1996
BEMS 1998 vs. BEMS 1996

SURVEY								
BEMS98				BEMS96				
(sample size = 304)				(sample size = 323)				
Participated			Did not Participate	Don't Know	Participated			Did not Participate	Don't Know
39			56	4	25			61	14
(sample size = 108)					(sample size = 87)				
1996	1997	1998			1996	1997	1998		
8	26	66			23	52	25		

- Although they are listed in PG&E's records as participants, only 39 percent of BEMS 1998 participants and only 25 percent of BEMS 1996 participants reported that they

had participated in BEMS or some other PG&E sponsored energy audit program since January 1996. This discrepancy can be used as a measure of how much the effects of program participation may have extended beyond the original decision maker or contact person.

- BEMS 1998 participants were significantly more likely to report that they had participated in a PG&E sponsored energy audit program.

- Participation was significantly more recent for BEMS 1998 than BEMS 1996, as would be expected.

Exhibit 7-10
Measures Recommended by BEMS or Other Audit Program
vs. Measures Installed
BEMS 1998 vs. BEMS 1996

	SURVEY			
	BEMS98		BEMS96	
MEASURE	MEASURE RECOMMENDED	MEASURE INSTALLED	MEASURE RECOMMENDED	MEASURE INSTALLED
Sample Size	108	43	87	48
T8	17	9	11	3
Reflector	5	4	2	1
CFL	2	1	3	1
HE CAC	3	.	2	1
Set Back Thermostat	1	.	2	2
CAC Maintenance	.	.	1	1
Lighting Occupancy Sensors	4	2	.	.

- While lighting occupancy sensors were reported as an energy audit recommendation by 4 percent of BEMS 1998 participants, no BEMS 1996 participants stated that lighting occupancy sensors were recommended by the energy audit.

- Significantly more BEMS 1998 participants than BEMS 1996 participants installed T8s.

Exhibit 7-11
Percentage of Respondents Who Participated in Express
Or Other Rebate Program Since January 1996
BEMS 1998 vs. BEMS 1996

PARTICIPATED IN REBATE PROGRAM	SURVEY	
	BEMS98	BEMS96
Sample Size	304	323
yes	12	18
no	85	73
don't know	3	9

- Significantly more BEMS 1996 participants reported that they had participated in Express or some other rebate program since January 1996.

Exhibit 7-12
Measures Installed Under Express
Or Other Rebate Program
BEMS 1998 vs. BEMS 1996

MEASURE	SURVEY	
	BEMS98	BEMS96
Sample Size	34	57
T8	7	8
Reflector	4	2
CFL	1	3
HE CAC	1	3
Set Back Thermostat	.	1
CAC Maintenance	.	.
Lighting Occupancy Sensors	.	.

Exhibit 7-13
Impact of BEMS Audit Program
On Future Energy-efficient Product Selection
BEMS 1998 vs. BEMS 1996

IMPACT		SURVEY	
		BEMS98	BEMS96
	Sample Size	108	87
BEMS IMPACT ON LIKLIHOOD OF SELECTING EE PRODUCTS IN THE FUTURE	little or no impact	18	21
	some impact	30	29
	much impact	53	50
BEMS IMPACT ON LONG TERM INVESTMENT ANALYSIS POLICIES FOR SELECTION OF EE PRODUCTS	little or no impact	24	21
	some impact	52	57
	much impact	24	21

Note: Based on a scale of 1 to 10, where 1 means had very little impact and 10 means had great impact (1-3 no / very little impact, 4-7 some impact, 8-10 great impact).

- There was no difference between BEMS 1998 and BEMS 1996 participants regarding the audit program's impact on future energy-efficient product selection and long term investment analysis policy creation.

Exhibit 7-14
Importance of BEMS Audit vs. Express Rebate
In Persuading Firm to Make a Energy-efficient Investment
BEMS 1998 vs. BEMS 1996

IMPORTANCE IN PERSUADING FIRM TO MAKE AN EE INVESTMENT	SURVEY	
	BEMS98	BEMS96
Sampe Size	17	28
audit much more important than rebate	28	3
audit somewhat more important than rebate	3	19
audit and rebate equally important	53	59
rebate somewhat more important than audit	7	8
rebate much more important than audit	9	10

- There is some anecdotal evidence that, as rebates have decreased, perceived importance of audits may have increased.

Exhibit 7-15
Barriers to Energy-efficient Investments and Practices
BEMS 1998 vs. BEMS 1996

BARRIER	AGREEMENT	SURVEY	
		BEMS98	BEMS96
	Sample Size	304	323
When considering a new EE investment, I am concerned that the actual bill savings will be less than what was estimated.	don't agree	14	16
	agree somewhat	47	53
	agree completely	39	31
It takes too much time and hassle to get enough information to make an informed decision about EE investments.	don't agree	32	37
	agree somewhat	47	42
	agree completely	22	21
There is too much time and hassle involved in selecting a qualified EE contractor.	don't agree	30	33
	agree somewhat	44	49
	agree completely	26	18
I feel uncertain about the reliability of information provided by the non-utility firms proposing EE investments.	don't agree	19	21
	agree somewhat	45	53
	agree completely	37	25
I am able to find information about EE investments from sources I trust, but the information is not very helpful to me in making decisions.	don't agree	34	31
	agree somewhat	45	52
	agree completely	21	17
Lack of financing is a barrier to our organization making EE investments that we want to make.	don't agree	28	28
	agree somewhat	35	36
	agree completely	38	36
I read or hear about specific kinds of EE investments that don not seem to be available from the suppliers we work with.	don't agree	43	48
	agree somewhat	39	35
	agree completely	18	17
There are EE investments that I am interested in making, but they always fall below other priorities.	don't agree	20	23
	agree somewhat	38	43
	agree completely	42	34

Note: Based on a scale of 1 to 10, where 1 don't agree at all and 10 is completely agree (1-3 don't agree, 4-7 agree somewhat, 8-10 completely agree).

- BEMS 1998 participants were significantly more likely to completely agree that when using an energy-efficient measure they were concerned that the actual bill savings might be less than originally estimated (performance uncertainty).

- BEMS 1998 participants were significantly more likely to completely agree that selecting a qualified energy efficiency contractor involves too much time and hassle (transaction / hassle cost).

- Although BEMS 1998 participants were significantly more likely to completely agree that they felt uncertain about the reliability of energy efficiency information provided by non-utility firms (asymmetric information), there was no difference between BEMS 1998 and BEMS 1996 participants when the responses for those who agreed completely and those who agreed somewhat were combined.

- Significantly more BEMS 1998 participants completely agreed that they have interest in making energy-efficient investments, but that these investments always fall below other priorities (bounded rationality).

- Significantly more BEMS 1996 participants somewhat agreed that while they are able to find information about energy-efficient investments from trustworthy sources, the information is not very helpful to them in making decisions (information/search costs).

Exhibit 7-16
Main Reason Why Firm Has Not Installed
High-efficiency Lighting Since January, 1996
BEMS 1998 vs. BEMS 1996

MAIN REASON WHY FIRM DID NOT INSTALL HIGH EFFICIENCY LIGHTING	SURVEY	
	BEMS98	BEMS96
Sample Size	165	155
No need/satisfied with current lighting.	34	37
Too expensive compared to other equipment.	27	33
Electronic ballasts are not reliable.	2	1
It would take too much time/work to make the change.	6	4
Designer or contractor recommended not use.	3	1
Not readily available.	0	4
Energy savings not adequate to justify initial cost.	4	6
Company policy to use magnetic ballasts.	.	.
Did not make formal comparison between high efficiency and standard efficiency equipment.	3	2
Rest of facility uses standard efficiency lighting.	1	2
We lease the space; not worth the extra expense.	16	4
Color/tone of light is not appropriate for intended application.	1	1
Was not aware of high efficiency options.	2	6
Uncertain about performance of occupancy sensors.	2	1
Don't know.	5	6

- Significantly more BEMS 1996 participants reported that their firm has not installed high-efficiency lighting recently because high-efficiency lighting is not readily available.

- Significantly more BEMS 1998 participants reported that their firm has not installed high-efficiency lighting recently because they lease the space where their firm is located.

Exhibit 7-17
Main Reason Why Firm Has Not Installed
A High-efficiency CAC Since January, 1996
BEMS 1998 vs. BEMS 1996

MAIN REASON WHY FIRM DID NOT INSTALL HIGH EFFICIENCY CENTRAL AIR CONDITIONER	SURVEY	
	BEMS98	BEMS96
Sample Size	224	210
No need/satisfied with current CAC.	55	57
Too expensive compared to other equipment.	17	32
High efficiency CACs are not reliable.	.	.
It would take too much time/work to make the change.	.	.
Designer or contractor recommended not use.	.	.
Not readily available.	.	.
Energy savings not adequate to justify initial cost.	7	1
Company policy to use standard efficiency CACs	.	.
Did not make formal comparison between high efficiency and standard efficiency equipment.	1	.
Rest of facility uses standard efficiency CACs.	.	.
We lease the space; not worth the extra expense.	16	6
Concerned about occupant comfort.	.	.
Was not aware of high efficiency options.	.	.
Don't know.	3	1

- Significantly more BEMS 1996 participants reported that the main reason why their firm has not installed a high-efficiency CAC recently is that high-efficiency CACs are too expensive compared to standard efficiency CACs.

- Significantly more BEMS 1998 participants reported that the main reason why their firm has not installed a high-efficiency CAC recently is that the energy savings are not adequate to justify the initial cost.

- Significantly more BEMS 1998 participants reported that their firm has not installed a high-efficiency CAC recently because they lease the space where their firm is located.

Exhibit 7-18
Attitudes Towards and Beliefs about
Energy-efficient Investments and Practices
BEMS 1998 vs. BEMS 1996

ATTITUDES TOWARDS/BELIEFS ABOUT ENERGY EFFICIENT INVESTMENTS/PRACTICES	AGREEMENT	SURVEY	
		BEMS98	BEMS96
	Sample Size	304	323
EE investments are something that all businesses should consider.	don't agree	2	2
	agree somewhat	18	18
	agree completely	80	81
EE investments will significantly reduce my bill.	don't agree	7	5
	agree somewhat	37	27
	agree completely	56	68
I intend to actively pursue EE investments in the future.	don't agree	10	8
	agree somewhat	39	36
	agree completely	51	56
Saving money on energy is important for my business.	don't agree	2	2
	agree somewhat	21	24
	agree completely	76	74
Conserving energy is an important part of being a good corporate citizen.	don't agree	3	2
	agree somewhat	14	18
	agree completely	83	80
EE investments and practices provide comfort, quality, and reliability that are as good as, or better than, standard efficiency solutions.	don't agree	2	2
	agree somewhat	39	35
	agree completely	59	63
There are important practical benefits that come with EE investments, apart from saving money.	don't agree	6	3
	agree somewhat	40	36
	agree completely	54	61
EE investments are easy to understand and use.	don't agree	13	9
	agree somewhat	55	56
	agree completely	32	35
I actively advocate EE investments and practices to others.	don't agree	22	17
	agree somewhat	42	43
	agree completely	36	40
I regularly hear about EE investments and practices from business contacts and/or professional organizations.	don't agree	45	34
	agree somewhat	43	43
	agree completely	12	23

Note: Based on a scale of 1 to 10, where 1 don't agree at all and 10 is completely agree (1-3 don't agree, 4-7 agree somewhat, 8-10 completely agree).

- Although BEMS 1996 participants were significantly more likely to completely agree that energy-efficient investments will greatly reduce their energy bill, there was no difference between BEMS 1996 and BEMS 1998 when responses for those who agreed completely and those who agreed somewhat were combined.

- BEMS 1996 participants were significantly more likely to completely agree that energy-efficient investments come with practical benefits other than saving money (a criterion related to diffusion of innovation).

- While BEMS 1996 participants were significantly more likely to completely agree that they hear about energy-efficient investments and practices from business contacts and/or professional organizations, BEMS 1998 participants were significantly more likely to disagree with this statement (related to communication factors).

Exhibit 7-19
Importance of Energy Efficiency to Decision-Makers at Firm
BEMS 1998 vs. BEMS 1996

		SURVEY	
		BEMS98	BEMS96
	Sample Size	304	323
IMPORTANCE OF EE TO DECISION MAKERS	very important	35	40
	somewhat important	57	46
	not very important	5	11
	not at all important	3	1
	don't know	0	2
FIRM HAS DEVELOPED POLICY FOR EE EQUIPMENT SELECTION	yes	17	26
	no	82	68
	don't know	2	6

- When asked to describe the importance of energy efficiency to the decision makers at their firm, BEMS 1998 participants were significantly more likely to describe it as somewhat important, and BEMS 1996 participants were significantly more likely to describe it as not very important.

- However, when asked to report whether their firm has developed a policy for the selection of energy-efficient measures, significantly more BEMS 1996 participants said "yes."

Exhibit 7-20
Application of Long Term Investment Analysis
To Energy-efficient Product Selection
BEMS 1998 vs. BEMS 1996

		SURVEY	
		BEMS98	BEMS96
	Sample Size	304	323
FIRM APPLIES LONG TERM INVESTMENT ANALYSIS TO EE PRODUCT SELECTION	yes	32	44
	no	62	50
	don't know	6	5
	Sample Size	86	120
PRIMARY INVESTMENT CRITERION	payback	45	45
	life cycle costing analysis	14	14
	internal rate of return	23	10
	don't know	17	32

- When asked to report whether their firm applies long term investment analysis the selection of energy-efficient measures, significantly more BEMS 1996 participants said "yes."

- Significantly more BEMS 1998 participants reported internal rate of return as their firm's primary investment criterion.

- Significantly more BEMS 1996 participants reported that they "don't know" what their firm uses as a primary investment criterion.

Exhibit 7-21
Longest Acceptable Payback Period
BEMS 1998 vs. BEMS 1996

LONGEST ACCEPTABLE PAYBACK PERIOD	SURVEY	
	BEMS98	BEMS96
Sample Size	38	49
1 year or less	29	2
2 years or less	34	14
3 years or less	44	34
4 years or less	49	55
5 years or less	88	74
9 years or less	90	76
at least 10 years	94	83

- BEMS 1998 participants were significantly more likely to demand shorter payback periods, specifically two years or less.

Exhibit 7-22
Self-Reported Knowledge of Energy-efficient Product Performance and Availability
BEMS 1998 vs. BEMS 1996

KNOWLEDGE OF EE PRODUCT PERFORMANCE AND AVAILABILITY	SURVEY	
	BEMS98	BEMS96
Sample Size	304	323
not knowledgeable	27	23
somewhat knowledgeable	59	61
very knowledgeable	14	17

Note: Based on a scale of 1 to 10, where 1 not knowledgeable and 10 is very knowledgeable (1-3 not knowledgeable, 4-7 somewhat knowledgeable, 8-10 very knowledgeable).

Firmographics

Exhibit 7-23
Number of Employees
BEMS 1998 vs. BEMS 1996

Number of Employees	SURVEY	
	BEMS98	BEMS96
	(sample size = 304)	(sample size = 323)
1 to 5	26%	26%
6 to 10	23%	15%
11 to 20	18%	18%
21 to 50	22%	20%
51 to 100	5%	9%
Over 100	5%	11%

Exhibit 7-24
Square Footage of Business Facility
BEMS 1998 vs. BEMS 1996

Square Footage	SURVEY	
	BEMS98	BEMS96
	(sample size = 304)	(sample size = 323)
less than 5.000	42%	30%
5,000 but less than 10,000	16%	19%
10,000 but less than 20,000	12%	15%
20,000 but less than 50,000	18%	13%
50,000 but less than 100,000	4%	6%
100,000 but less than 1 million	6%	9%
Over 1 million	0%	1%
don't know	2%	6%

- BEMS 1998 participants were slightly smaller than BEMS 1996 participants in number of employees and square footage of their business facility.

Exhibit 7-25
Organizational Involvement in Decision Making
BEMS 1998 vs. BEMS 1996

QUESTIONS	SURVEY	
	BEMS98	BEMS96
	(sample size = 304)	(sample size = 323)
assigned specific person to control or monitor energy usage	30%	42%
business rents facility	49%	41%
business pays entire electric utility bill	45%	34%
business pays part of electric utility bill	2%	5%
business pays none of electric utility bill	2%	1%
business is very active in making lighting and climate control equipment purchase decisions at facility	20%	12%
remodeled space since January 1996	33%	31%

- BEMS 1996 participants were significantly more likely to have assigned a specific person to control or monitor their firm's energy usage.
- BEMS 1998 participants were significantly more likely to rent their business facility.
- BEMS 1998 participants who rented their business facility were significantly more likely to pay the entire electric bill and be very active in making lighting and climate control equipment purchase decisions at the facility.

BEMS 1998 VS. PG&E TERRITORY AND LOW DSM STATES

The purpose of this section is to compare BEMS 1998 participants to PG&E NPs and Low DSM NPs to see if any changes in measure installations and attitudes toward energy efficiency can be attributed to the program.

Measure Changes Since January 1996

Exhibit 7-26
Percentage of Respondents
Who Changed Measures
BEMS 1998 vs. PG&E Territory and Low DSM States

MEASURE	SURVEY		
	BEMS98	PG&E TERRITORY	LOW DSM STATES
Sample Size	304	299	222
T8	36	23	23
Reflector	11	5	7
CFL	8	12	14
HE CAC	13	9	24
Set Back Thermostat	16	26	29
CAC Maintenance	51	59	65
Lighting Occupancy Sensors	9	6	7
COMPOSITE INDEX	143	140	169

- Generally, more Low DSM NPs made measure changes than either BEMS 1998 participants or PG&E NPs.

- BEMS 1998 participants were significantly more likely to install T8s than PG&E NPs and Low DSM NPs.

- BEMS 1998 participants were significantly more likely to install reflectors after de-lamping than PG&E NPs.

- BEMS 1998 participants were significantly less likely to install CFLs than Low DSM NPs.

- BEMS 1998 participants were significantly less likely to install set back thermostats than PG&E NPs and Low DSM NPs.

- BEMS 1998 participants were significantly less likely to perform maintenance of their air conditioning systems than PG&E NPs and Low DSM NPs.

Exhibit 7-27
Categorized Volume of Measures Changed Since January 1996
BEMS 1998 vs. PG&E Territory and Low DSM States

		SURVEY					
VOLUME	MEASURE	Sample Size	BEMS98	Sample Size	PG&E TERRITORY	Sample Size	LOW DSM STATES
1 to 25	T8		60		61		51
26 to 50	T8		12		6		12
51 to 100	T8		5		10		8
101 to 500	T8		20		14		22
500 plus	T8	74	3	74	10	53	7
1 to 25	Reflector		20		38		79
26 to 50	Reflector		5		9		8
51 to 250	Reflector		50		23		6
251 plus	Reflector	31	26	21	30	17	8
1 to 10	CFL		47		55		35
11 to 25	CFL		29		5		20
26 to 150	CFL		20		26		28
151 plus	CFL	30	4	37	14	32	17
1	HE CAC		37		45		49
2 to 5	HE CAC		59		23		30
6 to 10	HE CAC		2		11		9
11 plus	HE CAC	37	2	30	21	52	11

- Low DSM NPs were significantly less likely than BEMS 1998 participants and PG&E NPs to install 25 or fewer T8s.

- PG&E NPs were significantly less likely than BEMS 1998 participants and Low DSM NPs to install more than 100 T8s.

- The proportion of respondents reporting less than 25 and more than 50 reflectors installed varied significantly by survey group.

- BEMS 1998 participants were significantly more likely than PG&E NPs and Low DSM NPs to install less than 25 CFLs.

- Low DSM NPs were significantly more likely than BEMS 1998 participants and PG&E NPs to install more than 150 CFLs.

- BEMS 1998 participants were significantly more likely than PG&E NPs and Low DSM NPs to install five or fewer CACs.

- The proportion of respondents reporting more than 10 CACs installed varied significantly by survey group.

Exhibit 7-28
Analysis of Measure Volumetrics
BEMS 1998 vs. PG&E Territory and Low DSM States

MEASURE		SURVEY		
		BEMS98	PG&E TERRITORY	LOW DSM STATES
		(sample size = 304)	(sample size = 299)	(sample size = 222)
T8	respondents who changed measure	36	23	23
	Average number of changes	81	130	105
	percentage of changing respondents X average number changes	2,917	3,000	2,407
Delamp	respondents who changed measure	11	5	7
	Average number of changes	206	283	18
	percentage of changing respondents X average number changes	2,270	1,413	127
CFL	respondents who changed measure	8	12	14
	Average number of changes	26	100	77
	percentage of changing respondents X average number changes	206	1,202	1,075
HE CAC	respondents who changed measure	13	9	24
	Average number of changes	3	26	6
	percentage of changing respondents X average number changes	41	237	154
ASD	respondents who changed measure	NA	NA	NA
	Average number of changes	NA	NA	NA
	percentage of changing respondents X average number changes	NA	NA	NA
Sensor	respondents who changed measure	9	6	7
	Average number of changes	24	23	18
	percentage of changing respondents X average number changes	214	136	128

- Low DSM NPs installed a smaller volume of T8s than BEMS 1998 participants and PG&E NPs.
- BEMS 1998 participants installed a larger volume of reflectors than PG&E NPs, who in turn installed a greater volume than Low DSM NPs.
- PG&E NPs and Low DSM NPs installed a larger volume of CFLs than BEMS 1998 participants.
- PG&E NPs installed a larger volume of CACs than Low DSM NPs, who in turn installed a greater volume than BEMS 1998 participants.
- BEMS 1998 participants installed a larger volume of lighting occupancy sensors than PG&E NPs and Low DSM NPs.

Exhibit 7-29
Efficiency of Lighting Used in Facility
BEMS 1998 vs. PG&E Territory and Low DSM States

	SURVEY		
EFFICIENCY OF LIGHTING	BEMS98	PG&E TERRITORY	LOW DSM STATES
Sample Size	304	299	222
high efficiency	24	19	19
standard efficiency	43	47	46
mix of high and standard efficiency	32	33	35

Exhibit 7-30
Efficiency of CACs
Installed Since January 1996
BEMS 1998 vs. PG&E Territory and Low DSM States

	SURVEY														
	BEMS98					PG&E TERRITORY					LOW DSM STATES				
	(sample size = 304)					(sample size = 299)					(sample size = 222)				
INSTALLED CAC	yes			no	don't know	yes			no	don't know	yes			no	don't know
	21			79	1	20			79	1	37			62	1
	(sample size =58)					(sample size = 62)					(sample size = 82)				
	HE	SE	HE and SE	don't know		HE	SE	HE and SE	don't know		HE	SE	HE and SE	don't know	
EFFICIENCY	56	36	.	.		55	21	1	23		54	33	4	9	

- Significantly more Low DSM NPs (37 percent) than BEMS 1998 participants (21 percent) and PG&E NPs (20 percent) installed a CAC.

- Over half of BEMS 1998 (56 percent), PG&E NPs (55 percent) and Low DSM NPs (54 percent) claimed that the CAC they installed was high efficiency.

- The resulting net of high-efficiency installations here is consistent with those highlighted in Exhibit 7-26.

Exhibit 7-31
Measure's Impact on Confidence
That Energy-efficient Products Will Reduce Utility Bill
BEMS 1998 vs. PG&E Territory and Low DSM States

			SURVEY				
MEASURE	IMPACT	Sample Size	BEMS98	Sample Size	PG&E TERRITORY	Sample Size	LOW DSM STATES
	increase		51		52		49
	decrease		9		10		19
T8	same	72	40	68	39	51	32
	increase		57		45		53
	decrease		14		16		2
Reflector	same	28	28	19	39	16	45
	increase		65		70		59
	decrease		10		5		11
CFL	same	28	25	37	24	30	30
	increase		70		56		59
	decrease		5		6		14
HE CAC	same	33	24	27	38	52	28
	increase		56		57		43
	decrease		2		11		13
Set Back Thermostat	same	47	42	87	32	65	45
	increase		39		36		42
	decrease		9		8		7
CAC Maintenance	same	145	52	175	55	141	51
	increase		84		46		42
	decrease		6		16		14
Lighting Occupancy Sensors	same	17	10	22	38	20	44

- BEMS 1998 participants were significantly more likely to report that using a set back thermostat decreased their confidence that using energy-efficient measures will reduce their utility bill.

- BEMS 1998 participants were significantly more likely to report that using lighting occupancy sensors either increased or had no impact on their confidence that using energy-efficient measures will reduce their utility bill.

Exhibit 7-32
Percentage of Respondents Satisfied with Energy Savings
And Performance of Measure
BEMS 1998 vs. PG&E Territory and Low DSM States

		SURVEY					
MEASURE	SATISFACTION	Sample Size	BEMS98	Sample Size	PG&E TERRITORY	Sample Size	LOW DSM STATES
	dissatisfied		17		2		5
	satisfied		40		49		37
T8	very satisfied	72	43	68	50	51	58
	dissatisfied		5		.		.
	satisfied		41		51		47
Reflector	very satisfied	28	53	19	49	16	53
	dissatisfied		9		7		.
	satisfied		24		36		41
CFL	very satisfied	28	67	37	56	30	59
	dissatisfied		6		6		.
	satisfied		29		40		35
HE CAC	very satisfied	33	65	27	54	52	65
	dissatisfied		5		5		7
	satisfied		27		56		43
Set Back Thermostat	very satisfied	47	68	87	39	65	50
	dissatisfied		12		4		2
	satisfied		46		52		49
CAC Maintenance	very satisfied	145	41	175	44	141	49
	dissatisfied		.		13		10
	satisfied		10		27		45
Lighting Occupancy Sensors	very satisfied	17	90	22	60	20	45

Note: Based on a scale of 1 to 10, where 1 is very dissatisfied and 10 is very satisfied (1-3 dissatisfied, 4-7 satisfied, 8-10 very satisfied).

- BEMS 1998 participants were significantly more likely to be dissatisfied with the energy savings and performance of T8s, compared to PG&E NPs and Low DSM NPs.

- Low DSM NPs were significantly more likely to be very satisfied with the energy savings and performance of T8s than BEMS 1998 participants.

- No Low DSM NPs reported any dissatisfaction with CFLs. In contrast, some BEMS 1998 participants and PG&E NPs claimed to be dissatisfied with the energy savings and performance of CFLs.

- While BEMS 1998 participants were significantly more likely than PG&E NPs to be very satisfied with the energy savings and performance of set back thermostats, there was no difference when between BEMS 1998 and PG&E NPs when satisfied and very satisfied responses were combined.

- BEMS 1998 participants were significantly more likely to be dissatisfied with the energy savings attained via regular air conditioning system maintenance than PG&E NPs and Low DSM NPs.

- BEMS 1998 participants were significantly more likely to be very satisfied with the energy savings and performance of lighting occupancy sensors than PG&E NPs and Low DSM NPs.

- No BEMS 1998 participants reported being dissatisfied with the energy savings and performance of lighting occupancy sensors. In contrast, some PG&E NPs and Low DSM NPs claimed to be dissatisfied with the energy savings and performance of lighting occupancy sensors.

Exhibit 7-33
Impact of Current Energy-efficient Investments
On Future Selection of Energy-efficient Products
BEMS 1998 vs. PG&E Territory and Low DSM States

CURRENT EE INVESTMENTS MAKE FIRM HOW MUCH MORE LIKELY TO SELECT EE OPTIONS IN THE FUTURE	SURVEY		
	BEMS98	PG&E TERRITORY	LOW DSM STATES
Sample Size	199	211	174
much less likely	1	3	3
somewhat less likely	9	3	5
about as likely	14	12	14
somewhat more likely	31	32	38
much more likely	46	51	41

- PG&E NPs were significantly more likely to report that experiences with current energy-efficient investments have made their firm much more likely to select energy-efficient options in the future.

- Respondents were asked to report by what percentage they believed that a business like theirs could reduce its electricity bill via implementing all of the energy-efficient products and practices that are currently available, if none had been implemented thus far. In total, 31 percent of BEMS 1998 participants, 33 percent of PG&E NPs and 25 percent of Low DSM NPs reported that they could reduce their bill by up to 10 percent. About half (53 percent) of BEMS 1998 participants, 46 percent of PG&E NPs and 53 percent of Low DSM NPs reported that they could reduce their bill by 11 to 30 percent. One-sixth (16 percent) of BEMS 1998 participants, 22 percent of PG&E NPs and 20 percent of Low DSM NPs reported that they could reduce their bill by more than 30 percent.

Program Participation

Exhibit 7-34
Percentage of Respondents Who Participated in BEMS
Or Other Audit Program Since January 1996
BEMS 1998 vs. PG&E Territory and Low DSM States

SURVEY														
BEMS98					PG&E TERRITORY				LOW DSM STATES					
(sample size = 304)					(sample size = 299)				(sample size = 222)					
Participated			Did not Participate	Don't Know	Participated			Did not Participate	Don't Know	Participated			Did not Participate	Don't Know
39			56	4	10			83	7	13			83	4
(sample size = 108)					(sample size = 31)					(sample size = 30)				
1996	1997	1998			1996	1997	1998			1996	1997	1998		
8	26	66			13	60	27			22	23	55		

- As expected, BEMS 1998 participants were significantly more likely to report that they had participated in BEMS or some other energy audit program than PG&E NPs and Low DSM NPs.

- Reported participation was more recent for PG&E NPs and Low DSM NPs.

Exhibit 7-35
Measures Recommended by BEMS or Other Audit Program
vs. Measures Installed
BEMS 1998 vs. PG&E Territory and Low DSM States

	SURVEY					
	BEMS98		PG&E TERRITORY		LOW DSM STATES	
MEASURE	RECOMMENDED	MEASURE INSTALLED	RECOMMENDED	MEASURE INSTALLED	RECOMMENDED	MEASURE INSTALLED
Sample Size	108	43	31	13	30	30
T8	17	9	3	1	3	2
Reflector	5	4	1	.	.	.
CFL	2	1	1	.	1	.
HE CAC	3	.	1	.	1	1
Set Back Thermostat	1	.	1	1	2	1
CAC Maintenance	.	.	1	.	.	1
Lighting Occupancy Sensors	4	.	1	.	1	1

- BEMS 1998 participants were significantly more likely to report that an energy audit program had recommended the installation of T8s, reflectors and lighting occupancy sensors than PG&E NPs and Low DSM NPs.

- BEMS 1998 participants were significantly more likely to install audit-recommended T8s and reflectors than PG&E NPs and Low DSM NPs.

Exhibit 7-36
Percentage of Respondents Who Participated in Express Or Other Rebate Program Since January 1996
BEMS 1998 vs. PG&E Territory and Low DSM States

PARTICIPATED IN REBATE PROGRAM	SURVEY		
	BEMS98	PG&E TERRITORY	LOW DSM STATES
Sample Size	304	299	222
yes	12	3	8
no	85	91	87
don't know	3	6	5

- Significantly more BEMS 1998 participants than PG&E NPs and Low DSM NPs reported that they had participated in Express or some other rebate program since January 1996.

Exhibit 7-37
Measures Installed Under Express Or Other Rebate Program
BEMS 1998 vs. PG&E Territory and Low DSM States

MEASURE	SURVEY		
	BEMS98	PG&E TERRITORY	LOW DSM STATES
Sample Size	34	14	16
T8	7	2	.
Reflector	4	.	.
CFL	1	.	.
HE CAC	1	.	.
Set Back Thermostat	.	.	.
CAC Maintenance	.	.	.
Lighting Occupancy Sensors	.	.	.

Exhibit 7-38
Impact of BEMS Audit Program On Future Energy-efficient Product Selection
BEMS 1998 vs. PG&E Territory and Low DSM States

IMPACT		SURVEY		
		BEMS98	PG&E TERRITORY	LOW DSM STATES
Sample Size		108	31	0
BEMS IMPACT ON LIKELIHOOD OF SELECTING EE PRODUCTS IN THE FUTURE	little or no impact	18	13	.
	some impact	30	43	.
	much impact	53	44	.
BEMS IMPACT ON LONG TERM INVESTMENT ANALYSIS POLICIES FOR SELECTION OF EE PRODUCTS	little or no impact	24	7	.
	some impact	52	56	.
	much impact	24	37	.

Note: Based on a scale of 1 to 10, where 1 means had very little impact and 10 means had great impact (1-3 no/very little impact, 4-7 some impact, 8-10 great impact).

- BEMS 1998 participants were significantly more likely to report that the audit program had little or no impact on their firm's long term investment analysis policies for the selection of energy-efficient products.

Exhibit 7-39
Importance of BEMS Audit vs. Express Rebate
In Persuading Firm to Make a Energy-efficient Investment
BEMS 1998 vs. PG&E Territory and Low DSM States

IMPORTANCE IN PERSUADING FIRM TO MAKE AN EE INVESTMENT	SURVEY		
	BEMS98	PG&E TERRITORY	LOW DSM STATES
Sample Size	17	8	0
audit much more important than rebate	28	28	.
audit somewhat more important than rebate	3	.	.
audit and rebate equally important	53	20	.
rebate somewhat more important than audit	7	.	.
rebate much more important than audit	9	52	.

- While BEMS 1998 participants were more likely to consider the audit and the rebate as equally important, and PG&E NPs were more likely to consider the rebate much more important than the audit, these differences were not statistically significant.

Exhibit 7-40
Barriers to Energy-efficient Investments and Practices
BEMS 1998 vs. PG&E Territory and Low DSM States

BARRIER	AGREEMENT	SURVEY		
		BEMS98	PG&E TERRITORY	LOW DSM STATES
	Sample Size	304	299	222
When considering a new EE investment, I am concerned that the actual bill savings will be less than what was estimated.	don't agree	14	15	9
	agree somewhat	47	43	55
	agree completely	39	41	37
It takes too much time and hassle to get enough information to make an informed decision about EE investments.	don't agree	32	33	29
	agree somewhat	47	40	49
	agree completely	22	26	22
There is too much time and hassle involved in selecting a qualified EE contractor.	don't agree	30	32	31
	agree somewhat	44	43	43
	agree completely	26	24	27
I feel uncertain about the reliability of information provided by the non-utility firms proposing EE investments.	don't agree	19	17	23
	agree somewhat	45	48	49
	agree completely	37	35	28
I am able to find information about EE investments from sources I trust, but the information is not very helpful to me in making decisions.	don't agree	34	27	30
	agree somewhat	45	54	55
	agree completely	21	19	16
Lack of financing is a barrier to our organization making EE investments that we want to make.	don't agree	28	32	31
	agree somewhat	35	34	39
	agree completely	38	35	30
I read or hear about specific kinds of EE investments that don not seem to be available from the suppliers we work with.	don't agree	43	40	36
	agree somewhat	39	40	48
	agree completely	18	19	16
There are EE investments that I am interested in making, but they always fall below other priorities.	don't agree	20	22	23
	agree somewhat	38	40	50
	agree completely	42	38	28

Note: Based on a scale of 1 to 10, where 1 don't agree at all and 10 is completely agree (1-3 don't agree, 4-7 agree somewhat, 8-10 completely agree).

- Low DSM NPs were significantly more likely than BEMS 1998 participants and PG&E NPs to disagree that when using energy-efficient measures, they were concerned that actual bill savings might be less than originally estimated (performance uncertainty).

- BEMS 1998 participants were significantly more likely than Low DSM NPs to completely agree that they felt uncertain about the reliability of energy efficiency information provided by non-utility firms (asymmetric information).

- BEMS 1998 participants were significantly more likely than PG&E NPs to disagree that they are able to find information about energy-efficient investments from sources they trust, but that the information is not very helpful to them in making decisions (information / search costs).

- BEMS 1998 participants were significantly more likely than Low DSM NPs to completely agree that lack of financing is a barrier to their firm's making energy-efficient investments (access to financing).

- Low DSM NPs were significantly less likely than BEMS 1998 participants and PG&E NPs to completely agree that they are interested in making energy-efficient investments, but that these investments always fall below other priorities (bounded rationality).

Exhibit 7-41
Main Reason Why Firm Has Not Installed
High-efficiency Lighting Since January, 1996
BEMS 1998 vs. PG&E Territory and Low DSM States

MAIN REASON WHY FIRM DID NOT INSTALL HIGH EFFICIENCY LIGHTING	SURVEY		
	BEMS98	PG&E TERRITORY	LOW DSM STATES
Sample Size	165	161	108
No need/satisfied with current lighting.	34	39	58
Too expensive compared to other equipment.	27	29	16
Electronic ballasts are not reliable.	2	.	1
It would take too much time/work to make the change.	6	9	3
Designer or contractor recommended not use.	3	1	.
Not readily available.	.	.	2
Energy savings not adequate to justify initial cost.	4	6	3
Company policy to use magnetic ballasts.	.	.	1
Did not make formal comparison between high efficiency and standard efficiency equipment.	3	2	5
Rest of facility uses standard efficiency lighting.	1	1	1
We lease the space; not worth the extra expense.	16	9	7
Color/tone of light is not appropriate for intended application.	1	1	1
Was not aware of high efficiency options.	2	4	3
Uncertain about performance of occupancy sensors.	2	1	.
Don't know.	7	9	19

- Significantly more Low DSM NPs than BEMS 1998 participants and PG&E NPs reported that their firm has not installed high-efficiency lighting recently because they are satisfied with their current lighting and do not need new lighting.

- Significantly fewer Low DSM NPs than BEMS 1998 participants and PG&E NPs reported that their firm has not installed high-efficiency lighting recently because high-efficiency lighting is too expensive compared to standard efficiency lighting.

- Significantly more PG&E NPs than Low DSM NPs reported that their firm has not installed high-efficiency lighting recently because it would take too much time and work to make the change.

- Significantly more BEMS 1998 participants than PG&E NPs and Low DSM NPs reported that their firm has not installed high-efficiency lighting recently because they lease the space where their firm is located.

- Significantly more Low DSM NPs than BEMS 1998 participants and PG&E NPs reported that they do not know why their firm has not installed high-efficiency lighting recently.

Exhibit 7-42
Main Reason Why Firm Has Not Installed
A High-efficiency CAC Since January, 1996
BEMS 1998 vs. PG&E Territory and Low DSM States

MAIN REASON WHY FIRM DID NOT INSTALL HIGH EFFICIENCY CENTRAL AIR CONDITIONER	SURVEY		
	BEMS98	PG&E TERRITORY	LOW DSM STATES
Sample Size	224	225	130
No need/satisfied with current CAC.	55	58	64
Too expensive compared to other equipment.	17	23	14
High efficiency CACs are not reliable.	.	.	3
It would take too much time/work to make the change.	1	1	3
Designer or contractor recommended not use.	.	1	.
Not readily available.	.	.	1
Energy savings not adequate to justify initial cost.	7	3	1
Company policy to use standard efficiency CACs	.	.	.
Did not make formal comparison between high efficiency and standard efficiency equipment.	1	1	1
Rest of facility uses standard efficiency CACs.	.	.	2
We lease the space; not worth the extra expense.	16	9	9
Concerned about occupant comfort.	.	1	.
Was not aware of high efficiency options.	.	1	.
Don't know.	3	2	2

- Significantly more Low DSM NPs than BEMS 1998 participants reported their firm has not installed a high-efficiency CAC recently because they are satisfied with their current CAC and have no need to install a new one.

- Significantly fewer Low DSM NPs than PG&E NPs reported their firm has not installed a high-efficiency CAC recently because high-efficiency CACs are too expensive compared to standard efficiency CACs.

- Significantly more BEMS 1998 participants than Low DSM NPs reported their firm has not installed a high-efficiency CAC recently because energy savings is not adequate to justify the initial cost.

- Significantly more BEMS 1998 participants than PG&E NPs and Low DSM NPs reported their firm has not installed a high-efficiency CAC recently because they lease the space where their firm is located.

Exhibit 7-43
Attitudes Towards and Beliefs about
Energy-efficient Investments and Practices
BEMS 1998 vs. PG&E Territory and Low DSM States

ATTITUDES TOWARDS/BELIEFS ABOUT ENERGY EFFICIENT INVESTMENTS/PRACTICES	AGREEMENT	SURVEY		
		BEMS98	PG&E TERRITORY	LOW DSM STATES
	Sample Size	304	299	222
EE investments are something that all businesses should consider.	don't agree	2	3	5
	agree somewhat	18	17	21
	agree completely	80	80	75
EE investments will significantly reduce my bill.	don't agree	7	5	5
	agree somewhat	37	28	32
	agree completely	56	67	63
I intend to actively pursue EE investments in the future.	don't agree	10	11	13
	agree somewhat	39	41	40
	agree completely	51	49	47
Saving money on energy is important for my business.	don't agree	2	4	7
	agree somewhat	21	22	25
	agree completely	76	74	68
Conserving energy is an important part of being a good corporate citizen.	don't agree	3	1	4
	agree somewhat	14	15	23
	agree completely	83	84	73
EE investments and practices provide comfort, quality, and reliability that are as good as, or better than, standard efficiency solutions.	don't agree	2	3	3
	agree somewhat	39	38	35
	agree completely	59	59	62
There are important practical benefits that come with EE investments, apart from saving money.	don't agree	6	4	5
	agree somewhat	40	40	40
	agree completely	54	55	55
EE investments are easy to understand and use.	don't agree	13	12	15
	agree somewhat	55	53	59
	agree completely	32	35	26
I actively advocate EE investments and practices to others.	don't agree	22	19	32
	agree somewhat	42	39	39
	agree completely	36	42	29
I regularly hear about EE investments and practices from business contacts and/or professional organizations.	don't agree	45	41	48
	agree somewhat	43	40	34
	agree completely	12	19	18

Note: Based on a scale of 1 to 10, where 1 don't agree at all and 10 is completely agree (1-3 don't agree, 4-7 agree somewhat, 8-10 completely agree).

- Although PG&E NPs were significantly more likely to completely agree that energy-efficient investments will greatly reduce their energy bill, there was no difference between PG&E NPs and BEMS 1998 participants when responses for those who agreed completely and those who agreed somewhat were combined.

- BEMS 1998 participants were significantly more likely to completely agree that saving money is important for their business.

- Low DSM NPs were significantly less likely than BEMS 1998 participants and PG&E NPs to completely agree that conserving energy is an important part of being a good corporate citizen.

- PG&E NPs were significantly more likely than Low DSM NPs to completely agree that energy-efficient investments are easy to understand and use.

- Low DSM NPs were significantly more likely to disagree that they actively advocate energy-efficient investments and practices to others.

- BEMS 1998 participants were significantly less likely than PG&E NPs or Low DSM NPs to completely agree that they hear about energy-efficient investments and practices from business contacts and / or professional organizations.

Exhibit 7-44
Importance of Energy Efficiency to Decision-Makers at Firm
BEMS 1998 vs. PG&E Territory and Low DSM States

		SURVEY		
		BEMS98	PG&E TERRITORY	LOW DSM STATES
	Sample Size	304	299	222
IMPORTANCE OF EE TO DECISION MAKERS	very important	35	38	34
	somewhat important	57	46	49
	not very important	5	12	12
	not at all important	3	3	4
	don't know	0	1	1
FIRM HAS DEVELOPED POLICY FOR EE EQUIPMENT SELECTION	yes	17	22	17
	no	82	75	74
	don't know	2	3	8

- BEMS 1998 participants were significantly more likely than PG&E NPs and Low DSM NPs to report that energy efficiency is somewhat important to the decision-makers at their firm.

- BEMS 1998 participants were significantly more likely than PG&E NPs and Low DSM NPs to report that their firm had not developed a policy for the selection of energy-efficient equipment.

- Low DSM NPs were significantly more likely than BEMS 1998 participants and PG&E NPs to report that they did not know if their firm had developed a policy for the selection of energy-efficient equipment.

Exhibit 7-45
Application of Long Term Investment Analysis
To Energy-efficient Product Selection
BEMS 1998 vs. PG&E Territory and Low DSM States

		SURVEY		
		BEMS98	PG&E TERRITORY	LOW DSM STATES
Sample Size		304	299	222
FIRM APPLIES LONG TERM INVESTMENT ANALYSIS TO EE PRODUCT SELECTION	yes	32	43	31
	no	62	49	58
	don't know	6	7	11
Sample Size		86	131	73
PRIMARY INVESTMENT CRITERION	payback	45	35	33
	life cycle costing analysis	14	19	17
	internal rate of return	23	15	18
	don't know	17	31	31

- PG&E NPs were significantly more likely to report that their firm applies long term investment analysis to energy-efficient product selection.

- BEMS 1998 participants were significantly less likely to report that they do not know what their firm uses as a primary investment criterion.

Exhibit 7-46
Longest Acceptable Payback Period
BEMS 1998 vs. PG&E Territory and Low DSM States

LONGEST ACCEPTABLE PAYBACK PERIOD	SURVEY		
	BEMS98	PG&E TERRITORY	LOW DSM STATES
Sample Size	38	45	24
1 year or less	29	9	9
2 years or less	34	23	14
3 years or less	44	43	34
4 years or less	49	46	34
5 years or less	88	75	62
9 years or less	90	88	66
at least 10 years	94	94	67

- BEMS 1998 participants were significantly more likely to demand payback periods of one year or less.

- Low DSM NPs were significantly less likely to accept payback periods of more than five years.

Exhibit 7-47
Self-Reported Knowledge of Energy-efficient Product Performance and Availability
BEMS 1998 vs. PG&E Territory and Low DSM States

KNOWLEDGE OF EE PRODUCT PERFORMANCE AND AVAILABILITY	SURVEY		
	BEMS98	PG&E TERRITORY	LOW DSM STATES
Sample Size	304	299	222
not knowledgeable	27	22	32
somewhat knowledgeable	59	56	49
very knowledgeable	14	22	19

Note: Based on a scale of 1 to 10, where 1 not knowledgeable and 10 is very knowledgeable (1-3 not knowledgeable, 4-7 somewhat knowledgeable, 8-10 very knowledgeable).

- Low DSM NPs were significantly more likely to report that they do not consider themselves knowledgeable regarding energy-efficient product performance and availability.

- While PG&E NPs were significantly more likely than BEMS 1998 participants to consider themselves very knowledgeable regarding energy-efficient product performance and availability, there was no difference between PG&E NPs and BEMS 1998 participants when somewhat knowledgeable and very knowledgeable responses were combined.

Firmographics

Exhibit 7-48
Number of Employees
BEMS 1998 vs. PG&E Territory and Low DSM States

Number of Employees	SURVEY		
	BEMS98	PG&E TERRITORY	LOW DSM STATES
	(sample size = 304)	(sample size = 229)	(sample size = 222)
1 to 5	26%	30%	32%
6 to 10	23%	18%	17%
11 to 20	18%	13%	14%
21 to 50	22%	19%	16%
51 to 100	5%	9%	12%
Over 100	5%	10%	9%

Exhibit 7-49
Square Footage of Business Facility
BEMS 1998 vs. PG&E Territory and Low DSM States

	SURVEY		
	BEMS98	PG&E TERRITORY	LOW DSM STATES
SQUARE FOOTAGE	(sample size = 304)	(sample size = 229)	(sample size = 222)
less than 5.000	42%	31%	39%
5,000 but less than 10,000	16%	23%	19%
10,000 but less than 20,000	12%	14%	14%
20,000 but less than 50,000	18%	15%	7%
50,000 but less than 100,000	4%	7%	5%
100,000 but less than 1 million	6%	5%	6%
Over 1 million	0%	1%	3%
don't know	2%	3%	8%

- PG&E NPs and Low DSM NPs were similar, while BEMS 1998 participants were slightly smaller, based on the number of employees and square footage of their business facility.

Exhibit 7-50
Organizational Involvement in Decision Making
BEMS 1998 vs. PG&E Territory and Low DSM States

	SURVEY		
	BEMS98	PG&E TERRITORY	LOW DSM STATES
QUESTIONS	(sample size = 304)	(sample size = 229)	(sample size = 222)
assigned specific person to control or monitor energy usage	30%	33%	29%
business rents facility	49%	49%	37%
business pays entire electric utility bill	46%	44%	22%
business pays part of electric utility bill	2%	3%	6%
business pays none of electric utility bill	2%	2%	9%
business is very active in making lighting and climate control equipment purchase decisions at facility	20%	17%	4%
remodeled space since January 1996	33%	27%	35%

- Low DSM NPs were significantly less likely to rent their business facility.

- The Low DSM NPs who rented their business facility were significantly less likely than BEMS 1998 and PG&E NPs to pay the entire electric bill and to be very active in making lighting and climate control equipment purchase decisions at their facility.

BEMS 1998 VS. EXPRESS 1998

The purpose of this section is to compare BEMS 1998 and Express 1998 to see what differences in measure changes and attitudes towards energy efficiency exist between

participants of the two programs, and to identify any areas where BEMS may be outperforming or performing at parity with Express.

Measure Changes Since January 1996

Exhibit 7-51
Percentage of Respondents
Who Changed Measures
BEMS 1998 vs. Express 1998

MEASURE	SURVEY	
	BEMS98	EXP98
Sample Size	304	186
T8	36	59
Reflector	11	26
CFL	8	27
HE CAC	13	26
Set Back Thermostat	16	45
CAC Maintenance	51	72
Lighting Occupancy Sensors	9	21
COMPOSITE INDEX	143	276

- As expected, Express 1998 participants generally made more measure changes than BEMS 1998 participants.

Exhibit 7-52
Categorized Volume of Measures Changed Since January 1996
BEMS 1998 vs. Express 1998

VOLUME	MEASURE	SURVEY			
		Sample Size	BEMS98	Sample Size	EXP98
1 to 25	T8		60		24
26 to 50	T8		12		23
51 to 100	T8		5		15
101 to 500	T8		20		28
500 plus	T8	74	3	102	10
1 to 25	Reflector		20		32
26 to 50	Reflector		5		29
51 to 250	Reflector		50		20
251 plus	Reflector	31	26	42	19
1 to 10	CFL		47		27
11 to 25	CFL		29		19
26 to 150	CFL		20		31
151 plus	CFL	30	4	46	23
1	HE CAC		37		20
2 to 5	HE CAC		59		45
6 to 10	HE CAC		2		14
11 plus	HE CAC	37	2	56	21

- BEMS 1998 participants were significantly more likely than Express 1998 participants to install fewer than 25 T8s.

- Express 1998 participants were significantly more likely than BEMS 1998 participants to install more than 500 T8s.

- Express 1998 participants were significantly more likely than BEMS 1998 participants to install fewer than 50 reflectors.

- BEMS 1998 participants were significantly more likely than Express 1998 participants to install more than 50 reflectors.

- BEMS 1998 participants were significantly more likely than Express 1998 participants to install fewer than 25 CFLs.

- Express 1998 participants were significantly more likely than BEMS 1998 participants to install more than 25 CFLs.

- BEMS 1998 participants were significantly more likely than Express 1998 participants to install only one CAC.

- Express 1998 participants were significantly more likely than BEMS 1998 participants to install more than five CACs.

Exhibit 7-53
Analysis of Measure Volumetrics
BEMS 1998 vs. Express 1998

MEASURE		SURVEY BEMS98 (sample size = 304)	SURVEY EXP98 (sample size = 186)
T8	respondents who changed measure	36	59
	Average number of changes	81	175
	percentage of changing respondents X average number changes	2,917	10,303
Delamp	respondents who changed measure	11	26
	Average number of changes	206	157
	percentage of changing respondents X average number changes	2,270	4,080
CFL	respondents who changed measure	8	27
	Average number of changes	26	101
	percentage of changing respondents X average number changes	206	2,716
HE CAC	respondents who changed measure	13	26
	Average number of changes	3	10
	percentage of changing respondents X average number changes	41	253
ASD	respondents who changed measure	NA	NA
	Average number of changes	NA	NA
	percentage of changing respondents X average number changes	NA	NA
Sensor	respondents who changed measure	9	21
	Average number of changes	24	82
	percentage of changing respondents X average number changes	214	1,724

- Express 1998 participants installed a larger volume of T8s, reflectors, CFLs, CACs and lighting occupancy sensors than BEMS 1998 participants.

Exhibit 7-54
Efficiency of Lighting Used in Facility
BEMS 1998 vs. Express 1998

EFFICIENCY OF LIGHTING	SURVEY BEMS98	SURVEY EXP98
Sample Size	304	186
high efficiency	24	49
standard efficiency	43	16
mix of high and standard efficiency	32	32

- Express 1998 participants were significantly more likely than BEMS 1998 participants to report that their business uses high-efficiency lighting.

Exhibit 7-55
Efficiency of CACs
Installed Since January 1996
BEMS 1998 vs. Express 1998

	SURVEY									
	BEMS98					EXP98				
	(sample size = 304)					(sample size = 186)				
INSTALLED CAC	yes			no	don't know	yes			no	don't know
	21			79	1	41			57	1
	(sample size = 58)					(sample size = 86)				
EFFICIENCY	HE	SE	HE and SE	don't know		HE	SE	HE and SE	don't know	
	56	36		7		62	21	1	16	

- Significantly more Express 1998 participants (41 percent) than BEMS 1998 participants (21 percent) reported installing a CAC since January 1999.

- Significantly more BEMS 1998 participants (36 percent) than Express 1998 participants (21 percent) claimed that the CAC they installed was standard efficiency.

Exhibit 7-56
Measure's Impact on Confidence
That Energy-efficient Products Will Reduce Utility Bill
BEMS 1998 vs. Express 1998

		SURVEY			
MEASURE	IMPACT	Sample Size	BEMS98	Sample Size	EXP98
	increase		51		81
	decrease		9		2
T8	same	72	40	102	17
	increase		57		66
	decrease		14		4
Reflector	same	28	28	40	30
	increase		65		80
	decrease		10		4
CFL	same	28	25	46	16
	increase		70		76
	decrease		5		2
HE CAC	same	33	24	55	22
	increase		56		78
	decrease		2		1
Set Back Thermostat	same	47	42	74	21
	increase		39		61
	decrease		9		2
CAC Maintenance	same	145	52	120	37
	increase		84		86
	decrease		6		.
Lighting Occupancy Sensors	same	17	10	30	14

- Express 1998 participants were significantly more likely than BEMS 1998 participants to report that their confidence in the possibility of reducing utility bills by using energy-efficient practices increased after they used T8s and set back thermostats.

- Express 1998 participants were significantly more likely than BEMS 1998 participants to report that their confidence in the possibility of reducing utility bills by using energy-efficient practices increased after they performed regular maintenance on their air conditioning systems.

Exhibit 7-57
Percentage of Respondents Satisfied with Energy Savings
And Performance of Measure
BEMS 1998 vs. Express 1998

MEASURE	SATISFACTION	SURVEY			
		Sample Size	BEMS98	Sample Size	EXP98
	dissatisfied		17		2
	satisfied		40		24
T8	very satisfied	72	43	102	74
	dissatisfied		5		.
	satisfied		41		42
Reflector	very satisfied	28	53	40	58
	dissatisfied		9		8
	satisfied		24		18
CFL	very satisfied	28	67	46	74
	dissatisfied		6		.
	satisfied		29		41
HE CAC	very satisfied	33	65	55	59
	dissatisfied		5		4
	satisfied		27		35
Set Back Thermostat	very satisfied	47	68	74	61
	dissatisfied		12		2
	satisfied		46		42
CAC Maintenance	very satisfied	145	41	120	56
	dissatisfied		.		5
	satisfied		10		20
Lighting Occupancy Sensors	very satisfied	17	90	34	74

Note: Based on a scale of 1 to 10, where 1 is very dissatisfied and 10 is very satisfied (1-3 dissatisfied, 4-7 satisfied, 8-10 very satisfied).

- Express 1998 participants were significantly more likely than BEMS 1998 participants to be very satisfied with the energy savings and performance of T8s.

- Express 1998 participants were significantly more likely than BEMS 1998 participants to be very satisfied with the energy savings and performance achieved by performing regular maintenance on their CACs.

Exhibit 7-58
Impact of Current Energy-efficient Investments
On Future Selection of Energy-efficient Products
BEMS 1998 vs. Express 1998

CURRENT EE INVESTMENTS MAKE FIRM HOW MUCH MORE LIKELY TO SELECT EE OPTIONS IN THE FUTURE	SURVEY	
	BEMS98	EXP98
Sample Size	199	169
much less likely	1	1
somewhat less likely	9	1
about as likely	14	10
somewhat more likely	31	23
much more likely	46	64

- No significant differences were reported among BEMS 1998 and Express 1998 participants regarding the impact of current energy-efficient investments on future selection of energy-efficient products.

- Respondents were asked to report by what percentage they believed that a business like theirs could reduce its electricity bill via implementing all of the energy-efficient products and practices that are currently available. About 31 percent of BEMS 1998 participants and 25 percent of Express 1998 participants reported that they could reduce their bill by up to 10 percent, 53 percent of BEMS 1998 participants and 56 percent of Express 1998 participants reported that they could reduce their bill by 11 to 30 percent, and 16 percent of BEMS 1998 participants and 18 percent of Express 1998 participants reported that they could reduce their bill by more than 30 percent.

Program Participation

- Express 1998 participants were significantly more likely than BEMS 1998 participants to report that experiences with their current energy-efficient investments made them much more likely to select energy-efficient options in the future.

- BEMS 1998 participants were significantly more likely than Express 1998 participants to report that experiences with their current energy-efficient investments made them somewhat less likely to select energy-efficient options in the future.

Exhibit 7-59
Percentage of Respondents Who Participated in BEMS
Or Other Audit Program Since January 1996
BEMS 1998 vs. Express 1998

SURVEY								
BEMS98				EXP98				
(sample size = 304)				(sample size = 186)				
Participated			Did not Participate	Don't Know	Participated			Did not Participate	Don't Know
39			56	14	29			63	8
(sample size = 108)					(sample size = 46)				
1996	1997	1998			1996	1997	1998		
8	26	66			11	28	61		

- BEMS 1998 participants were significantly more likely than Express 1998 participants to report that they had participated in BEMS or some other energy audit program.

Exhibit 7-60
Measures Recommended by BEMS or Other Audit Program
vs. Measures Installed
BEMS 1998 vs. Express 1998

	SURVEY			
	BEMS98		EXP98	
MEASURE	MEASURE RECOMMENDED	MEASURE INSTALLED	MEASURE RECOMMENDED	MEASURE INSTALLED
Sample Size	108	43	46	17
T8	17	9	10	5
Reflector	5	4	1	.
CFL	2	1	2	1
HE CAC	3	.	1	.
Set Back Thermostat	1	.	1	1
CAC Maintenance	.	.	.	.
Lighting Occupancy Sensors	4	2	.	.

Exhibit 7-61
Percentage of Respondents Who Participated in Express
Or Other Rebate Program Since January 1996
BEMS 1998 vs. Express 1998

PARTICIPATED IN REBATE PROGRAM	SURVEY	
	BEMS98	EXP98
Sample Size	304	186
yes	12	62
no	85	35
don't know	3	3

- As expected, significantly more Express 1998 participants than BEMS 1998 participants reported that they had participated in Express or some other rebate program Since January 1996.

Exhibit 7-62
Measures Installed Under Express
Or Other Rebate Program
BEMS 1998 vs. Express 1998

MEASURE	SURVEY	
	BEMS98	EXP98
Sample Size	34	108
T8	7	34
Reflector	4	4
CFL	1	5
HE CAC	1	6
Set Back Thermostat	.	1
CAC Maintenance	.	.
Lighting Occupancy Sensors	.	2

- Express 1998 participants were significantly more likely than BEMS 1998 participants to install T8s under a rebate program.

Exhibit 7-63
Impact of BEMS Audit Program
On Future Energy-efficient Product Selection
BEMS 1998 vs. Express 1998

IMPACT		SURVEY	
		BEMS98	EXP98
	Sample Size	108	46
BEMS IMPACT ON LIKELIHOOD OF SELECTING EE PRODUCTS IN THE FUTURE	little or no impact	18	11
	some impact	30	29
	much impact	53	59
BEMS IMPACT ON LONG TERM INVESTMENT ANALYSIS POLICIES FOR SELECTION OF EE PRODUCTS	little or no impact	24	28
	some impact	52	34
	much impact	24	38

Note: Based on a scale of 1 to 10, where 1 means had very little impact and 10 means had great impact (1-3 no / very little impact, 4-7 some impact, 8-10 great impact).

- While Express 1998 participants were significantly more likely than BEMS 1998 participants to report that the BEMS audit program had much impact on their firm's long term investment analysis policies for energy-efficient product selection, there was no difference between Express 1998 and BEMS 1998 participants when some impact responses and much impact responses were combined.

Exhibit 7-64
Importance of BEMS Audit vs. Express Rebate
In Persuading Firm to Make a Energy-efficient Investment
BEMS 1998 vs. Express 1998

IMPORTANCE IN PERSUADING FIRM TO MAKE AN EE INVESTMENT	SURVEY	
	BEMS98	EXP98
Sample Size	17	32
audit much more important than rebate	28	8
audit somewhat more important than rebate	3	14
audit and rebate equally important	53	46
rebate somewhat more important than audit	7	9
rebate much more important than audit	9	23

- BEMS 1998 participants were significantly more likely than Express 1998 participants to consider the audit much more important than the rebate.

Exhibit 7-65
Barriers to Energy-efficient Investments and Practices
BEMS 1998 vs. Express 1998

BARRIER	AGREEMENT	SURVEY	
		BEMS98	EXP98
Sample Size		304	186
When considering a new EE investment, I am concerned that the actual bill savings will be less than what was estimated.	don't agree	14	13
	agree somewhat	47	44
	agree completely	39	42
It takes too much time and hassle to get enough information to make an informed decision about EE investments.	don't agree	32	44
	agree somewhat	47	34
	agree completely	22	22
There is too much time and hassle involved in selecting a qualified EE contractor.	don't agree	30	43
	agree somewhat	44	35
	agree completely	26	21
I feel uncertain about the reliability of information provided by the non-utility firms proposing EE investments.	don't agree	19	21
	agree somewhat	45	53
	agree completely	37	26
I am able to find information about EE investments from sources I trust, but the information is not very helpful to me in making decisions.	don't agree	34	41
	agree somewhat	45	43
	agree completely	21	16
Lack of financing is a barrier to our organization making EE investments that we want to make.	don't agree	28	40
	agree somewhat	35	28
	agree completely	38	32
I read or hear about specific kinds of EE investments that don not seem to be available from the suppliers we work with.	don't agree	43	52
	agree somewhat	39	38
	agree completely	18	10
There are EE investments that I am interested in making, but they always fall below other priorities.	don't agree	20	26
	agree somewhat	38	48
	agree completely	42	26

Note: Based on a scale of 1 to 10, where 1 don't agree at all and 10 is completely agree (1-3 don't agree, 4-7 agree somewhat, 8-10 completely agree).

- Express 1998 participants were significantly more likely to disagree that it takes too much time and hassle to get enough information to make an informed decision about energy-efficient investments (transaction / hassle costs).

- Express 1998 participants were significantly more likely to disagree that there is too much time and hassle to selecting a qualified energy-efficient contractor (transaction / hassle costs).

- While BEMS 1998 participants were significantly more likely than Express 1998 participants to agree completely that they feel uncertain about the reliability of information provided the non-utility firms (asymmetric information), there was no difference between BEMS 1998 participants and Express 1998 participants when agree somewhat and agree completely responses were combined.

- Express 1998 participants were significantly more likely than BEMS 1998 participants to disagree that lack of financing is a barrier to their firm's making energy-efficient investments (access to financing).

- BEMS 1998 participants were significantly more likely than Express 1998 participants to agree completely that they read or hear about specific kinds of energy-efficient investments that do not seem to be available from the suppliers they work with (relates to product unavailability).

- While BEMS 1998 participants were significantly more likely than Express 1998 participants to agree completely that the energy-efficient investments they are interested in making always fall below other priorities (bounded rationality), there was no difference between BEMS 1998 participants and Express 1998 participants when agree somewhat and agree completely responses were combined.

Exhibit 7-66
Main Reason Why Firm Has Not Installed
High-efficiency Lighting Since January, 1996
BEMS 1998 vs. Express 1998

MAIN REASON WHY FIRM DID NOT INSTALL HIGH EFFICIENCY LIGHTING	SURVEY	
	BEMS98	EXP98
Sample Size	165	46
No need/satisfied with current lighting.	34	36
Too expensive compared to other equipment.	27	28
Electronic ballasts are not reliable.	2	.
It would take too much time/work to make the change.	6	17
Designer or contractor recommended not use.	3	1
Not readily available.		.
Energy savings not adequate to justify initial cost.	4	2
Company policy to use magnetic ballasts.	.	.
Did not make formal comparison between high efficiency and standard efficiency equipment.	3	3
Rest of facility uses standard efficiency lighting.	1	6
We lease the space; not worth the extra expense.	16	1
Color/tone of light is not appropriate for intended application.	1	3
Was not aware of high efficiency options.	2	.
Uncertain about performance of occupancy sensors.	2	1
Don't know.	7	4

- Significantly more Express 1998 participants than BEMS 1998 participants reported that their firm has not installed high-efficiency lighting recently because it would take too much time and work to make the change.

- Significantly more BEMS 1998 participants than Express 1998 participants reported that their firm has not installed high-efficiency lighting recently because they lease the space where their firm is located.

Exhibit 7-67
Main Reason Why Firm Has Not Installed
A High-efficiency CAC Since January, 1996
BEMS 1998 vs. Express 1998

MAIN REASON WHY FIRM DID NOT INSTALL HIGH EFFICIENCY CENTRAL AIR CONDITIONER	SURVEY	
	BEMS98	EXP98
Sample Size	224	106
No need/satisfied with current CAC.	55	54
Too expensive compared to other equipment.	17	31
High efficiency CACs are not reliable.	.	.
It would take too much time/work to make the change.	1	
Designer or contractor recommended not use.		.
Not readily available.		.
Energy savings not adequate to justify initial cost.	7	3
Company policy to use standard efficiency CACs	.	.
Did not make formal comparison between high efficiency and standard efficiency equipment.	1	0
Rest of facility uses standard efficiency CACs.	.	2
We lease the space; not worth the extra expense.	16	8
Concerned about occupant comfort.		.
Was not aware of high efficiency options.	.	.
Don't know.	3	1

- Significantly more Express 1998 participants than BEMS 1998 participants reported that their firm has not installed a high-efficiency CAC recently because high-efficiency CACs are too expensive compared to standard efficiency CACs.

- Significantly more BEMS 1998 participants than Express 1998 participants reported that their firm has not installed a high-efficiency CAC recently because they lease the space where their firm is located.

Energy Efficiency Attitudes and Practices

Exhibit 7-68
Attitudes Towards and Beliefs about
Energy-efficient Investments and Practices
BEMS 1998 vs. Express 1998

ATTITUDES TOWARDS/BELIEFS ABOUT ENERGY EFFICIENT INVESTMENTS/PRACTICES	AGREEMENT	SURVEY	
		BEMS98	EXP98
	Sample Size	304	186
EE investments are something that all businesses should consider.	don't agree	2	1
	agree somewhat	18	15
	agree completely	80	83
EE investments will significantly reduce my bill.	don't agree	7	4
	agree somewhat	37	21
	agree completely	56	75
I intend to actively pursue EE investments in the future.	don't agree	10	5
	agree somewhat	39	29
	agree completely	51	66
Saving money on energy is important for my business.	don't agree	2	3
	agree somewhat	21	11
	agree completely	76	86
Conserving energy is an important part of being a good corporate citizen.	don't agree	3	2
	agree somewhat	14	9
	agree completely	83	89
EE investments and practices provide comfort, quality, and reliability that are as good as, or better than, standard efficiency solutions.	don't agree	2	2
	agree somewhat	39	27
	agree completely	59	71
There are important practical benefits that come with EE investments, apart from saving money.	don't agree	6	2
	agree somewhat	40	30
	agree completely	54	68
EE investments are easy to understand and use.	don't agree	13	12
	agree somewhat	55	41
	agree completely	32	47
I actively advocate EE investments and practices to others.	don't agree	22	19
	agree somewhat	42	29
	agree completely	36	52
I regularly hear about EE investments and practices from business contacts and/or professional organizations.	don't agree	45	36
	agree somewhat	43	42
	agree completely	12	22

Note: Based on a scale of 1 to 10, where 1 don't agree at all and 10 is completely agree (1-3 don't agree, 4-7 agree somewhat, 8-10 completely agree).

- Although Express 1998 participants were significantly more likely to completely agree that energy-efficient investments will greatly reduce their energy bill, there was no difference between Express 1998 and BEMS 1998 participants when responses for those who agreed completely and those who agreed somewhat were combined.

- BEMS 1998 participants were significantly more likely than Express 1998 participants to disagree that they intend to actively pursue energy-efficient investments in the future.

- Although Express 1998 participants were significantly more likely than BEMS 1998 participants to completely agree that saving money is important for their business, there was no difference between Express 1998 and BEMS 1998 participants when responses for those who agreed completely and those who agreed somewhat were combined.

- Although Express 1998 participants were significantly more likely than BEMS 1998 participants to completely agree that conserving energy is an important part of being a good corporate citizen, there was no difference between Express 1998 and BEMS 1998 participants when responses for those who agreed completely and those who agreed somewhat were combined.

- Although Express 1998 participants were significantly more likely than BEMS 1998 participants to completely agree that energy-efficient investments and practices provide comfort, quality and reliability that are as good as, or better than, standard efficiency solutions, there was no difference between Express 1998 and BEMS 1998 participants when responses for those who agreed completely and those who agreed somewhat were combined.

- Although Express 1998 participants were significantly more likely than BEMS 1998 participants to completely agree that there are important practical benefits that come with energy-efficient investments, apart from saving money, there was no difference between Express 1998 and BEMS 1998 participants when responses for those who agreed completely and those who agreed somewhat were combined.

- Although Express 1998 participants were significantly more likely than BEMS 1998 participants to completely agree that energy-efficient investments are easy to understand and use, there was no difference between Express 1998 and BEMS 1998 participants when responses for those who agreed completely and those who agreed somewhat were combined.

- Although Express 1998 participants were significantly more likely than BEMS 1998 participants to completely agree that they actively advocate energy-efficient investments and practices to others, there was no difference between Express 1998 and BEMS 1998 participants when responses for those who agreed completely and those who agreed somewhat were combined.

- Express 1998 participants were significantly more likely than BEMS 1998 participants to completely agree that they regularly hear about energy-efficient investments and practices from business contacts and / or professional organizations.

Exhibit 7-69
Importance of Energy Efficiency to Decision-Makers at Firm
BEMS 1998 vs. Express 1998

		SURVEY	
		BEMS98	EXP98
Sample Size		304	186
IMPORTANCE OF EE TO DECISION MAKERS	very important	35	44
	somewhat important	57	48
	not very important	5	5
	not at all important	3	2
	don't know	0	1
FIRM HAS DEVELOPED POLICY FOR EE EQUIPMENT SELECTION	yes	17	27
	no	82	68
	don't know	2	5

- Express 1998 participants were significantly more likely than BEMS 1998 participants to report that energy efficiency is very important to the decision-makers at their firm.

- Express 1998 participants were significantly more likely than BEMS 1998 participants to report that their firm had developed a policy for the selection of energy-efficient equipment.

Exhibit 7-70
Application of Long Term Investment Analysis
To Energy-efficient Product Selection
BEMS 1998 vs. Express 1998

		SURVEY	
		BEMS98	EXP98
Sample Size		304	186
FIRM APPLIES LONG TERM INVESTMENT ANALYSIS TO EE PRODUCT SELECTION	yes	32	47
	no	62	49
	don't know	6	4
Sample Size		86	91
PRIMARY INVESTMENT CRITERION	payback	45	38
	life cycle costing analysis	14	15
	internal rate of return	23	16
	don't know	17	31

- Express 1998 participants were significantly more likely than BEMS 1998 participants to report that their firm applies long term investment analysis to energy-efficient product selection.

- Express 1998 participants were significantly more likely than BEMS 1998 participants to report that they do not know what their firm uses as a primary investment criterion.

Exhibit 7-71
Longest Acceptable Payback Period
BEMS 1998 vs. Express 1998

LONGEST ACCEPTABLE PAYBACK PERIOD	SURVEY	
	BEMS98	EXP98
Sample Size	38	36
1 year or less	29	7
2 years or less	34	19
3 years or less	44	49
4 years or less	49	59
5 years or less	88	76
9 years or less	90	78
at least 10 years	94	81

- BEMS 1998 participants were significantly more likely than Express 1998 participants to demand payback periods of one year or less.

Exhibit 7-72
Self-Reported Knowledge of Energy-efficient Product Performance and Availability
BEMS 1998 vs. Express 1998

KNOWLEDGE OF EE PRODUCT PERFORMANCE AND AVAILABILITY	SURVEY	
	BEMS98	EXP98
Sample Size	304	186
not knowledgeable	27	16
somewhat knowledgeable	59	59
very knowledgeable	14	25

Note: Based on a scale of 1 to 10, where 1 not knowledgeable and 10 is very knowledgeable (1-3 not knowledgeable, 4-7 somewhat knowledgeable, 8-10 very knowledgeable).

- BEMS 1998 participants were significantly more likely than Express 1998 participants to report that they do not consider themselves knowledgeable regarding energy-efficient product performance and availability.

- Express 1998 participants were significantly more likely than BEMS 1998 participants to consider themselves very knowledgeable regarding energy-efficient product performance and availability.

Firmographics

Exhibit 7-73
Number of Employees
BEMS 1998 vs. Express 1998

NUMBER OF EMPLOYEES	SURVEY	
	BEMS98	EXP98
	(sample size = 304)	(sample size = 186)
1 to 5	26%	21%
6 to 10	23%	15%
11 to 20	18%	13%
21 to 50	22%	15%
51 to 100	5%	13%
Over 100	5%	23%

Exhibit 7-74
Square Footage of Business Facility
BEMS 1998 vs. Express 1998

SQUARE FOOTAGE	SURVEY	
	BEMS98	EXP98
	(sample size = 304)	(sample size = 186)
less than 5.000	42%	22%
5,000 but less than 10,000	16%	13%
10,000 but less than 20,000	12%	13%
20,000 but less than 50,000	18%	25%
50,000 but less than 100,000	4%	10%
100,000 but less than 1 million	6%	11%
Over 1 million	0%	1%
don't know	2%	5%

- Express 1998 participants were significantly different than BEMS 1998 participants in terms of number of employees and square footage of business facility, suggesting that the two programs target somewhat different kinds of businesses within the broad categories surveyed, and upon which weighting was based.

Exhibit 7-75
Organizational Involvement in Decision Making
BEMS 1998 vs. Express 1998

QUESTIONS	SURVEY	
	BEMS98	EXP98
	(sample size = 304)	(sample size = 323)
assigned specific person to control or monitor energy usage	30%	47%
business rents facility	49%	31%
business pays entire electric utility bill	46%	29%
business pays part of electric utility bill	2%	0%
business pays none of electric utility bill	2%	2%
business is very active in making lighting and climate control equipment purchase decisions at facility	20%	18%
remodeled space since January 1996	33%	45%

- Express 1998 participants were significantly more likely to have assigned a specific person to control or monitor their firm's energy usage.
- BEMS 1998 participants were significantly more likely to rent their business facility.
- BEMS 1998 participants that rented their business facility were significantly more likely to pay the entire electric bill.

8. ANALYSIS OF MARKET EFFECTS

PROGRAM THEORY PLAUSIBILITY

The BEMS program historically has had direct, measurable impacts only upon end users and not upon supply-side market actors, because of its emphasis, and also because of its administrative and funding structure. While targeted supply-side market barriers exist regarding the core technologies support by BEMS, the majority of barriers regarding those technologies are faced by end users (as outlined in Chapter 4).

The BEMS program is designed primarily to reduce end-user barriers related to information/search costs, asymmetric information, performance uncertainty, and transaction/hassle costs. By reducing these barriers, BEMS aims to increase and accelerate short-term demand for and adoption of high-efficiency measures, thereby reducing supply-side market uncertainty (and increasing their stocking and promotion of high-efficiency measures). Driven by positive end-user experiences with high-efficiency measures, greater supply and greater demand should converge to cause lower prices, bolstering sustained end-user demand. En route to a sustainably transformed market for these measures among small and mid-size C/I customers, positive shifts in diffusion-of-innovation and communications-related factors are expected as well.

The BEMS program could be augmented by, for instance, contemplating explicit links with supply-side actors, and also emphasizing recent links with the SmarterEnergy™ site, in which case a fresh look at program theory "plausibility" would be required. However, given the current end-user-focused role of the BEMS program, the current program theory (as outlined in Chapter 4) seems fairly straightforward, and plausible, particularly given the program's track record.

The remainder of this chapter focuses on measurement and assessment of market effects, based on results from the end-user survey conducted among specific small to mid-size C/I end users within and outside PG&E territory. A brief discussion of results from Express-focused supply-side surveys then follows.

APPROACH TO ASSESSMENT OF MARKET EFFECTS

As stated earlier, the target population for this market effects analysis is C/I customers less-than-500 kW. The end-user survey and analyses were targeted to this segment, with samples of interviews completed among each of the following populations:

- 1998 BEMS participants (based on MDSS data)
- 1996 BEMS participants (based on MDSS data)
- 1993-1998 BEMS nonparticipants (based on MDSS data) – "PG&E NPs"

- C/I customers in utility territories with low historical DSM program offerings, where a mapping scheme was used to correlate company size and type information with PG&E customer size – "Low-DSM NPs"

- 1998 Express participants (based on MDSS data).

Sample for the PG&E customers was designed to exclude duplication across segments (with 1998 Express participants first priority, then 1998 BEMS participants, then 1996 BEMS participants, then PG&E NPs). To the extent possible based on the distribution of program participants, interviews in each of the five segments were distributed equally across each of the following 12 cells (and minimums were set where equal distribution was impractical):

- Offices – under 20 kW, 20-99 kW, 100-499 kW

- Retail – under 20 kW, 20-99 kW, 100-499 kW

- Institutional – under 20 kW, 20-99 kW, 100-499 kW

- Other – under 20 kW, 20-99 kW, 100-499 kW

Each of the 60 unique sub-cells (5 segments times 12 cells) was weighted such that the distribution of less-than-500 kW interviews in each segment mirrored the kWh distribution of the entire less-than-500 kW population in PG&E territory. (In fact, this weighting scheme was similar to the results if the weighting "target" had been 1998 or 1996 BEMS participation.) In this way, the analysis of results and market effects was weighted proportionally to the demand reduction opportunities throughout the less-than-500 kW population. Also, and very importantly, this approach controlled for any variations across segments in customer size or type that might have muddied assessment of market effects – BEMS participants were in effect compared to similarly constructed "peer groups," avoiding apples-and-oranges comparisons.

The basic approach for measuring market effects ideally involves various criteria or analyses, each of which can complement the others if convergence is seen across them. These include:

- **Attribution** of desirable attitudes and behaviors to BEMS, of which the survey includes two relevant examples.

- **Longitudinal** changes in market barriers, diffusion-of-innovation criteria, communication factors, and other metrics, within a specific cohort. In this context, we have no broad benchmark of end-user attitudes or behaviors at some point earlier in the life of the BEMS program, to serve as the basis for true longitudinal analysis. However, we can conduct a "quasi-longitudinal" analysis by comparing attitudes and behaviors of 1998 and 1996 BEMS participants, with the assumption that *at the time of initial participation* these cohorts reflected similar attitudes and behaviors. There is no way to be certain of this assumption's validity, of course, but if we make it we then can attribute any differences between the two cohorts as evidence of changes over time possibly influenced by BEMS participation. Also, while not conclusive,

differences between the two cohorts can provide important clues regarding the highest-potential metrics for tracking MT toward sustainability.

- **Cross-sectional differences** between segments (such as those surveyed) on the above indicators, where differences are consistent with a specific aspect of program theory. For this analysis, two sets of cross-sectional analysis were completed. The first compared 1998 BEMS participants with PG&E NPs and Low-DSM NPs. As evidence of MT, one might reasonably expect that perceptions of market barriers, as well as attitudes, intentions, and behaviors related to the market metrics addressed by BEMS, would display a pattern in which the most "positive" indicators are seen among 1998 BEMS participants, followed by PG&E NPs, followed by Low-DSM NPs. That is, we might expect BEMS participants to have the most direct positive impacts from the BEMS program, while we might expect the cumulative impact of BEMS (and other programs) to be reflect more positive end-user attitudes and behaviors inside PG&E territory than in Low-DSM areas. 1998 BEMS and Express participants also were compared in terms of end-user survey responses, with the goal of isolating specific areas where BEMS may be doing as good a job as (or a better job than) Express on certain market metrics, in which case the emphases of BEMS and Express can be segmented, sharpened and made more complementary over time.

- **Vertical "gap analysis,"** essentially meaning a cross-sectional comparison between end users and one or more supply-side market actor groups, with an emphasis on different groups' perceptions of barriers facing end users. The notion is that significant differences between supply-side market actors and end users regarding the importance or pervasiveness of market barriers, or perceived differences in energy-efficient product and market characteristics, can themselves act as a barrier to MT. Because the BEMS program does not directly interact with individual supply-side market actors, this dimension of market effects assessment is not very relevant for BEMS (although it is relevant for Express).

- Achievement of specific, ***a priori*** **thresholds** for market barrier pervasiveness, intentions toward high-efficiency purchases in the future, etc. In early program planning and program theory development discussions, no *a priori* thresholds emerged as proximate or ultimate market effects indicators, so this dimension is excluded from the analysis.

- **Statistical analysis** was conducted in an attempt to identify market effects attributable to the BEMS program. The objective of this modeling effort was to identify correlations between customers' energy efficiency adoption behavior and their firmographics, perceptions of barriers, attitudes and other decision-making policies.

In summary, the following market effects assessment emphasizes end-user attribution of positive attitudes and intentions to BEMS participation: "quasi-longitudinal" assessment of potential longer-term effects of BEMS participation; and cross-sectional comparison of 1998 BEMS participants to "peers" within and outside PG&E territory. The discussion is organized by the three comparison sets: (1) 1998 vs. 1996 BEMS participants, (2) 1998 BEMS participants vs. PG&E NPs and Low-DSM NPs, and (3) 1998 BEMS vs. Express participants.

MARKET EFFECTS ASSESSMENT

In general, the market effects assessment emphasizes the market barriers, rate-of-diffusion factors, and feedback/communication network factors summarized in Exhibit 4-4, and addresses the market effects indicators summarized in Exhibit 4-12. Measure change behaviors also are considered in assessing the case for MT.

The indicators listed in Exhibit 4-12 provided the basis and served as a checklist for the questions emphasized in this initial primary data collection effort, as well as assessed judgmentally based on a broader review of the BEMS market environment. Initial pre-testing of the combined BEMS/Express end-user survey did not reflect broad familiarity with high-efficiency measures, criteria, options, or providers. Pre-testing also indicated that BEMS participants had a difficult time expressing their uncertainty regarding measure performance, before and after measure installations, when these often occurred many months ago. As a result, the survey was refined to emphasize end-user attitudes regarding current energy-efficient measures and providers, as well as market barriers, diffusion-of-innovation factors, and feedback/communication factors.

Several market barriers not hypothesized to be particularly addressable by BEMS, critical to this market segment, and/or associated with the products emphasized (hidden costs, feature inseparability, and irreversibility) were de-emphasized in primary data collection. Also, by their very nature, two diffusion-of-innovation criteria ("observability" and "trialability") can be assessed judgmentally more readily than through "voice-of-the-market" input. Observability refers to the degree of public visibility a product and its corresponding benefits have; to the degree that high-efficiency measures offer greater performance, they are "observable." However, the primary benefit of high-efficiency measures tends to be delivery of "adequate" product performance with lower life cycle cost, typically unobservable to all but the bill payer. Trialability refers to the extent to which a product can be tried on a low-cost or low-risk basis before full purchase commitment; generally speaking, mainstream energy efficiency measures such as those addressed in this study have low "trialability."

With the preceding exceptions, the remaining market effects indicators (relating to market barriers, diffusion-of-innovation factors, and communications factors) were addressed in the end-user survey. The table below recaps the general market barrier type and more specific market effects indicator from Exhibit 4-12, along with the corresponding question number(s) in the survey in the attached Appendix. Also, BR093 and BR094 (reasons for not having installed high-efficiency lighting and HVAC, respectively) addressed a range of potential market barriers, where significant differences between comparison groups could be interpreted as market effects indicators. In addition, self-reported behaviors (measure changes) also were incorporated in the analysis of market effects. Finally, occasionally questions that do not map explicitly into the program theory/market effects indicator table were included for descriptive and possible segmentation/modeling purposes, for instance firmographics, acceptable payback, and perceived bill-savings potential of high-efficiency investments. (Note that questions CH081 and DM111 are indicated with an asterisk because they captured attribution to BEMS of changes in likelihood of using high-efficiency products in the future, and impacts on long-term decision making.)

Barrier/Factor Type	*Market Effects Indicator*	*End-User Q#*
Awareness/Information	(1) Believe have access to unbiased EE information (e.g., reduced asymmetric information, search costs)	BR092, item 4
Decision Process	(2) HE options worthy of consideration	BR092, items 9 and 11, also DM101-106
	(3) Believe HE will significantly reduce energy bills	CH071 and BR092, items 1 and 10
	(4) Available information provided significant decision-making resource	BR092, item 5
	(5) Reduced hassle / transaction costs	BR092, items 2 and 3
	(6) Changes consideration of HE in future	CH075, CH081*, also DM111*
	(7) Access to financing (not expressly addressed by BEMS, but included for comparison to other factors)	BR092, item 6
	(8) Bounded rationality (not expressly addressed by BEMS, but included as a check)	BR092, item 8
	(9) Product / service unavailability (not expressly addressed by BEMS, but included as a check)	BR092, item 7
Perceived Uncertainty/ Unreliability	(10) HE options (and providers) worth considering	BR092, items 9 and 11, also DM101-106
	(11) Changes consideration of HE in future	CH075, CH081*, DM111*
	(12) Measure satisfaction (not included in 4-12, but an important, and linked, metric)	CH073
Feedback/ Communications Network	(13) Actively advocate energy efficiency, hear about EE from business contacts / professional organizations	DI131, items 6 and 7
Rate-of-Diffusion	(14) Measures relating to the compatibility, complexity, relative advantage, and ability to fulfill felt need	DI131, items 1-5

The remainder of the market effects analysis focuses on market effects indicators where significant differences were seen between the relevant comparison groups, linked to one of the indicators coded 1-14 in the table above where relevant. Differences regarding measure change behavior that may support evidence for MT also are included. These comparisons are ordered as Chapter VI as: "quasi-longitudinal" BEMS 1998 vs. BEMS 1996 participants; cross-sectional BEMS 1998 vs. PG&E NPs vs. Low-DSM NPs; and cross-sectional BEMS 1998 vs. Express 1998 participants. The focus in the following discussion is not on every isolated difference, but on the broader pattern of differences, and what this may imply about market effects attributable to BEMS, either directly or indirectly.

Before the discussion based on comparisons is a brief discussion about attribution to BEMS of specific end-user intentions. Two survey questions, CH081 and DM111, address (respectively) the impact of BEMS on their likelihood of selecting energy-efficient options in the future, and its impact on long-term policies for selecting energy-using equipment. Both questions used 10-point scales, where 1 meant no impact on their likelihood, and 10 means they would be much more likely to do so. These questions relate to market effects indicators 6 and 11 in the preceding table.

- Of 108 BEMS 1998 participants who reported participation in the program (and therefore were asked these questions), one-half (53 percent) indicated BEMS participation would have a fairly significant impact (ratings of 8, 9, or 10), while 30 percent gave a 4, 5, 6, or 7 rating indicating at least some impact, and one-fifth (18 percent) gave a 1, 2, or 3 rating indicating little impact. (Results were very similar among the 87 BEMS 1996 participants reporting participation.)

- Conversely, only one-quarter (24 percent) indicated BEMS participation would have a significant impact on future decision-making practices, although one-half (52 percent) said it would have at least some impact, and one-quarter (24 percent) indicated it would have little impact. (Again, BEMS 1996 participant responses were very similar.)

In summary, it is reasonable to assert that BEMS has a fairly significant impact on increasing participant awareness of and openness to high-efficiency solutions. It also is reasonable to say that BEMS has a moderate impact on future decision-making practices.

BEMS 1998 VS. BEMS 1996 PARTICIPANTS

In this comparison, areas where BEMS 1996 participants report more desirable ratings than BEMS 1998 participants *may* be an indication of market effects over time following BEMS participation, although as stated earlier this comparison alone cannot be definitive. As noted earlier, the concern here is not with recapping isolated differences (as outlined in Chapter 6), but assessing broader patterns.

- BEMS 1996 participants in general exhibit more measure changes since January 1996, and specifically more CFLs and set-back thermostats, and are more likely to perform HVAC maintenance. This at least implies that some of these arguably "secondary" measures and practices may have been engendered by the previous audit and initial installations of "primary" technologies like high-efficiency HVACs and T8s.

- Similarly, BEMS 1996 participants reported more volumetric CFL and CAC installations, though it must be noted that 1998 participants reported more volumetric T8, de-lamping, and lighting sensor changes (the three are likely to have significant correlation with each other). However, the T8 results appeared to be skewed by one or two (valid) outliers, indicating that on balance the volumetric indicators also favor at least the *possibility* that BEMS participants may continue to install more and different measures over time.

- Supporting the preceding assertion is the finding that BEMS 1996 participants were more likely than BEMS 1998 participants to have participated in the Express program since January 1996.

- However, when those who had not installed high-efficiency lighting and HVAC were asked why not, the differences between BEMS 1998 and BEMS 1996 responses suggested more of a cohort-based difference than a difference based on evolution of attitudes and behaviors after BEMS participation. Specifically, BEMS 1996 participants more often said they had not installed high-efficiency lighting because it is not readily available, while BEMS 1998 participants more often said it was because they rent space (they were more likely than BEMS 1996 participants to rent space). This underscores the need to follow up with previous BEMS participants to ensure they remain aware of current high-efficiency options. Likewise, it also underscores the need for BEMS and related programs to factor split incentives into program structure and presentation as smaller C/I customers receive increasing attention.

- Similarly, BEMS 1996 participants more often said they had not installed high-efficiency HVAC because of the first cost premium, while BEMS 1998 participants more often said it was because they doubted savings would justify the cost (indicator #3), and because they rent space. Again, BEMS 1996 participants reflected a perhaps outdated concern, while BEMS 1998 participant concerns were more tied to the problem of payback in a split incentives situation.

- Importantly, BEMS 1996 participants were more likely than BEMS 1998 participants to report having a policy for energy-efficient equipment selection, and to apply long-term investment analysis to energy product selection. While (as with all differences between these two groups) it is possible that these are cohort differences, it is at least plausible that BEMS participation spurs participants over time to take a more long-term, objective view of high-efficiency investments. (This relates to indicators #2 and #10 above.)

- Equally importantly, on several barrier-related metrics, BEMS 1998 participants reported higher agreement ratings – that is, a greater sense of barrier pervasiveness. (There were no attributes on which BEMS 1996 participants gave higher ratings.) The barriers were related to performance uncertainty (indicator #3), transaction/hassle cost (indicator #5), asymmetric information (indicator #1), and bounded rationality (indicator #8).

- Finally, BEMS 1996 participants reported higher agreement ratings with several "positive-leaning" statements (while BEMS 1998 participants reported higher ratings on none). These were belief that high-efficiency investments will significantly reduce their bills (indicator #3), agreement that energy efficiency offers important non-financial benefits (indicator #14), and agreement that they regularly hear about energy efficiency from business contacts (indicator #13).

In summary, the balance and pattern of differences between BEMS 1996 and BEMS 1998 participants offers *some* support for the notion that BEMS participation can engender greater awareness, consideration, use, and acceptance of high-efficiency investments among smaller C/I customers. At the same time, there are complications in attributing market effects to the BEMS program based on the notion that the preceding differences represent life cycle-based improvements in market effects over time, as follows.

- As noted earlier, within the confines of a single cross-sectional study comparing two cohorts, it is impossible to distinguish between cohort effects (e.g., 1996 and 1998 BEMS participants are inherently different in needs, attitudes, and behaviors) and life cycle effects (e.g., broadly speaking, there is a progression that BEMS participants' attitudes and behaviors tend to follow over time, following program participation). In many consumer behavior contexts, it is common to find both cohort and life cycle factors at work, and only monitoring distinct cohorts over time can enable sufficient distinction between the two types of effects. It may be that some or even all of the attitudinal and behavioral differences between 1996 and 1998 BEMS participants simply indicate that 1998 participants are inherently more demanding and less attractive high-efficiency prospects.

- The mix of BEMS audit types has shifted from 1996 to 1998, away from the more customer-initiated BEST (in-person and telephone) applications, and towards the PG&E-initiated Business Edge mail survey, which also captures less information. This shift in emphasis may have caused differences between 1996 and 1998 in which kinds of businesses were exposed to BEMS, and therefore which kinds of recommendations were applicable, and in turn which kinds of measures and practices were undertaken. This sequence also could have translated to greater Express participation, higher impacts, and as a result more positive responses to barrier- and other attitude-related questions.

- As noted on the preceding page, one key finding was that BEMS 1998 participants were significantly more likely than 1996 participants to rent/lease their space (49 versus 41 percent). Although a complete analysis was beyond the scope of this evaluation (own/rent and many other distinctions were only apparent as a result of the main end-user analysis described in Chapter 7), QC conducted a preliminary analysis of BEMS 1998 participant data, comparing owners and renters. There were specific areas where owners provided more positive responses than renters (where BEMS 1996 participants also had provided more positive responses than 1998 participants), including:
    - More common HVAC maintenance,

- More CFL and CAC installations on a volumetric basis,
- More common Express participation, and
- More use of long-term investment analysis in equipment selection decisions.

In addition, there were areas where BEMS 1998 owners provided more positive responses than did BEMS 1998 renters, in ways that do *not* correspond to differences between BEMS 1998 and 1996 participants:

- More recommendations through BEMS,
- Greater BEMS impact on intent to pursue energy-efficient investments, and greater intent to pursue energy efficiency in the future,
- Greater self-reported advocacy, and knowledge, of energy efficiency,
- More employees and workspace square footage.

However, except regarding greater perceived transaction/hassle costs associated with energy-efficient investments, the differences between 1996 and 1998 BEMS participants were not apparent when BEMS 1998 owners and renters were compared.

A preliminary picture begins to emerge, one where larger businesses that own their workspaces historically received in-person BEST audits that resulted in greater impacts and participant intent to pursue energy efficiency in the future. Over time, the remaining businesses may have been smaller, more often renters, and more often audited by the Business Edge mail tool, possibly with fewer recommendations and changes, and lower impacts. The most powerful way to parse out the degree of cohort effects, audit-form effects, and own/rent effects - versus the desired *life cycle* effects that would support the case for market effects – is to track these (or other) distinct BEMS participant cohorts over time, and control for audit form and own/rent in the analysis.

BEMS 1998 PARTICIPANTS VS. PG&E NPS VS. LOW-DSM NPS

In this comparison, desirable differences between BEMS participants and the other two groups, particularly in the area of forward-looking attitudes and intentions, implies some support for the notion that BEMS participation impacts these attitudes and intentions. When PG&E NPs exhibit a desirable difference versus Low-DSM NPs, this supports the notion that BEMS may have contributed at least indirectly (along with other, related programs and efforts) to transform the PG&E market. In particular, we were looking for comparisons where the most desirable responses were found among 1998 BEMS participants, and the least desirable among Low-DSM NPs, reflecting a "stair-step" relationship across the three groups.

- While Low-DSM NPs reported more frequent HVAC-related installations and behavior since January 1996 than did the other two groups, this appears tied to the climate zone (and possibly building/equipment age) of the mix of territories comprising the Low-DSM geography. In addition, BEMS 1998 participants reported less frequent CFL installations than did the other groups. Conversely, T8 and de-lamping/reflector installations were most frequent among BEMS 1998 participants. This pattern of self-reported behaviors does not particularly support the notion of a transformed energy efficiency market in PG&E territory.

- Low-DSM NPs reported a lower volume of T8 installations and de-lamp/reflector changes than did the other groups. However, Low-DSM and PG&E NPs reported a greater volume of CFL changes than did BEMS 1998 participants, while PG&E NPs reported a greater volume of HVAC changes than did either of the other groups. BEMS 1998 participants reported a modestly greater volume of lighting sensor changes than did the other groups. As with the preceding bullet, this pattern of self-reported behaviors does not particularly support the notion of MT.

- Although the pattern varied somewhat across measures, overall BEMS 1998 participants appeared less satisfied with the energy savings and performance of measures installed, relative to PG&E and Low-DSM NPs. Low-DSM NPs generally were more satisfied than were PG&E NPs. BEMS 1998 participants were more satisfied than the other groups with their experience with set-back thermostats and light sensors, suggesting that BEMS may play an important role in managing expectations regarding these "secondary" measures, and avoiding their inappropriate use. On balance, this pattern does not reflect the theorized "stair-step" pattern of responses across BEMS 1998 participants, PG&E NPs, and Low-DSM NPs.

- However, PG&E NPs were more likely than Low-DSM NPs to say their energy efficiency measure experiences made them "much more likely" to select high-efficiency options in the future, an isolated but important piece of evidence in support of a transformed market (indicators #6 and #11).

- Also, BEMS 1998 participants were more likely than PG&E NPs to report participation in the Express program, suggesting that BEMS plays an important "feeder" role for Express, if indirectly at this point (this is consistent with findings reported in the previous section).

- In terms of market barriers, Low-DSM NPs reported less performance uncertainty and bounded rationality than did the other groups, although this may simply indicate that they are lower on the energy efficiency learning-and-adoption curve (apart from HVAC). A case can be made that performance uncertainty and bounded rationality may actually come to the forefront as customers begin to actively investigate high-efficiency measures, then (hopefully) these concerns become more moderated as customers learn about different measures and providers. However, BEMS 1998 participants also perceived greater asymmetric information and access-to-financing barriers than did Low-DSM NPs. Overall, the pattern of responses across market barrier questions does not support the notion of a transformed market (indicators #3, #8, #1, and #7).

- Though responses were mixed when respondents were asked why they had not previously installed high-efficiency HVAC and lighting, BEMS 1998 participants were more likely than the others to mention that they rent their space (related to split incentives), along with (for HVAC) attendant concerns about measure cost-justification.

- PG&E NPs were more likely than Low-DSM NPs to agree that energy-efficient investments will reduce their energy bill (indicator #3), that energy-efficient investments are easy to understand and use (indicator #14), that conserving energy is an important part of being a good corporate citizen (indicator #14), and that they actively advocate energy-efficient investments and practice to others (indicator #13). On the latter two measures, BEMS 1998 participants also agreed more often than did Low-DSM NPs. Also, while more likely than the other two groups to value saving energy (indicator #14), BEMS 1998 participants also agreed less often that they hear about energy efficiency from business contacts. Overall, this pattern of responses provides support for the notion that the BEMS program has contributed, at least indirectly and partially, to the development of a market that is more confident in and attuned to energy efficiency.

- BEMS 1998 participants reported that decision makers at their firm ascribed somewhat greater importance to energy efficiency than did the other two groups (indicators #2 and #10), although this difference was modest. Conversely, however, BEMS 1998 participants were less likely to report having policies in place for the selection of energy equipment selection (indicators #2 and #10). Interestingly, PG&E NPs were more likely than either group to report use of long-term investment analysis to these purchases (indicators #2 and #10). BEMS 1998 participants were more likely than the other groups to expect one-year paybacks, probably because they also were more likely to lease space. Overall, this pattern of responses is mixed, at best, in terms of potential for demonstrating meaningful MT.

Based on this comparison set, support for BEMS contribution to MT is weak at best, and any credit ascribed to the program could only be attributed indirectly, because of all of the other factors that might also influence movement toward MT beyond the base of program participants. However, there are isolated pieces of information suggesting BEMS may have had such an effect to date, in particular the notion that it is at least indirectly a feeder for Express, and also the possibility that BEMS accelerates diffusion- and communications-related market processes. It also is evident in this and the preceding section that split incentives are likely to emerge as a more visible and complicated market barrier, the farther down into the C/I customer base the BEMS program is targeted.

Interpreting the results from this three-group comparison, particularly the Low-DSM group versus the others, is complicated. The Low-DSM respondents, in general, are in more HVAC-oriented climates, as reflected in measure change data. They also are more likely to own their own workspaces, which as was seen earlier can be an indicator of greater energy efficiency experience and propensity. Low-DSM respondents also may reflect the adage that "a little knowledge is dangerous," in that perceived barriers may start somewhat low, actually increase as small businesses examine energy-efficient solutions more attentively, then (hopefully) decline as information from sources (like BEMS in PG&E territory) helps to ally their fears.

BEMS 1998 PARTICIPANTS VS. EXPRESS 1998 PARTICIPANTS

As noted earlier, the purpose of comparing 1998 BEMS and Express participants was to isolate any areas of customer attitudes, perceptions, intentions, or behaviors, where BEMS

may be doing as good a job as (or a better job than) Express on certain market metrics. While this seemed a challenging goal, given that Express involves paying customers to change their behavior while BEMS plays more of an informational, supportive, and "funneling" role, the hypothesis was that the data might identify areas where the emphases of BEMS and Express could be segmented, refined, and made more complementary over time.

In reality, the data do not support this hypothesis; in short, Express 1998 participants reported more desirable attitudes, perceptions, intentions, and behaviors than did BEMS 1998 participants across-the-board. A key difference between the two groups was that BEMS 1998 participants were more likely than Express 1998 participants (49 versus 31 percent) to rent their space, and to report this as a barrier to previous installation of high-efficiency HVAC and lighting. BEMS 1998 participants also were more likely, therefore, to expect a one-year payback. Even given the weighting of the data by kWh within set business size and type categories, Express participants were larger than were BEMS participants. BEMS and Express participants expressed similar responses regarding the impact of previous energy-efficient investments on future likelihood of energy-efficient investments, and perceived savings potential from energy-efficient investments. Otherwise, response parity between the groups was rare or peripheral to issues of market effects.

SUPPLY-SIDE RESULTS

While more than half of the HVAC and lighting contractors and distributors interviewed regarding Express supply-side effects were aware of BEMS, a minority (11 of the 44 aware of BEMS) claimed to have gained incremental business from the program. It is possible, of course, that these supply-side market actors benefited from the program in ways that were not obvious to them. Only one of the 67 respondents (a lighting distributor) indicated that the program had a significant impact on their businesses, though most acknowledged (or assumed) that the program had at least some effect. Contractors indicated various reasons why the program did not have a high impact for them, including the fact that they work through general contractors, or that they do their own audits. The distributors appeared more cognizant of BEMS' value in presenting unbiased information to end users, and in creating awareness of energy-efficient options. Overall, these supply-side market actors attributed some increase in customer awareness and use of energy-efficient measures, though only a few reported meaningful increases. Overall, these results seem to be about what might have been expected, given that BEMS historically has not been linked directly to supply-side market actors, in terms of feeding them leads or acting as a mechanism for providing customers with information on specific vendors.

STATISTICAL MODELING

Another method for identifying market effects is through the use of statistical models. The objective of the modeling effort presented here is to attempt to identify correlations between customers' adoption behavior and their firmographics, perceptions of barriers, attitudes and decision-making policies. Through this analysis, we ideally would be able to identify:

- What types of firmographics are consistent with customers that tend to adopt energy efficiency measures.

- What barriers have been reduced or eliminated among customers adopting energy efficiency measures.

- What types of attitudes and decision-making policies are common among customers adopting energy efficiency measures.

By isolating specific characteristics that are correlated with energy-efficient adoptions, we can identify if market effects are present by comparing these characteristics among selected groups of customers. For example, if we find that a specific attitude is correlated with energy-efficient adoptions, and customers in PG&E's service territory are much more likely to display this attitude than customers in Low DSM States, then we can infer some market effects have occurred.

For this analysis, we used logistic models to predict the probability that a customer has adopted an energy-efficient measure. This analysis focused on the adoptions of T-8 fixtures and CACs, because these were the most prevalent measures installed in our sample of customers. The logistic models attempted to predict the adoption of each measure individually as a function of each customer's firmographics, perceptions of barriers, attitudes and other decision-making policies. The model took on the following form:

$$ADOPT_{m,c} = FIRM_c + BARRIER_c + ATTITUDE_c + POLICIES_c$$

Where,

$ADOPT_{m,c}$ = one if customer c adopted measure m.

$FIRM_c$ = an array of indicator variables, that equal one if a customer c displays a specific type of firmographic.

$BARRIER_c$ = an array of indicator variables, that equal one if a customer c *strongly disagrees* with the presence of a specific type of barrier.

$ATTITUDE_c$ = an array of indicator variables, that equal one if a customer c *strongly agrees* with a specific attitude.

$POLICIES_c$ = an array of indicator variables, that equal one if a customer c institutes a specific type of policy.

The predictive (or independent) variables used in the model are presented in Exhibit 8-1, below.

A second stage of the analysis was to include three additional predictive variables that accounted for (1) reported participation in an audit program (BEMS or otherwise), (2) known participation in BEMS (via the MDSS tracking system), and (3) location within PG&E's service territory. What we would hope to find is that these three variables are strong predictors of energy-efficient adoptions. This would indicate that there are market effects occurring among each group which have not been captured by the barriers, attitudes and policies; even after correcting for any firmographic differences in the populations.

A third stage of this analysis was to use the initial set of predictive variables to estimate the probability that a customer participated in the BEMS program, or that a customer was serviced by PG&E. This analysis allows us to identify which types of firmographics, perceptions of barriers, attitudes and other decision-making policies are consistent with either BEMS participants, or PG&E customers. Ideally what we would find is that the same variables that predict the adoption of an energy-efficient measure, also predict participation in BEMS or location within PG&E's service territory.

A final stage of the analysis was to estimate the probability of an energy-efficient adoption under different situations. These situations included whether or not the measure was adopted as a result of the audit (BEMS or otherwise), whether or not the adoption occurred among a BEMS participant, and whether or not the adoption occurred within PG&E's service territory. Therefore, there were six different cases that we analyzed for each measure. By comparing the results across these six models, we hoped to see different sets of firmographics, perceptions of barriers, attitudes and other decision-making policies act as the key predictive variables. If this were true, we could infer that the act of adopting under a given situation was related to certain customer characteristics. For example, if we found one specific barrier to be a strong predictor of adopting a measure as a result of an audit, but it was not predictive of the other five situations, then we could infer that the audit was successful in reducing the perception of this barrier.

Exhibit 8-1 summarizes the results of the modeling effort. Shown in the rows of the exhibit are the various predictive variables: firmographics, perceptions of barriers, attitudes and other decision-making policies. Shown in the columns are the different events being estimated: participation in BEMS, located in PG&E's service territory, adopting T-8s, and adopting CACs. The cells of the table indicate which of the independent variables were strong predictors that are either positively or negatively correlated with each event.

Measure Adoption

Firmographics

For both T-8s and CACs, customer size, ownership, having an energy manager, and being active in making equipment purchase decisions are all strong predictors of adoption. The same set of characteristics is consistent with BEMS participants and PG&E customers. It is likely that these types of customers generally have a higher propensity to adopt energy-efficient measures. Therefore, some of the difference between PG&E and Low-DSM State adoptions may simply be attributable to the differences in ownership and size observed between the two samples. This is not necessary an indication of market effects, however the fact that BEMS participants, and PG&E customers in general, are more likely to have an energy manager, and be active in making equipment purchase decisions may be an effect.

Barriers

Both T-8 and CAC adopters agree that they are concerned that the actual bill savings associated with high efficiency investments will be less than what was estimated (performance uncertainty). This belief may be founded on the actual experience since they are adopters. Therefore, it may not be the perception of performance uncertainty that causes

adoption, but rather, adoption causing the perception. BEMS participants and PG&E customers, however, strongly disagree with this statement. Even though this appears to be a contradiction, it may still indicate a positive market effect, because BEMS participants and PG&E customers do not see actual bill savings as a potential barrier (performance uncertainty).

Exhibit 8-1
Logistic Model Results
Predicting Participation and Adoption

Predictive Variables		Events			
		Participation		Adoption	
Variable	Description	BEMS Part	Low DSM Customer	Adopted T-8s	Adopted CACs
Firmographics					
FG132	Large Employee	⇩	⇩	⇧	⇧
FG133	Large SqFt	⇧	⇧	⇧	
FG134	Energy Manager			⇧	⇧
FG135	Owner	⇧	↑	↑	⇧
FG136	Pay All Bill	⇧	↑		⇩
FG137	Very Active Decision Making	⇧	⇧	⇧	↑
Perception of Barriers					
BR092_1	Performance Uncertainty (Disagree)	⇧	⇧	⇩	↓
BR092_2	Transaction/Hassle Cost for Info (Disagree)				⇧
BR092_3	Transaction/Hassle Cost for Contractor (Disagree)	⇩			⇧
BR092_4	Asymmetric Information (Disagree)		⇩		⇧
BR092_5	Information/Search Cost (Disagree)		⇩		
BR092_6	Access to Financing (Disagree)	⇩			
BR092_7	Product Availability (Disagree)	⇧	⇧		
BR092_8	Bounded Rationality (Disagree)			⇧	
Attitudes					
DI131	Save Money Important (Agree)			⇧	⇧
DI1312	Conserve Energy Important (Agree)	⇧	⇧		⇩
DI1313	Efficient Better Performance than Standard (Agree)		⇩	⇩	⇧
DI1314	Important Nonmonetary Benefits (Agree)		⇩		
DI1315	Easy to Understand and Use (Agree)		⇧		
DI1316	Advocate Efficiency (Agree)			⇧	⇩
DI1317	Hear from Professionals (Agree)				
BR092_9	All Should Consider Efficiency (Agree)			⇩	
BR092_10	Efficiency Reduce Bill (Agree)	⇩			⇧
BR092_11	Future Intentions (Agree)	⇧		↑	
Policies					
DM102	Policy for Efficiency				
DM105	Long Term Investment Criteria	⇩		⇧	

KEY

↑	Variable is a very strong predictor of event occurring
⇧	Variable is a strong predictor of event occurring
⇩	Variable is a strong predictor of event not occuring
↓	Variable is a very strong predictor of event not occuring

T-8 adopters strongly disagree that energy-efficient investments seem to fall below other priorities, indicating that overcoming bounded rationality positively effects adoption. This

variable was not significant in predicting either BEMS participation or PG&E customers, however.

CAC adopters strongly disagree that there is too much time and hassle involved in both obtaining information to make an informed decision about energy-efficient investments, and to select a qualified contractor (transaction/hassle costs). Therefore, this barrier can be inferred as being an important event to overcome. The only significant effect we found among BEMS participants and PG&E customers, was that BEMS participants also agreed that there are transaction and hassle costs associated with selecting a qualified contractor. We have found that CACs are more commonly installed in the Low DSM states. Therefore, it is possible that one reason for this effect is due to contractor availability. Of course, this could be a climatic effect: The majority of Low DSM States are in a warmer climate where there is more demand for air conditioning, and therefore more demand for (and supply of) contractors.

CAC adopters also strongly disagree that they feel uncertain about the reliability of information provided by non-utility firms proposing energy-efficient investments for their business (asymmetric information). This could be related to the barrier discussed above regarding transaction and hassle costs. Not only do CAC adopters find it easier to select a contractor, but they also feel the information provided by the contractor is reliable. For this barrier, we found that PG&E customers agree about the uncertainty of reliable information from non-utility firms.

Although information/search costs, access to financing, and product availability were strong predictors of either T-8 or CAC adoption, they were not for predicting either BEMS participation or PG&E customers. While product availability does not appear to be a barrier for either adoption group, information/search costs is a barrier for PG&E customers, and access to financing is a barrier for BEMS participation.

Overall, there are no strong indications of market effects as a result of this analysis.

Attitudes

Both T-8 and CAC adopters strongly agree that saving money on energy is important for their business, which is consistent with what we would expect. This attitude, however, is not significant in predicting BEMS participation or PG&E customers.

Interestingly, there are no other predictive attitudes that are consistent among T-8 and CAC adopters. In fact, there are two predictive attitudes which are opposite of each other. CAC adopters strongly agree that energy-efficient investments and practices provide comfort, quality, and reliability that are as good as, or better than, standard efficiency solutions. T-8 adopters do not strongly agree with this statement. This may indicate that customers are more concerned with the comfort, quality, and reliability of CACs than T-8s. This attitude is not a significant predictor of BEMS participation, but PG&E customers do not strongly agree with this statement.

Another contradiction in attitudes between T-8 and CAC adopters occurred with energy efficiency advocacy. T-8 adopters strongly agree that they advocate energy-efficient

investments and practices to others, while CAC adopters do not. This statement is not predictive of BEMS participation or being a PG&E customer.

One attitude that is contradictory among CAC adopters, and BEMS participants and PG&E customers, is the belief that conserving energy is an important part of being a good corporate citizen. CAC adopters do not strongly agree with this statement, whereas the other two groups do. What is interesting about this finding is that CAC adopters are more prevalent among customers in Low DSM States. This may be another indication that these high adoption rates are due to climatic effects, and not because of customer attitudes regarding energy efficiency.

Another contradiction that lies between CAC adopters and BEMS participants is the belief that energy-efficient investments will significantly reduce their energy bill. What is unusual about this is that CAC adopters strongly agreed with this statement, but also had strong performance uncertainty concerns. Perhaps this can be explained by the fact that these customers have high expectations about savings, but also have some reservations about their expectations being met. Again, this could be a climatic effect. If CAC usage is a large component of the customer's bill, then they would likely have high expectations of bill savings. BEMS participants do not strongly agree that energy-efficient investments will significantly reduce their energy bill. However, BEMS participants do not have concerns with performance uncertainty. In this case, BEMS participants appear to have low expectations with regards to savings, but feel certain about them.

One positive indication of market effects is that both T-8 adopters and BEMS participants strongly agree that they intend to actively pursue energy-efficient investments in the future. In fact, this is one of the strongest predictors of T-8 adoption.

One attitude that was only predictive of T-8 adoption was the lack of strong agreement that energy-efficient investments are something that all businesses should consider.

There were two additional attitudes that were only predictive for PG&E customers. PG&E customers strongly agreed that energy efficiency investments are easy to understand and use. However, they do not strongly agree with the belief that there are important practical benefits that come with energy-efficient investments, apart from saving money. This is inconsistent with their belief that conserving energy is an important part of being a good corporate citizen, but consistent with the belief that energy-efficient investments and practices do not necessarily provide comfort, quality, and reliability as good as, or better than, standard efficiency solutions.

Overall, there are no strong indicators of market effects, other than both T-8 adopters and BEMS participants strongly agree that they intend to actively pursue energy-efficient investments in the future.

Policies

Having a policy for the selection of energy-efficient equipment was not a strong predictor of adoption, BEMS participation, or PG&E customer. Routinely applying long-term investment analysis to energy equipment selection (such as payback), however, was a positive predictor

for T-8 adoption. This is understandable, given that T-8 retrofits are generally more of a proactive decision, compared to CAC replacement, which is often a reactive decision. The use of an investment criteria, however, was a negative predictor of BEMS participation.

Overall, there are no strong indicators of market effects.

Addition of Participation Variables

Perhaps the strongest indication of market effects occurred when three new predictive variables were added to the T-8 and CAC models to account for BEMS participation, recollection of an audit, and being a Low DSM customer.

Recalling having had an audit performed was the single most predictive variable for estimating T-8 adoption. Although not as strong, participation in BEMS was also positively correlated with predicting T-8 adoption. Being a Low DSM customer was also predictive of T-8 adoption, but not nearly as strong as the others.

As expected, being a Low DSM customer was the single most predictive variable for estimating CAC adoption. In addition, participation in BEMS and recalling an audit were also positively correlated with predicting CAC adoption. Although not as powerful, these two variables were relatively strong predictors. For example, there were considerably more predictive than being a Low DSM customer was for T-8 adoption.

Climatic Effect on CAC Adoption

As discussed, we have found that high efficiency CAC adoption is more prevalent among customers in Low DSM states. We have asserted that this may be due to climatic differences between California and the Low DSM states. We found from the surveys that 37% of the Low DSM customers installed a CAC since January 1996. Of these customers, 54% installed high efficiency equipment. Among PG&E customers, only 26% installed CAC. But, 56% of the PG&E CAC adopters installed high efficiency equipment. Therefore, if we were to correct for the rate of CAC installations, we would find that PG&E customers are more likely to adopt high efficiency CACs.

To test this, we developed a model to predict being a Low DSM customer. We used the same set of predictive variables discussed above, but added to additional variables: having installed a CAC (of any efficiency), and having installed a high efficiency CAC. We found that the act of installing a CAC was a very strong predictor of being a Low DSM customer. However, the act of installing a high efficiency CAC was negatively correlated with being a Low DSM customer. This confirmed our analysis above.

Paths to T-8 Measure Adoption

As discussed earlier, we developed separate models to predict the probability of adopting T-8s:

1. As a result of an audit
2. Unrelated to an audit
3. Among BEMS participants
4. Among all nonparticipants
5. Among PG&E customers
6. Among Low DSM customers

Exhibit 8-2 summarizes the results of this stage of the modeling effort. The different events being estimated include the various paths to T-8 adoption: Adopting T-8s as a result of an audit, adopting T-8s unrelated to an audit, adopting T-8s among BEMS participants, adopting T-8s among all nonparticipants, adopting T-8s among PG&E customers, adopting T-8s among Low DSM customers.

Firmographics

Again, customer size, ownership, having an energy manager, and being active in making equipment purchase decisions were generally strong predictors of adoption through each path. The only significant difference across the six paths was for customers in Low DSM states, where being active in making energy efficiency decisions was more important for adoption than simply paying all of the electricity bill. The opposite was true of PG&E customers.

Barriers

Performance uncertainty seemed to be more of a concern among T-8 adopters that did not have an audit or participate in BEMS. Although we did not see a significant result among T-8 adopters who were BEMS participants or those who adopted as a result of the audit, we still feel this is an indication that the audit has had a positive effect on reducing performance uncertainty.

Only the T-8 adopters that were Low DSM customers seem to strongly disagree that there is a hassle involved with finding a qualified contractor. This is consistent with what we found above.

Customers that adopted T-8s as a result of the audit still face the barrier of asymmetric information, feeling uncertain about the reliability of information provided by non-utility firms. This may be a direct result of their involvement with the audit. The audit may have

instilled greater confidence with their utility, and therefore reduced their certainty about vendor reliability.

Exhibit 8-2
Logistic Model Results
Paths to Measure Adoption

Predictive Variables		Event = T-8 Adoption					
		Result of Audit		BEMS Part		Result of Location	
Variable	Description	Through Audit	Outside of Audit	BEMS Part	BEMS Nonpart	PG&E Customer	Low DSM Customer
Firmographics							
FG132	Large Employee	⇩	⇧		↑		↑
FG133	Large SqFt	⇧	⇧	⇧		⇧	
FG134	Energy Manager		⇧				
FG135	Owner	↑	↑	↑	⇧	↑	
FG136	Pay All Bill	↑		⇧	⇩	↑	↓
FG137	Very Active Decision Making		⇧	⇧		⇧	⇧
Perception of Barriers							
BR092_1	Performance Uncertainty (Disagree)		⇩		⇩		⇩
BR092_2	Transaction/Hassle Cost for Info (Disagree)						
BR092_3	Transaction/Hassle Cost for Contractor (Disagree)						⇧
BR092_4	Asymmetric Information (Disagree)	↓					
BR092_5	Information/Search Cost (Disagree)	⇧					
BR092_6	Access to Financing (Disagree)	↑	⇩				
BR092_7	Product Availability (Disagree)				⇩		⇩
BR092_8	Bounded Rationality (Disagree)		⇧	⇧	⇧	⇧	⇧
Attitudes							
DI131	Save Money Important (Agree)		⇧	⇧			
DI1312	Conserve Energy Important (Agree)			⇧	⇩		
DI1313	Efficient Better Performance than Standard (Agree)	⇩	⇩	⇩		⇩	
DI1314	Important Nonmonetary Benefits (Agree)	⇩					⇧
DI1315	Easy to Understand and Use (Agree)	⇩					
DI1316	Advocate Efficiency (Agree)	⇧				⇧	
DI1317	Hear from Professionals (Agree)	↓					
BR092_9	All Should Consider Efficiency (Agree)		⇩				
BR092_10	Efficiency Reduce Bill (Agree)	↑					
BR092_11	Future Intentions (Agree)	↑	⇧	↑		↑	
Policies							
DM102	Policy for Efficiency	⇩	⇧				⇩
DM105	Long Term Investment Criteria		⇧				

KEY

↑	Variable is a very strong predictor of event occurring
⇧	Variable is a strong predictor of event occurring
⇩	Variable is a strong predictor of event not occuring
↓	Variable is a very strong predictor of event not occuring

Customers that adopted T-8s as a result of the audit have overcome the barrier of information/search costs, feeling that they are able to find information about energy-efficient investments from sources that they trust, which is helpful in making decisions. Again, this is likely a direct result of the audit providing them useful information from a trustworthy source.

Another barrier that has been reduced among customers that adopted T-8s as a result of the audit is access to financing. Customers that adopted T-8s outside of the audit, however, still felt that access to financing was a barrier to making energy efficiency investments.

T-8 adopters that were not BEMS participants, or were from Low DSM states, both agree that they encounter product availability problems.

All groups except those that adopted through the audit, disagree that energy-efficient investments that they are interested in making fall below other priorities.

Overall, the most significant market effects appear to be among customers that have installed T-8s as a result of an energy audit.

Attitudes

T-8 adopters that were BEMS participants or that adopted outside of an audit program, strongly agreed that saving money on energy is important for their business. BEMS participants, however, were the only adopters to strongly agree that conserving energy is an important part of being a good corporate citizen. In fact, Low DMS adopters disagreed with this statement.

All paths except for non-BEMS participant and Low DSM adopters disagreed that energy-efficient investments and practices provide comfort, quality, and reliability that are as good as, or better than, standard efficiency solutions. This may be a result of the type of measure installed, as discussed earlier.

Only Low DSM adopters agreed that there are important practical benefits that come with energy-efficient investments, apart from saving money. Only BEMS participants disagreed with this statement.

Customers adopting through an audit program disagreed that energy-efficient investments are easy to understand and use. However, these customers and PG&E adopters both agree that they actively advocate energy-efficient investments and practices to others.

Only customers adopting through an audit program disagreed that they regularly hear about energy-efficient investments and practices from business contacts and/or professional organizations. Furthermore, only this group agreed that energy-efficient investments will significantly reduce their energy bill. However, these customers also disagreed that energy-efficient investments are something that all businesses should consider.

Customers adopting through an audit program, BEMS participant adopters, and PG&E adopters, also strongly felt that they intend to actively pursue energy-efficient investments in the future.

Overall, these findings are a little mixed, but there are some indications of market effects among customers within PG&E's service territory.

Policies

Customers that adopted T-8s outside of the audit appear to be more likely to have policies for selecting and apply long-term investment criteria when selecting energy-efficient equipment.

Overall, there are no strong indicators of market effects.

Paths to CAC Measure Adoption

The same six paths towards measure adoption were modeled for CACs:

1. As a result of an audit
2. Unrelated to an audit
3. Among BEMS participants
4. Among all nonparticipants
5. Among PG&E customers
6. Among Low DSM customers

Because only six customers reported installing a CAC as a result of an audit, the model was deemed to be unreliable. Therefore, these results of this path are not presented or discussed, and neither are its cohort path (adoption outside of an audit).

Exhibit 8-3 summarizes the results of this stage of the modeling effort. The different events being estimated include the various paths to CAC adoption: Adopting CACs among BEMS participants, adopting CACs among all nonparticipants, adopting CACs among PG&E customers, adopting CACs among Low DSM customers.

Firmographics

For the first time, there was some inconsistencies between the relationship with firmographics and the path to measure adoption. First of all, customer size was not as significant a predictor as it had been for other models, and neither was having an energy manager. More interesting was the relationship between ownership and adoption. Both owners and lessees paying all of their energy bill turned out to be negatively correlated among customers adopting CACs outside of the BEMS program, and in Low DSM States, in particular. Being actively involved in energy-efficient decisions was positively correlated for all paths, except Low DSM adopters. In fact, no firmographic variable was strongly positively correlated with CAC adoption among customers in Low DSM states.

These results indicate that there are likely sample differences between customers in PG&E's service territory versus the Low DSM states. Including these firmographics variables in the models will help correct for these differences.

Exhibit 8-3
Logistic Model Results
Paths to Measure Adoption

Predictive Variables		Event = CAC Adoption			
		BEMS Part		Result of Location	
Variable	Description	BEMS Part	BEMS Nonpart	PG&E Customer	Low DSM Customer
Firmographics					
FG132	Large Employee		⇧	⇧	
FG133	Large SqFt				
FG134	Energy Manager		⇧	⇧	
FG135	Owner	↑	⇩	↑	⇩
FG136	Pay All Bill	↑	↓	↑	↓
FG137	Very Active Decision Making	↑	⇧	↑	
Perception of Barriers					
BR092_1	Performance Uncertainty (Disagree)	⇩	↓	⇩	↓
BR092_2	Transaction/Hassle Cost for Info (Disagree)	⇧		⇧	
BR092_3	Transaction/Hassle Cost for Contractor (Disagree)		⇧		↑
BR092_4	Asymmetric Information (Disagree)	↑		⇧	
BR092_5	Information/Search Cost (Disagree)				
BR092_6	Access to Financing (Disagree)				⇩
BR092_7	Product Availability (Disagree)	⇧			
BR092_8	Bounded Rationality (Disagree)		⇧		⇧
Attitudes					
DI131	Save Money Important (Agree)		↑	⇧	↑
DI1312	Conserve Energy Important (Agree)	⇧	↓		↓
DI1313	Efficient Better Performance than Standard (Agree)	⇧			
DI1314	Important Nonmonetary Benefits (Agree)			⇩	
DI1315	Easy to Understand and Use (Agree)	⇧	⇩	⇧	⇩
DI1316	Advocate Efficiency (Agree)	⇩		⇩	
DI1317	Hear from Professionals (Agree)				
BR092_9	All Should Consider Efficiency (Agree)				⇩
BR092_10	Efficiency Reduce Bill (Agree)	↑		⇧	
BR092_11	Future Intentions (Agree)				⇧
Policies					
DM102	Policy for Efficiency	⇧			
DM105	Long Term Investment Criteria				

KEY	
↑	Variable is a very strong predictor of event occurring
⇧	Variable is a strong predictor of event occurring
⇩	Variable is a strong predictor of event not occuring
↓	Variable is a very strong predictor of event not occuring

Barriers

Performance uncertainty was a concern among all paths of adoption. This is further evidence of the reverse causal effect discussed earlier: That adoption of a high efficiency CAC caused the concern that the actual bill savings will be less than what was estimated.

Perhaps the most interesting comparison of barrier questions is among the two transaction/hassle costs questions. BEMS participants and PG&E customers that adopted CACs disagree that it takes too much time and hassle to get enough information to make an informed decision about energy-efficient investments. However, customers that adopted CACs in Low DSM States, or that were not BEMS participants disagree that there is too much time and hassle involved in selecting a qualified energy efficiency contractor. No group had a result that would indicate that they strongly agree with either statement.

We believe this to be a positive finding because, as we discussed earlier, the hassle of finding a contractor among customers in Low DSM States may be a result of a climatic effect, which could result in a greater supply of contractors. Overcoming the barrier of finding information to make an informed decision may be more a direct result of the effectiveness of the BEMS program.

Another positive market effect can be seen among asymmetric information. Customers adopting CACs that are BEMS participants and PG&E customers in general, strongly disagree that they feel uncertain about the reliability of information provided by non-utility firms. This barrier was not significant for CAC adopters in Low DSM states.

Furthermore, CAC adopters in Low DSM states reported that access to financing is still a barrier; whereas this barrier was insignificant for all other paths.

Only CAC adopters that were BEMS participants disagreed that product availability was a barrier; whereas this barrier was insignificant for all other paths.

Possibly the only negative finding in this set of comparisons was the fact that Low DSM adopters and non-BEMS participants disagreed with the bounded rationality barrier. This barrier was insignificant for all other paths.

Overall, there appears to be some significant market effects occurring among BEMS participants, as well as with customers in PG&E's service territory.

Attitudes

All paths except for CAC adopters that were BEMS participants, strongly agreed that saving money on energy is important for their business. BEMS participants, however, were the only adopters to strongly agree that conserving energy is an important part of being a good corporate citizen. In fact, Low DMS adopters and non-BEMS participants disagreed with this statement.

Only BEMS participant adopters felt energy-efficient investments and practices provide comfort, quality, and reliability that are as good as, or better than, standard efficiency solutions. Only PG&E customer adopters disagreed that there are important practical benefits that come with energy-efficient investments, apart from saving money.

Both BEMS participant and PG&E customer adopters agreed that energy-efficient investments are easy to understand and use; whereas Low DSM adopters and non-BEMS participants disagreed.

Only Low DSM adopters disagree that energy-efficient investments are something that all businesses should consider.

Both BEMS participant and PG&E customer adopters believe that energy-efficient investments will significantly reduce their energy bill.

In contrast to many of the above findings, BEMS participant and PG&E customer adopters did not agree that they actively advocate energy-efficient investments and practices to others. Furthermore, only Low DSM adopters intend to actively pursue energy-efficient investments in the future.

For the most part, there appears to be some transformation in attitudes that indicates positive market effects that may be attributable to the BEMS program.

Policies

Overall, there are no strong indicators of market effects. The only significant effect identified was with CAC adopters that were BEMS participants, who had a policy of selecting energy-efficient equipment.

Summary of Modeling Results

Market effects are most evident when we focus our analysis on the paths to measure adoption. The greatest evidence of market effects occurs among customers that adopt measures as a result of an energy audit, and among customers that both adopted and participated in BEMS. We see more positive attitudes towards energy efficiency among these customers, and fewer stated barriers to adoption.

Furthermore, we see some evidence of market effects among BEMS participants, in general. Perhaps the strongest evidence is the significance that BEMS participation has in predicting measure adoption. In addition, we found these customers to have strong intentions to install energy-efficient measures in the future.

IN CONCLUSION

The primary function of BEMS is to inform and encourage customers and move them closer to investment in energy efficiency, but not to "trigger" that investment to the degree that Express is intended to (and does). As such, the "bar is set high" at the outset for being able to demonstrate MT effects that can be unambiguously attributed to the BEMS program. At the same time, there is some evidence from the comparison of 1996 versus 1998 program participants suggestive of life cycle-based market effects. As discussed earlier, cohort tracking over time, with analysis controlling for own/rent and audit form, is necessary to parse out potential market effects from results of other factors.

A. BEMS/EXPRESS END-USER MARKET EFFECTS SURVEY INSTRUMENT

B. EXPRESS SUPPLY-SIDE SURVEY INSTRUMENTS

C. BUSINESS EDGE TOOL AND BEST

D. EXPRESS PROGRAM DESCRIPTION