FINAL EVALUATION, MONITORING, AND VERIFICATION (EM&V) REPORT

FOR THE ENERGYSMART GROCER PROGRAM

2004-2005

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Energy Division
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505 Van Ness Avenue
San Francisco, CA 94102

Submitted by
PWP INC.
11820 Silent Valley Lane
Gaithersburg, MD 20878

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EXECUTIVE SUMMARY

The Energy Smart Grocer (ESG) Program implemented by Portland Energy Conservation, Inc. (PECI), worked to provide information, technical assistance, and financial incentives for independent grocers to purchase and install energy efficient refrigeration, lighting and HVAC systems. The program was delivered to independent food retailers in the territories of PG&E, SCE, and SDG&E, and was planned to facilitate 1,300 retrofits over the two-year period of 2004-2005 and deliver 59,164,941 annual kWh of energy savings, according to the CPUC decision approving the program.

The methods used to evaluate the activities of the ESG program and the results achieved are discussed in this report, and follow the description set out in the EM&V plan approved by the CPUC in September 2004. To evaluate the ESG Program, the EM&V objectives of the CPUC were addressed through analysis of data collected through a combination of secondary data and program document review, on-site visits to verify installations, and interviews with program staff, participants, and key market actors, consistent with the implementation plan described by PECI and the EM&V goals and budget. Results were presented for participation, program impact, process evaluation, and baseline/market assessment.

ES.1 PROGRAM PARTICIPATION RESULTS

As summarized in Exhibit ES-1, the program exceeded its overall goals for both annual deemed savings and the number of stores with retrofits. (Note that the deemed savings numbers presented here are those reported by PECI , which include the CPUC-stipulated NTG of 0.96.)

Exhibit ES-1
Summary of Program Results, by Segment

Utility	No. of Audits Completed			No. of Stores With Rebates/Retrofits			Deemed Annual Savings (kWh)		
	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural
All	359	210	149	1357	1018	339	59,826,622	37,852,733	21,973,889
PG&E	176	116	60	464	362	102	27,564,558	15,014,742	12,549,817
SCE	132	58	74	526	346	180	19,835,642	12,637,296	7,198,347
SDG&E	51	36	15	367	310	57	12,426,421	10,200,696	2,225,726

In contrast to the 2003 program, the number of audits for 2004-05 was significantly less than the number of stores receiving rebates, for several reasons.

- A deliberate effort was made to provide every audited store with at least some direct install (DI) measures – usually either compact fluorescent (CFL) bulbs, a CoolerMiser beverage vendor controller, or a low-cost anti-sweat heater (ASH) control.

- About 130 stores installed rebated measures in 2004-2005 after having been among the 650 stores audited through the ESG program in 2003.

- As contractors became more familiar with the program, some actively sought out stores where they could install program measures without the store having completed an audit. This was particularly true for such items as strip curtains and door gaskets.

While the increased activity among contractors to install measures without audits indicates a degree of market transformation, the lower proportion of audits in 2004-05 suggests that a number of energy efficiency opportunities may have been missed as contractors focused on the "low hanging fruit" and on easily reached urban stores.

- The percentage of retrofits accounted for by rural stores (25%) is much lower than the percentage of rural audits (41%), indicating that many more non-audit retrofits were installed in urban areas as contractors focused on these stores

- The average deemed annual savings per retrofit were 75% higher for rural than for urban stores (37.2 MWh vs. 64.8 MWh). While this is due in part to the many small convenience and liquor stores in urban areas where contractors could easily install gaskets, strip curtains, and ASH controls, it also suggests that stores receiving audits were more likely to undertake additional cost-effective energy efficiency actions.

ES 2. IMPACT EVALUATION RESULTS

Since the Independent Grocer program is using Express Efficiency deemed savings for measuring energy savings, the primary emphasis of the M&V activities for most program measures was on verification of installed measures and therefore program savings. However, more detailed analysis was conducted in an effort to verify or refine deemed savings estimates for several key measures: floating head and floating suction pressure control, medium temperature anti-sweat heater control, and compact fluorescent bulbs. For all measures, the CPUC stipulated net-to-gross of 0.96 was used to calculate the evaluation results, since it was not part of the evaluation plan to address the stipulated NTG values.

Floating Head/Suction Pressure Control

Floating head/suction pressure control (FHPC/FSPC) refers to the use of a control strategy that allows the head/suction pressure in the refrigeration system to vary, or float, in response to changes in ambient temperature, thereby saving energy, particularly at night or other times when temperatures are relatively low. To assess the impact of these measures short-term monitoring data, site audit information, and manufacturers specifications were used to model the performance of refrigeration system floating head pressure controls and floating suction pressure controls for a sample of 15 grocery stores participating in the program.

Results of the modeling effort indicate that the average savings per installed horsepower (hp) of compressor was 435 kWh/hp for FHPC and 178 kWh/hp for FSPC. The savings from FHPC are lower than the deemed savings for this measure. This is likely due to the observed delta T between condensing and ambient temperature being higher than the targets and condenser capacity being undersized relative to store refrigerated load.

Calculated separately, mean FHP impacts for air-cooled condensers are somewhat higher than those for evaporative condensers (468 kWh vs. 406 kWh). While the difference between those

two means is not statistically significant, both modeled impacts are statistically significantly different from the deemed savings values of 900 kWh for air cooled and 1100 kWh for evaporative condensers. Based on these results, we drew the following conclusions:

- While the calculated impacts for FSP control are within 10% of those specified by the deemed savings, the FHP impacts are less than half the deemed savings level.

- Even with this relatively small sample, the mean calculated savings are statistically significantly different at the 95% confidence level from the deemed savings values for both air cooled and evaporative condensers.

- We therefore considered the deemed savings value for the FSP impact calculations verified, but reduced the FHP impacts per hp by 50% for calculating annual net impacts.

Anti-sweat Heater Control

For anti-sweat heater (ASH) controls on refrigerated case doors, the initial ASH measure encouraged by the 2004-2005 ESG program was a simple ASH bypass that could be overridden by a timer switch to turn the heaters on for up to 12 hours when needed. Data loggers were installed at 10 stores with this measure installed to determine how frequently the ASH were turned on, and data were also collected on the connected load of the ASH being turned off/cycled and the number of doors controlled at each of the stores.

The results showed that the impact of ASH controls depends both on the percentage of time the heaters are on and on the heating load. For connected loads of .5 amps per door (slightly lower than what newer doors with heaters were found to draw) actual impacts will always be less than deemed savings even if the heaters are never turned on; at the other extreme, impacts for ASH with connected loads of 2 amps per door (found on some older coolers) will exceed the deemed savings estimate as long as the heater is turned off at least 35-40% of the time.

- Data from stores where loggers were installed showed that the mean connected load for ASH where controllers were installed was .37 amps per foot (or .92 amps per 30" door) and the percentage of time heaters were turned on averaged less than 1%.

- Given the .37 amp/foot connected load and 99% reduction in ASH run time, annual impacts per linear foot for the timer controlled ASH controls can be calculated as 369 kWh (.37 amps * 115 volts/amp * 8760 * .99/1000.)

Because of problems in the operation of the timer-controlled ASH (i.e., condensation forming on doors because store personnel did not use the override function), the program shifted its ASH control emphasis to systems that automatically turn on the heater based on temperature and humidity sensor readings. To measure the cycling of these Altech controls, run time meters (as opposed to on-off loggers) were installed at three MT ASH control sites to show the total hours of operation for the heaters since the installation of the meters. If, as our findings with the three run-time metered Altech installations indicate, the heaters are on about 8% of the time, the .37 amp/foot connected load would result in annual savings per linear foot of 343 kWh – exactly the deemed savings value. Based on these results, we did not see any reason to revise the deemed savings estimate of impacts for medium temperature ASH controls.

CFL Bulbs

The high rate of burn-outs/removals (35.8%) observed during an initial round of site inspections prompted a more detailed analysis of retention for this measure, and a subsequent adjustment of associated impacts. A second round of verifications focusing exclusively on CFLs was conducted in early 2006. The percentage of CFLs still installed and operating ranged from zero to 100% at individual stores, and averaged 63.7% overall. Given the substantial numbers of sites with measure retention issues, the impacts attributable to CFLs were reduced by 36% in the first year and all subsequent years. While it is likely that there will be additional failures/removals in future years, we do not have a solid basis for estimating these removals, so we have reduced CFL impacts by 36% over the deemed life of the measure.

Calculation of Impacts

For other measures, site visits confirmed that the measures were installed in accordance with the operating conditions stipulated by the deemed savings terms and conditions. Once the impacts for CFLs and FHP control were adjusted and installation of measures was confirmed, energy and peak demand impacts were calculated by year in accordance with the CPUC workbook format. Savings for rebated measures by year are presented in Exhibit ES-2. The Gross Program Projected Savings are greater than those reported by PECI because the latter include the CPUC-stipulated net-to-gross of 0.96, while the *ex ante* gross savings do not.

Exhibit ES-2 – Gross ExAnte and Net Evaluation Confirmed Savings – ESG Program Total

Year	Calendar Year	Gross Program - Projected MWh Savings	Net Evaluation Confirmed Program MWh Savings	Gross Program - Projected Peak MW Savings	Evaluation Projected Peak MW Savings**
1	2004	24,281	21,479	8.00	7.46
2	2005	62,319	54,836	13.96	12.74
3	2006	62,319	54,836	13.96	12.74
4	2007	62,319	54,836	13.96	12.74
5	2008	52,078	45,037	12.80	11.62
6	2009	45,089	38,297	11.54	10.41
7	2010	43,722	36,982	10.64	9.55
8	2011	43,722	36,982	10.64	9.55
9	2012	40,767	34,615	10.24	9.20
10	2013	31,418	25,761	9.07	8.12
11	2014	31,418	25,761	9.07	8.12
12	2015	31,267	25,616	9.06	8.10
13	2016	30,145	24,539	8.94	7.99
14	2017	27,558	22,055	8.66	7.72
15	2018	24,714	20,643	8.28	7.53
16	2019	17,103	16,419	2.91	2.79
17	2020	10,711	10,290	1.50	1.44
18	2021	0	0	0	0
19	2022	0	0	0	0
20	2023	0	0	0	0
TOTAL	**2004-2023**	640,949	548,981		

While both floating head pressure and CFL impacts were adjusted based on evaluation results, most of the difference between the program projected and evaluation confirmed savings is accounted for by the reduction in FHP impacts for both air cooled and evaporative condensers.

ES 3. PROCESS EVALUATION RESULTS

The primary goal of the process evaluation activities was to provide ESG Program Managers at PECI with ongoing feedback that could be used to make timely adjustments in program design or delivery. Important findings were passed along to PECI in phone calls and documented in memos to ensure that maximum benefit could be derived from the EM&V activities.

Interviews and field observations generally confirmed earlier findings regarding the efficacy of program delivery and the critical role played by the ESG Energy Experts. As the program has evolved, however, so has the role of the Energy Experts. While they remain key players both in the delivery of the program and in the development of relationships between independent grocers and vendors, the growing number of retrofits conducted directly by contractors without a previous store audit has diminished the role of the Energy Experts.

In a telephone survey, store decision makers were asked to rate the quality of various aspects of the ESG program. Results are summarized below for two categories of stores: those that received rebates and those that received audits and direct install measures only.

Exhibit ES-3
Mean Respondent Rating of Program Elements

	Non-Direct Install		Direct Install Only		Contractors
	Unweighted	Weighted	Unweighted	Weighted	
Program promotional materials	4.7	4.9	4.7	4.8	4.0
Quality of the store audit	5.0	4.6	4.7	4.7	5.2
Technical knowledge of the program staff	5.2	5.2	4.7	4.4	4.7
Responsiveness of the program staff	5.1	5.6	4.4	4.3	5.1
Level of incentives provided by the program	4.9	5.4	4.5	4.6	5.1
Paperwork and procedures required to receive incentives	5.0	5.7	4.8	4.7	4.9
Quality of vendors	4.8	5.1	4.5	4.6	
Performance of measures installed though the program	5.0	5.7	4.5	4.6	4.7
	n=56 resp., 303 stores		n=35 resp., 56 stores		n=20

*Respondents were asked to rate each attribute on a 1 to 6 scale, where 1 is very poor and 6 is excellent

The results show that store decision makers are quite satisfied with the program overall, with all of the program elements receiving ratings of 4.3 or higher on a 1 to 6 scale. Stores receiving more than direct install measures tended to assign higher ratings to all of the program elements, although the differences were statistically significant at the 90% confidence level only for the technical knowledge of the program staff and the responsiveness of the program staff.

Contractor perspectives on the various program elements, also presented in the table, reflect a high level of satisfaction with most program elements, particularly the quality of the store audit, the responsiveness of program staff, and the level of incentives. Contractors were less satisfied with program promotional materials, which received the lowest mean rating.

Store decision makers were also asked to rate the value of various program elements in helping them overcome barriers to the installation of energy efficient equipment in their stores.

Exhibit ES-4
Perceived Value of Program Elements

	Non-Direct Install		Direct Install	
	Unweighted	Weighted	Unweighted	Weighted
Audits	4.9	5.1	4.3	4.0
Technical assistance	4.8	5.0	4.3	4.1
Informational brochures	4.2	4.7	4.3	4.2
Demonstration stores	3.6	3.3	3.9	3.9
Rebates/incentives	5.2	5.7	4.7	4.8
Web-based information	3.4	4.4	3.5	3.3
Training for staff	3.4	3.8	3.5	3.4
Financing	3.6	2.3	3.7	3.6

* Respondents were asked: On a scale of 1 to 6, where 1 is not at all helpful and 6 is very helpful, how helpful would you find each of the following in promoting energy efficient equipment at your stores

Consistent with the ratings of ESG program elements analyzed above, non-direct install respondents gave the highest ratings to the value of incentives, followed by audits and technical assistance. Since direct install stores – which include more small convenience stores and liquor stores – placed a relatively high value on financing, there may be opportunities to incorporate this program feature into future offerings targeted to smaller stores.

ES 4. MARKET BASELINE AND MARKET EVALUATION

Both audit data and contractor reported estimates of the percentage of stores with specific technologies were used to assess the baseline technologies currently in place, while surveys of store decision makers were used to investigate perceived barriers and decision making.

The audit database created by the ESG Program includes data on existing lighting, HVAC and refrigeration equipment for more than 1,000 stores audited from 2003 through 2005, and provided the following findings.

Audit Data: Lighting.--While the total feet of T12 lamps in audited stores (more than 7 million feet) exceeds the total of T8 lamps, the number of T8s (47%) exceeds either the standard (42%) or energy saver T12s (11%) individually, while there are virtually no T5s (<.05%), suggesting that there are still significant opportunities within the independent grocer sector to improve energy efficiency through lighting retrofits. The total number of lamp-feet of T12 to T8 replacements for the 2003 and 2004/05 programs combined amounted to approximately 47,000 feet (plus about 8,000 feet of delamping), or less than 1% of the potential for the audited stores.)

Audit Data: Refrigeration.-- Refrigerated case audit data were analyzed separately for walk-ins and conventional cases. Audit results indicate that the walk-in cases represent numerous opportunities for increased energy efficiency that the ESG program successfully exploited, but also illustrate the relatively modest penetration in terms of the percentage of potential realized.

- Only about one-third of walk-ins in audited stores had strip curtains, indicating that, at a minimum, more than 3,000 doors could have had strip curtains installed (many walk ins have more than one door, so the actual number of potential installations would be greater.) Strip curtains are rebated by the square foot, so the 14,734 square feet of strip curtains rebated by the program for 2004-05 represent approximately 700 3' x 7' doors, or less than one-fourth the potential identified in the audits.

- Similarly, about-one third of walk-ins were identified as having door gaskets that were in poor condition, representing some (1587 doors times 7+7+4) 26,000 linear feet of gaskets. The 2004/5 ESG program rebated 2100 linear feet of walk-in door gaskets, representing less than 10 percent of the gaskets on walk-ins identified as in poor condition.

- Moreover, most strip curtains and gaskets installed through the program were in stores that did not receive an audit, but were approached directly by a contractor.

- There are also opportunities to replace non-walk-in open cases with closed, particularly the 7.3% of low temperature cases (roughly 3 open 8-foot cases per audited store) that currently do not have doors. In addition, most medium temperature cases are open, and replacing those with closed cases (as provided for by the Energy Smart Grocer program) offers significant potential savings.

Contractor Estimates: Additional baseline data are provided by contractor estimates of the percentage of stores with specific technologies, presented below.

Exhibit ES-5 -- Contractor Estimates of Technology Penetration

Among the food stores that you service, approximately what percentage have each of the following technologies in place:	Percent of Stores
Energy Management Systems	55%
Floating head pressure controls	37%
Multiplexed compressors	44%
Night covers for refrigerated cases (for stores not open 24/7)	24%
Cycling of anti-sweat heaters/ controls for anti-sweat heaters	41%
Permanent Split Capacitor (PSC) evaporator fan motors	32%
Electronically commutated (ECM) evaporator fan motors	20%
What percent of freezer (low temperature) cases have doors?	70%
What percent of (MT) refrigerated cases have doors?	28%
What percent of case doors are low/no heat?	32%

As with the results of the audits, these findings indicate good penetration of many energy efficient technologies, but also highlight the extent to which further savings are possible. Contractor responses also indicate that, on average, 60% of the energy efficient measures they installed over the past 3 years involved a rebate, so that most of the high efficiency measures previously installed in audited stores were the result of either the ESG program or other utility rebate programs. Moreover, the percentage installed without rebates includes larger chains serviced by these contractors, and many chains simply do not bother with incentives.

In conclusion, it appears from the current mix of installed technologies that the ESG Program has targeted measures where ample opportunities existed for efficiency improvements and that the rebated measures do not constitute standard practice in the independent grocer market.

Perceived Barriers.--Responses to questions regarding perceived barriers to energy efficiency among store decision makers show that, for participants who received rebates, perceptions of barriers to energy efficiency do not appear to be significantly different from those reported by participants in the 2003 ESG program, particularly with regard to such key issues as obtaining estimates of potential savings (3.7 for 2003 vs. 3.9 for 2004/5), payback concerns for efficient equipment (3.7 vs. 3.6), and the difficulty of getting trustworthy technical advice (3.3 vs. 3.1). Compared to 2003 respondents, 2004/5 participants assigned somewhat higher ratings to the role of decisions made at corporate headquarters and the difficulty of obtaining financing.

Direct-install-only participants in the 2004-2005 program appear to consider it less difficult to find reliable estimates of potential energy savings than did 2003 participants who received no rebates or rebates of less than $100. The lower barriers for direct-install only participants are encouraging in that they suggest decision maker attitudes were changed at least somewhat by their involvement with the program. Unlike many of the 2004-2005 participants who received rebates, almost all of the direct install participants had face-to-face interaction with the program's Energy Experts, which may have contributed to their reduced perceptions of the importance of barriers.

Decision Making.--In addition to baseline issues, the market evaluation investigated decision making among program participants and found the following.

- Overwhelmingly, both direct install stores and those who received rebates said they participated in the ESG program primarily to reduce their utility bills or, to a lesser extent, save energy. Fewer than 10% of respondents said they participated primarily to take advantage of the rebates.

- Many participants in the program appear to recognize the growing importance of energy efficiency: over half of respondents who received rebates say that their emphasis on energy has increased (compared to 40% of direct install participants,) which may help explain why they were motivated to take action through the ESG program.

- Respondents who received rebates were also more likely to anticipate a greater proportion of energy efficient equipment in the future: two-thirds of participants who received rebates expect a higher percentage of energy efficient equipment in their stores in the future, compared to fewer than half of direct install participants. This tends to support the view that decision makers with an out-of-pocket investment in energy efficiency are more likely to be committed to improving the overall efficiency of their stores in the future.

- The commitment to improving energy efficiency appears to be at least partly dependent upon the availability of incentives. Only 25% of non-direct install customers and 40% of direct install participants said that they would be very likely to undertake additional energy efficiency actions if the ESG program were no longer offered, while 31% of non-direct install and 23% of direct install participant would be very unlikely to do so.

ES 5. CONCLUSIONS AND RECOMMENDATIONS

The 2004-2005 ESG program built on the success of the 2003 program in that it installed measures in more than 1350 stores, provided audits to 359, and successfully reached both smaller stores (through contractors) and rural stores (through audits and direct installs). While the overall goal of the program – targeting independent grocery stores – remained unchanged in 2004-2005, we found that several aspects of the implementation and delivery of the ESG program differed from the 2003 program approach:

- Greater emphasis on impacts rather than reaching a hard-to-reach market, with no reporting of the percentage of rural stores contacted by the program

- Reliance on contractors rather than program staff to deliver low cost measures to many stores, which extended program reach into many new stores (e.g., liquor stores, small convenience stores). This meant a more limited role for the ESG Energy Experts, and therefore less education and training of store owners and decision makers, with more potential savings left unrealized. (Annual deemed savings per rebated/retrofitted store averaged 44,087 kWh in 2004-2005, vs. 70,194 kWh in 2003.)

- Fewer audits and therefore less use of the GrocerSmart audit tool reduced the amount of information conveyed during the course of a "typical" retrofit.

The number of vendors offering qualifying measures to independent grocers grew significantly during the ESG program, and a growing proportion of retrofits was initiated by contractors in stores that had not had an audit. In all, 64% of the retrofits completed through the 2004-2005 program were done by vendors in stores that had never had an audit.

The program reached its goals in terms of the number of retrofits and the amount of deemed savings. However, evaluation confirmed annual impacts were 8.7% less than deemed savings, primarily because of the reduced savings calculated for Floating Head Pressure control. The evaluation also found issues relating to impacts for several other measures. Specifically, the high rate of failures/removals for screw-in CFLs after just one year suggests that CFLs are not an appropriate measure as the lead-in to additional energy efficiency actions. The high failure rate, particularly in freezer applications, not only limits the actual savings from this measure but also supports the perception that energy efficient technologies are inherently unreliable.

Such low cost measures as gasket repair, auto closers, ASH control and evaporator fan control offer opportunities for significant savings in the most difficult part of the market – liquor stores and convenience/gas station stores, where they can deliver savings that the owner can actually see on the bill.

- The ASH control timer switch was (correctly) pulled from some markets, but it still appears to make sense for some applications in dry climates, where it is an easily sold low cost application that can provide significant savings, as long as adequate support is provided. In other regions, ASH controls such as the Altech or similar systems remove the risk of store operators failing to turn on the heater when necessary.

- Because ASH control impacts depend critically on the connected load of the heater being controlled, we recommend that incentives associated with ASH control vary with the measured load of heaters on the doors being controlled.

Issues surrounding both CFLs and timer controlled ASH controls call attention to the importance of ongoing outside support and education for small store owners.

- The ESG program provided this kind of support to a greater degree in 2003, when more stores were audited, giving the program's Energy Experts an opportunity to sit down and review all the measures and actions that a food store can take to save energy.

- Having contractors fill that role is effective for knowledgeable contractors working with a (relatively) large chain, but does not seem to work for smaller stores. To make small, low-cost measure jobs profitable, contractors minimize their selling and education time at small stores; instead they rely on rebates to make the decision to install a few measures essentially a no-brainer, so that they can go in, complete the job, and move on.

- In addition to lacking the time to educate decision makers, contractors also do not enjoy the level of trust that the Energy Experts have developed over the past several years.

Overall, the Energy Smart Grocer program has been very successful in moving a traditionally underserved market segment toward greater energy efficiency through a mix of program elements and a highly responsive adaptive management strategy. Both the results achieved and the high degree of satisfaction expressed by respondents regarding the various program elements indicate that the 2004-2005 ESG program strategies have been successful. Indicators of this success include:

- To streamline the participation process, the ESG made numerous mid-course corrections to attempt to increase the amount of information transfer for stores that conducted retrofits through contractors, including contractor briefings, follow-up phone calls and visits, and leave behind information addressing operating considerations for the installed measures (particularly for timer-controlled ASH controls).

- Baseline data collected from stores and contractors indicate that the measures and technologies promoted by the ESG program are far from baseline practice in independent grocery stores; contractor and participant responses also suggest that most customers will not take energy efficiency actions in the absence of some kind of incentives.

- There is also evidence that program participation appears to reduce the level of barriers perceived by store owners, in that owners whose stores receive only direct install measures perceive somewhat higher barriers than those who pursue additional energy efficiency opportunities through the program. As another indication of the influence of the ESG program, perceived barriers were lower for customers who received direct-install measures only in 2004-2005 than for customers who received rebates of less than $100 in 2003.

1. INTRODUCTION

This report presents the Evaluation, Monitoring, and Verification (EM&V) of the 2004-2005 Energy Smart Grocer (ESG) Program implemented by Portland Energy Conservation, Inc. (PECI). It should be noted that many EM&V activities have been conducted in real time, with feedback offered to the program implementation staff as EM&V activities were conducted and results were obtained. This report documents those earlier findings, even though some of them will already have been acted on by the program management. The EM&V report was prepared at the request of the California Public Utilities Commission and managed by the CPUC Energy Division. It was funded through the public goods charge (PGC) for energy efficiency and is available for download at www.calmac.org.

In the remainder of this first section, we provide an overview of the ESG program, a discussion of the program's goals, and a summary of the program's results. The next section describes the approach that was used for the EM&V, including evaluation objectives and data sources. In Section 3, we present the results of the EM&V effort, including a discussion of program participation and results of the impact, process, and market evaluations. Finally, we offer conclusions and recommendations for the program moving forward.

1.1 PROGRAM DESCRIPTION

The Energy Smart Grocer (ESG) Program implemented by Portland Energy Conservation, Inc. (PECI), worked to provide information, technical assistance, and financial incentives for independent grocers to purchase and install energy efficient lighting, refrigeration and HVAC systems. The program was delivered to independent food retailers in the territories of PG&E, SCE, and SDG&E.

It was originally intended that the wholesaler serving independent grocers would play a pivotal role in delivering the program, to mirror the energy-efficiency expertise that larger chains receive from their in-house corporate support function. In practice, however, the role of the wholesalers has been more limited. While the major wholesalers helped the 2003 ESG program become established initially, they had essentially no involvement in the 2004-2005 program. Instead, the key players in the program have been the ESG program's Energy Experts and a network of contractors/suppliers. The Energy Experts conducted audits, made recommendations, and provided both technical and project management assistance, while participating contractors provided products and services in the context of the ESG program and incentive structure.

The program was planned to facilitate 1,300 retrofits over the two-year period of 2004-2005 and deliver 59,164,941 annual kWh of energy savings, according to the CPUC decision approving the program. While many program goals were consistent with those of the previous 2003 program, there were several notable changes:

- Even though the program description in the EM&V RFP noted that at least 20% of the grocers served were to be outside the large urban areas of San Francisco, Oakland, San Jose, Los Angeles, and San Diego, the workbooks PECI was required to submit to the CPUC did not require a breakout of non-urban stores.

- There appears to have been more emphasis on resource acquisition and less emphasis on transforming the market by educating independent grocers about energy efficiency.

- No explicit goals were set for the number of audits; instead, goals were framed in terms of the number of retrofits and kWh saved. This allowed the program to leverage the activities of contractors who installed measures at stores that had not received audits, but it limited the interaction between the program's Energy Experts and decision makers at those stores. While there were still contacts between the Energy Experts and owners of non-audited stores, the lack of audits for those stores diminished a valuable educational component of the program.

1.2 ACTIVITIES/RESULTS

Since its initiation in January 2004, the current ESG program has exceeded its overall goal of deemed annual savings, as summarized in Exhibit 1.

Exhibit 1
Summary of Program Results

Utility	Rebates/ Retrofits Total	Annual Deemed Savings (kWh) Total
All	1,357	59,826,622
PG&E	464	27,564,558
SCE	526	19,835,642
SDG&E	367	12,426,421

Building on the relationships and infrastructure to deliver energy efficiency services to independent grocers developed during the 2003 program, the number and volume of retrofits and rebates increased steadily throughout 2004 and 2005. Retrofit and rebate activity continued into early 2006 as a number of planned projects reached completion.

The methods used to evaluate the activities of the ESG program and the results achieved are discussed in the following sections of this report, and follow the description set out in the EM&V plan approved by the CPUC in September 2004.

2. APPROACH

This section presents the approach that was used for the EM&V activities. As stated in the CPUC directive, the following are the EM&V objectives of the Commission:

- Measuring level of energy and peak demand savings achieved

- Measuring cost-effectiveness

- Providing up-front market assessments and baseline analysis, especially for new programs

- Providing ongoing feedback, and corrective and constructive guidance regarding the implementation of programs

- Measuring indicators of the effectiveness of specific programs, including testing of the assumptions that underlie the program theory and approach

- Assessing the overall levels of performance and success of programs

- Informing decisions regarding compensation and final payments

- Helping to assess whether there is a continuing need for the program.

In approaching the above objectives, we have explicitly mapped these requirements to the traditional market, process, and impact components of an evaluation to ensure 1) that appropriate resources are allocated to each task, and 2) to use those resources efficiently by grouping related tasks and using a single data collection activity to address multiple objectives. Our approach to each of the CPUC Policy Manual Goals outlined in the RFP is presented in Exhibit 2. Note that several of the research objectives fall under more than one of the above tasks, since findings from more than one evaluation activity were used to provide the needed analysis and recommendations.

Many of the EM&V activities for the 2004-5 program evaluation represent a continuation of activities performed for the 2003 program; this affects the relative importance of various EM&V goals. As explained in the California Evaluation Framework, the fact that this is not a brand new program means that the need to revisit process evaluation and baseline issues is less urgent than it was in the program's first year. Nevertheless, both baseline issues and ongoing process evaluation feedback to support program improvements have been addressed in some detail over the course of this evaluation.

Exhibit 2
Addressing the CPUC Policy Manual Goals

CPUC/Policy Manual Evaluation Goal	Priority for ESG EM&V (from RFP)	How the plan addresses the goal or justification for not doing so:	Issues of concern, if any:
Measure energy and peak savings*	**Critical**	For floating head pressure (FHP), floating suction pressure (FSP), and medium temp anti-sweat heater control (MT-ASH), use monitoring data. For other measures, deemed savings approach, using Express Efficiency values	
IPMVP Option or justification for not meeting IPMVP		Option A: Partially Measured Retrofit Isolation. We are a) verifying the installation and the proper operation of the system through the collection of monitoring data that allow isolation of the relevant energy flows associated with the retrofit and b) gathering pre- and post-retrofit data that isolates the measure in question and using it to developing an alternative estimate of savings that will either confirm or refine the deemed savings numbers.	For other measures, stipulated values under deemed savings approach include measure connected load and assumed hours of operation. Hours of operation will be verified using GrocerSmart audit tool; connected load will not.
Measurement (and/or impact)		Monitoring of 40-60 sites for FHP and FSC, 20 sites for MT-ASH	Persistence of some measures (CFLs, strip curtains, gaskets) is a potential issue.
Sampling plan, adequacy, non-biased (for each data collection element)		120 stores with installed measures will be verified and owners/ decision makers interviewed.	Stores will be selected at random, in proportion to the number in each IOU territory and to the number of participants in non-urban (HTR) areas.
Analytical method(s) & data sources explained		GrocerSmart database provides engineering estimates of savings, which can be compared to deemed savings calculations.	Comparison of GrocerSmart and deemed savings estimates is for information only; larger impacts can not be claimed.
Method for peak demand estimates		For floating head pressure, floating suction pressure, and medium temp anti-sweat heater control, use monitoring data. For other measures, verify calculations using deemed savings	Variations between deemed savings and impacts calculated by GrocerSmart will be identified.
Net-to-gross methodology		Verify calculations using monitoring results, deemed savings and CPUC-stipulated net to gross.	
Program cost-effectiveness*	**Critical**	Compare verified net impacts with program costs to confirm program cost-effectiveness	
Provide upfront market assessment and baseline analysis	**Program has extensive baseline information**	GrocerSmart database provides detailed information on pre-participation baseline for all stores audited to date. Interviews with vendors will be used to assess availability, stocking, standard installation of EE measures	
Provide ongoing feedback and guidance	**Secondary**	Several interim memos will be prepared to provide real-time feedback to ESG program staff.	
Process evaluation design		Interviews will be conducted with program central office and field staff, participating vendors, wholesaler representatives, and participating stores	Program staff will be chosen for interviews; vendors will be selected at random, but sample size will not be large enough to ensure statistical accuracy.
Sampling plan, adequacy		In addition to interviews conducted with owners at the time of measure verification, interviews will be conducted with 40 stores that completed audits but received only direct-install measures	Stores will be selected at random, in proportion to the number in each IOU territory and to the number of participants in non-urban (HTR) areas.
Measure indicators of effectiveness and testing program theory (PT/LM) and approach	**Secondary**	Interviews with decision makers, program staff, and vendors will examine appropriateness of program design and implementation assumptions.	
Assess the overall levels of performance and success	**Critical**	In addition to verifying impacts, store visits and interviews will address changes in owner knowledge, attitudes, willingness/ability to manage energy. Interviews with vendors will address program's success in changing vendor practices and attitudes.	
Inform decisions regarding compensation and final payments	**Critical**	Verify cost-benefit calculations using monitoring data	
Help assess the continuing need for the program	**Critical**	Decision maker, vendor, and other interviews will determine the extent to which store owners have acquired knowledge of/access to EE measures, as well as the market's willingness/ability to provide those measures in the absence of the ESG program.	

2.2 DATA SOURCES

The EM&V goals described above were addressed through analysis of data collected through a combination of secondary data and program document review, on-site visits to verify installations, and interviews with program staff, participants, and key market actors, consistent with the implementation plan described by PECI and the EM&V goals and budget. Each of these data sources is discussed below.

2.2.1 Document Review and Secondary Data

Review and analysis of the "paper trail" for each aspect of the program was used to provide a thorough understanding of how the program is being implemented. In addition, a review of program documents was used to look for variances between planned and actual implementation; internal documents also provided information on quantitative measures of program activity, such as number of audits conducted and measures installed. PECI provided the evaluator with access to the full program Access database, with new versions made available via PECI's ftp site as the database was updated.

Since the program used stipulated savings values, program data also served as the basis for estimated impacts. These numbers were reviewed for consistency with the equipment observed during on-site visits, as well as for computational accuracy.

2.2.2 Primary Data

Primary data were collected directly from program staff and subcontractors, program participants, and other market actors. The EnergySmart Grocer program has built strong relationships with multiple market players, including wholesalers, retailers, installation contractors, equipment suppliers, and equipment manufacturers. It was important to track these relationships to determine whether program messages were received and practices were affected. We used both site visits to participating stores and telephone interviews with other players as our method of collecting primary data. The following groups of market actors were the subject of primary data collection efforts.

Program Staff and Subcontractors—We were in regular contact with EnergySmart Grocer program staff for the duration of the EM&V effort, and conducted numerous informal interviews with key staff and subcontractors to get their insights into program progress, adjustments, and challenges.

Program Participants—A key data collection effort for the M&V aspect of this project were the site visits to a sample of participating stores to confirm measure installation. We conducted such visits to approximately 10 percent of all sites with rebated measures installed through the program. We also surveyed 56 store decision makers with responsibility for 269 stores regarding perceptions of the program and the implementation process. (Note that the number of decision makers interviewed was less than the number of stores because some decision makers are responsible for multiple stores.) In addition to verifying that measures have been installed, the site visits were used to review the application and operating conditions of the measures to ensure that program terms and conditions were met. To meet the requirements of IPMVP Option A, for several measures (floating head pressure, floating suction pressure,

medium temperature anti-sweat heater control) site visits were used to collect metered data in support of the impact evaluation.

Surveys were also conducted with 35 decision makers for 56 stores that completed audits but received only direct-install measures. Reasons for their failure to install rebated measures were investigated, as were decision maker perceptions and attitudes toward energy efficiency.

Equipment Manufacturers/Distributors — Because of their depth of in-house expertise and their experience, major national manufacturers often exert considerable influence in equipment selection decisions, especially for specialized refrigeration equipment. The markets for refrigeration cases, compressors, and valves are dominated by a few manufacturers, and we spoke with local manufacturers representatives of these major players to assess their perceptions of the program and the extent to which they believe it has influenced the market.

Wholesalers — The existing relationship between independent grocers and their wholesaler was important to the initial acceptance of the EnergySmart Grocer program, but it has become less important as the direct relationship between the ESG Energy Experts and store owners/managers appears to have become more significant. We nevertheless made contact with representatives of the participating wholesaler to provide a somewhat broader perspective on the retail food market.

Suppliers/Service Providers — Local contractors supplement (and often supplant) in-house store maintenance organizations, playing a critical role in the installation and operation of energy-using equipment – particularly for smaller groceries and independents. Interviews were conducted with 20 refrigeration contractors who were familiar with and had at least some contact with the program.

Associations, Industry Experts — Information was obtained from trade associations in the form of published data, including trade publications, directories, and web sites.

Survey instruments are attached in Appendix A to this report.

2.3 SAMPLE FRAME

The sample frame for the data collection efforts is presented in Exhibit 3.

Exhibit 3
2004-2005 EnergySmart Grocer Program Evaluation
Sample Frame

Survey type / Market Actors	Verification	Telephone Survey
Participants		
Installed Recommended Measures	125	271 (stores)
PG&E	55	23 decision makers
SCE	45	20 decision makers
SDG&E	25	13 decision makers
Direct-Install Measures Only		35 dec. mkrs; 56 stores
Wholesaler Staff		1
Manufacturers' Reps		5
Contractors		20
Associations/observers		2
Implementation Staff		9
Field Monitoring		
Floating Head Pressure	10	
Floating Suction Pressure	10	
Medium Temperature Anti-Sweat Heater Control	13	

Note that 125 installations were confirmed through on-site inspection. Surveys were also conducted with decision makers representing 271 stores to address market and process evaluation issues. In addition, field data were collected for the 15 stores that were used to model floating head pressure and/or floating suction pressure controls (as well as 10 that were not used in the modeling effort), and for 13 stores where medium temperature anti-sweat heater controls are installed. We had originally planned to collect data from 20 MT ASH sites using on-off data loggers that track when the override feature of the ASH control was engaged. It was found, however, that the failure of store operators to override the controls in some instances led to condensation in some climate zones; as a result, the Energy Smart Grocer program retrofitted a number of the simpler ASH switches with more complex models that did not lend themselves to simple data logging, as discussed in the impact section below.

The visited store sample was developed by taking every 10th store with measures installed into the sample at the time the visits were conducted, and was therefore representative of the population by utility territory, urban/non-urban location, size, and other factors. For a proportion of p=0.5 (e.g., where 50% of sampled stores say they intend to take a given action within the next year) a sample of 120 yields a proportion confidence interval of 0.411-0.589 at the 95% confidence level, for a relative accuracy of $\pm$18%. Attaining a relative accuracy of $\pm$10% at the 95% confidence level would require a sample of almost 400 for p=0.5 and of 900 for p=0.3, and we believe the level of precision provided by the 120-point sample should be adequate.

To the extent that findings regarding the impact of floating head pressure (FHP) control are based on a limited number of sites used in modeling impacts, there is considerable uncertainty surrounding the resulting impact estimates. Nevertheless, we have adjusted the FHP impacts using the best data available, and we believe more research on this (with a larger sample contributing to the modeling effort) would be worthwhile.

3. RESULTS

This section summarizes the results of the evaluation. The section begins with an analysis of program participation by audit status, utility and rural vs. urban. Next we discuss the impacts associated with the measures installed through the program, including both direct calculation of impacts from metered/logged data collected on site and verification of deemed savings. A discussion of the effectiveness of program delivery is presented in the results of the process evaluation. Finally, results of the baseline assessment and market evaluation are presented.

3.1 PROGRAM PARTICIPATION

In addition to the overall participation data summarized in section 1, program results were analyzed by utility and -- even though the 20 percent rural participation originally included in the program goals were not formally included in the ESG Program's reporting to the CPUC – by urban and rural stores. Note that the deemed annual savings reported by PECI incorporate the 0.96 net-to-gross value stipulated for program measures by the CPUC.

Exhibit 4
Summary of Program Results, by Segment

	No. of Audits Completed			No. of Stores With Rebates/Retrofits			Deemed Annual Savings (kWh)		
Utility	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural
All	359	210	149	1357	1018	339	59,826,622	37,852,733	21,973,889
PG&E	176	116	60	464	362	102	27,564,558	15,014,742	12,549,817
SCE	132	58	74	526	346	180	19,835,642	12,637,296	7,198,347
SDG&E	51	36	15	367	310	57	12,426,421	10,200,696	2,225,726

It appears that the ESG program, in addition to reaching its targeted number of retrofits and deemed savings, achieved its earlier goal of reaching out to the non-urban independent grocer market, both in terms of the number of retrofits and in terms of the deemed savings associated with measure installations. It should be noted that the definition of "rural" means that stores are located outside the Standard Metropolitan Statistical Areas (SMSAs) of San Francisco, Oakland, San Jose, Sacramento, Los Angeles, and San Diego. As such, these rural stores include many that are located in suburban areas that would not ordinarily be considered rural. Non-urban stores actually accounted for well over 20% of program participation, whether defined by the number of audits (41% of the total), the number of retrofits completed (25%) or estimated program impacts based on deemed savings (37%). SCE's territory had the highest proportion of rural stores with retrofits (34%), while SDG&E's had the lowest (15.5%).

The number of audits for 2004-05 was significantly less than the number of stores receiving rebates – unlike 2003 when only 370 of 650 audited stores received retrofits/rebates. The higher ratio of installations/retrofits to audits can be attributed to several factors:

- A deliberate effort was made to provide every audited store with at least some direct install (DI) measures – usually either CFL bulbs, a CoolerMiser beverage vendor controller, or a low-cost anti-sweat heater (ASH) control.

- Some stores took action in 2004-2005 after having been among the 650 stores audited through the ESG program in 2003.

- As contractors became more familiar with the program, some actively sought out stores where they could install program measures without the store having completed an audit. This was particularly true for such items as strip curtains and door gaskets.

While the increased activity among contractors to install measures without audits indicates a degree of market transformation, the lower proportion of audits in 2004-05 suggests that a number of energy efficiency opportunities may have been missed as contractors focused on the "low hanging fruit" and on easily reached urban stores. The following findings support this hypothesis:

- The percentage of retrofits in rural stores is much lower than the percentage of rural audits (25% vs. 41%), indicating that many more non-audit retrofits were installed in urban areas as contractors focused on these stores

- The average deemed savings per retrofit were 75% higher for rural than for urban stores (37.2 MWh vs. 64.8 MWh). While this is due in part to the many small convenience and liquor stores in urban areas where contractors could easily install such measures as gaskets, strip curtains, and ASH controls, it also suggests that stores receiving audits were more likely to undertake additional cost-effective energy efficiency actions.

The relative roles of audits and contractors in driving direct-install-only (DI) and non-direct install (non-DI) retrofits can be examined further by analyzing the breakdown of various types of retrofits, as shown in Exhibit 5.

Exhibit 5 -- Audits and Retrofits

Unique Stores with any retrofit in 2004/2005	1,357
Stores never audited with non DI retrofit in 2004/2005	868
Stores audited in 2004/5 with DI retrofits only in 2004/2005	161
Stores audited in 2004/5 with non-DI retrofits in 2004/2005	198
Stores audited in 2003 with non-DI retrofits in 2004/2005	130

Among the 998 stores that installed retrofits without having an audit in 2004/2005, about 13% were following up on a 2003 audit, while 87% (or 64% of all stores with retrofits in 2004/2005) never had an audit. This reinforces the finding that 2004/2005 program results were much more contractor-driven than those for the 2003 program. As noted previously, this helped the program achieve its impact goals, but it probably limited the ability of the ESG program to inform and educate store decision makers. First, previous survey results found that the GrocerSmart audit tool was a valuable means of making owners more aware of energy usage patterns and energy efficiency opportunities in their stores, and second, the greater reliance on

contractors reduced the interaction with the program Energy Experts that had reinforced the results of the audit and encouraged greater follow-up.

3.2 PROGRAM IMPACTS

Since the Independent Grocer program is using Express Efficiency deemed savings for measuring energy savings, the primary emphasis of the M&V activities for most program measures was on verification of installed measures and therefore program savings. However, more detailed analysis was conducted for several key measures: floating head and floating suction pressure control, medium temperature anti-sweat heater control, and compact fluorescent bulbs. Results for each of these measures are discussed below.

3.2.1 Floating Head/Suction Pressure

Short-term monitoring data, site audit information, and manufacturers specifications were used to model the performance of refrigeration system floating head pressure controls (FHPC) and floating suction pressure controls (FSPC) for a sample of grocery stores participating in the Energy Smart Grocer (ESG) program. This section of the report describes the refrigeration model inputs, assumptions, methodology, and results of this evaluation.

Approach

A refrigeration model was used to calculate energy savings from FHPC and FSPC on a sample of 15 stores. All 15 of the sites implemented FHPC, but only 8 of the sites implemented FSPC. The inputs to the model include store refrigeration load, condenser specifications, compressor performance data, as well as suction and head pressure control set points before and after measure implementation.

Each store was audited as part of the Energy Smart Grocer program. As part of the audit the store refrigerated cases and walk-ins were inventoried by case type and product. Average case load data compiled from Hussmann catalogues was used in conjunction with the audit data to estimate the total store refrigeration load.

Compressor sizes, quantities, suction temperature, and refrigerants used were provided by the refrigeration contractor for each site evaluated. Compressor performance data was obtained from Copeland for compressors of equivalent size and refrigerant. This performance data was used in the refrigeration model to determine compressor capacity and power consumption at varying suction and head pressures.

Refrigeration systems were monitored by the refrigeration contractor at 10 minute intervals for six days before and six days after the measures were implemented. The monitored data included suction pressure and condensing pressure for each discrete system. The monitored suction pressures were used to determine the set point used in the model. A fixed set point was used in the model base case, and post-install case for sites implementing FSPC measures. The monitored head pressure was used to determine the fixed set point in the base case, and the fixed delta T to ambient temperature in the post-install case. Because a minimum head pressure was maintained at low ambient conditions, the average delta T was calculated from points where the ambient temperature is above 50°F.

Refrigeration Model

The refrigeration model uses a bin method approach to estimate the energy use of the refrigeration system; that is, we determined the savings from the use of FHP for various five-degree ranges or "bins" of ambient temperature and then calculated savings over the course of a typical year based on the number of hours of each ambient temperature bin that would be expected. Weather data from the California Energy Commission's California Thermal Zones (CTZ) were used in the bin simulations. Site specific data from store audits were used to determine refrigeration loads for refrigerated cases and walk-ins. An average evaporator duty of 78% was used to determine total refrigeration loads. This duty factor is based on experience with average loads compared to design loads.

The performance of system compressors was based on specifications from Copeland, who supplies compressors for the majority of grocery applications. The performance was adjusted for the observed suction and discharge pressures for each specific system and the operating characteristics observed in pre and post monitoring data.

The performance (capacity and efficiency) of condensing equipment was likewise corrected for outside air temperature in each bin. The capacity was also corrected linearly for the number of fans that are running at a time, or the fan speed, as per guidelines from condenser manufacturers.

The operating condensing temperature (and thus head pressure) for each bin was determined from a numerical solution method. Numerical methods are needed to solve for head pressure because of the interdependences among system components. For example, the compressor efficiency depends on the condensing temperature. The condensing temperature depends on how much heat the system needs to reject. One contribution to the heat rejection needed is the compressor heat output, which depends on the compressor efficiency. The cyclical nature of the related factors necessitates numerical solving techniques. The model starts with a guess of the condensing temperature, determines the system loads under this condition (i.e. heat rejection capacity needed), and then compares them with the heat rejection capacity. It then calculates a guess that will better match capacity with loads. The model continues to make improved guesses until the capacity and loads of the condensers are matched. The system has a natural equilibrium because higher condensing temperatures increase the capacity of the condensers, and lower condensing temperatures decrease the capacity of the condensers.

Floating Suction Pressure Controls (FSPC)

The pressure at which the refrigerant leaves the evaporators and enters the compressors is the suction pressure. The baseline systems are controlled using simple pressure switches to maintain design suction pressure at all times, regardless of the refrigeration load. This means that the systems are at all times able to deliver design capacity in the cases and walk-ins.

By floating the suction pressure based on case load, it is possible to raise the evaporator temperature by an average of 2° to 5° F. This greatly reduces the amount of work that the compressors need to perform, resulting in energy savings. Refrigeration controls can affect this by measuring the discharge air temperature in representative cases. The suction pressure can

then be controlled to supply the maximum suction pressure that can still meet the discharge air temperature set points on all the circuits on the rack.

This scenario was modeled based on the average increase in suction temperature observed in the post-installation monitoring data. Compressor specifications in the proposed case reflect a weighted average of loaded and unloaded conditions to simulate this change.

Floating Head Pressure Control (FHPC)

The head pressure (condensing pressure) for the refrigeration racks is constant under the baseline controls. The baseline systems are controlled using simple pressure switches to maintain design head pressure at all times, regardless of the outside air temperature. The capacity of the condenser depends linearly on the temperature difference (delta T) between the loop temperature and outside air temperature . The capacity also depends on the number of fans that are on, or the speed of fans equipped variable frequency drives, and manufacturers estimate that the natural convection capacity (i.e. when fans are off) is close enough to zero to be ignored. Therefore, when fans are off, the capacity of the condenser is greatly diminished, and the head pressure increases accordingly.

The basis of the FHPC measure is to control the condenser fans better to ensure that the condensing pressure is kept low, particularly when the weather is mild or cool. The strategy is to control the fans to maintain a fixed delta T across the condenser. Actual delta T values were calculated from the monitoring data for use in this analysis. For air-cooled condensers serving low temperature systems the target delta T is 8°F and for air-cooled condensers serving medium temperature systems the target delta T is 12°F. For evaporative condensers the target delta T is 18°F. However, the target delta T can only be achieved if the condenser is sufficiently sized. This strategy will bring the condenser fans on longer, and drive down the operating pressure of the system. Lower head pressure greatly improves the compressor efficiency. A minimum pressure will still be provided so that thermostatic expansion valve operation will be reliable.

Findings

The average savings per installed horsepower (hp) of compressor was 435 kWh/hp for FHPC and 178 kWh/hp for FSPC. The savings from FHPC is lower than the deemed savings for this measure. This is likely due to the observed delta T between condensing and ambient temperature being higher than the targets and condenser capacity being undersized relative to store refrigerated load. Exhibit 6 shows the target delta T, the actual delta T based on monitoring data, and the condenser sizing ratio (condenser capacity/refrigerated load) along with the FHPC savings at each store.

Exhibit 6 – Stores Used to Model FHP and FSP Impacts

Site	Condenser	Target FHPC delta T (°F)	Actual FHPC delta T (°F)	Condenser Sizing Ratio	FHPC Savings (kWh/hp)
Store 1	evaporative	18	15.7	2.22	663
Store 2	air-cooled	10	13.8	2.00	483
Store 3	air-cooled	10	10	7.64	891
Store 4	evaporative	18	21	2.38	313
Store 5	evaporative	18	35.6	1.87	562
Store 6	air-cooled	10	16.7	0.95	214
Store 7	air-cooled	10	6	0.74	462
Store 8	evaporative	18	35.7	1.46	330
Store 9	evaporative	18	21.1	10.41	496
Store 10	air-cooled	10	9	1.12	70
Store 11	air-cooled	10	14.5	1.36	552
Store 12	evaporative	18	35	1.40	488
Store 13	evaporative	18	14.3	0.78	90
Store 14	evaporative	18	32	2.35	302
Store 15	air-cooled	10	14.4	2.05	601

Exhibit 7 lists energy and demand savings for each measure at the 15 stores evaluated.

Exhibit 7 – Model Results

Store	Condenser Type	Comp hp	Measure	Store Savings kW	Store Savings kWh	Unit Savings kW/hp	Unit Savings kWh/hp
1	evaporative	253	Floating Suction	0.4	4,101	0.002	16
			Floating Head	11.0	167,719	0.043	663
2	air-cooled	59.5	Floating Suction	3.2	33,905	0.054	570
			Floating Head	1.6	28,740	0.027	483
3	air-cooled	143	Floating Suction	1.1	10,403	0.008	73
			Floating Head	42.2	127,422	0.295	891
4	evaporative	240	Floating Suction	1.5	28,256	0.006	118
			Floating Head	(1.4)	75,205	(0.006)	313
5	evaporative	135	Floating Suction	n/a	n/a	n/a	n/a
			Floating Head	(0.0)	75,884	(0.000)	562
6	air-cooled	325	Floating Suction	n/a	n/a	n/a	n/a
			Floating Head	(0.3)	69,632	(0.001)	214
7	air-cooled	140	Floating Suction	n/a	n/a	n/a	n/a
			Floating Head	0.2	64,707	0.001	462
8	evaporative	107.5	Floating Suction	n/a	n/a	n/a	n/a
			Floating Head	(4.7)	35,496	(0.044)	330
9	evaporative	160	Floating Suction	0.2	7,654	0.001	48
			Floating Head	1.9	79,329	0.012	496
10	air-cooled	121.5	Floating Suction	n/a	n/a	n/a	n/a
			Floating Head	5.0	8,533	0.041	70
11	air-cooled	137.5	Floating Suction	n/a	n/a	n/a	n/a
			Floating Head	(4.2)	75,834	(0.031)	552
12	evaporative	135	Floating Suction	4.7	41,676	0.035	309
			Floating Head	(0.8)	65,885	(0.006)	488
13	evaporative	162.6	Floating Suction	n/a	n/a	n/a	n/a
			Floating Head	(3.6)	14,699	(0.022)	90
14	evaporative	135	Floating Suction	2.0	20,481	0.015	152
			Floating Head	(0.6)	40,714	(0.004)	302
15	air-cooled	141	Floating Suction	2.7	20,009	0.019	142
			Floating Head	0.5	84,759	0.004	601
	Averages		**Floating Suction**				**178**
			Floating Head				**435**

Calculated separately, mean FHP impacts for air-cooled condensers are somewhat higher than those for evaporative condensers (468 kWh vs. 406 kWh). While the difference between those two means is not statistically significant, both modeled impacts are statistically significantly different from their deemed savings values of 900 kWh for air cooled and 1100 kWh for evaporative condensers. Based on the results of the modeling efforts, we drew the following conclusions:

- While the calculated impacts for FSP control are within 10% of those specified by the deemed savings, the FHP impacts are less than half the deemed savings level.

- Even with this relatively small sample, the mean calculated savings are statistically significantly different at the 95% confidence level from the deemed savings values for both air cooled and evaporative condensers.

- We therefore considered the deemed savings value for the FSP impact calculations verified, but reduced the FHP kW and kWh impacts per hp by 50% for calculating annual net impacts.

We had hoped to be able to use the results of the modeling exercise to calibrate impacts from other FHP/FSC stores. That proved to be impracticable because 1) the modeling could not be completed until the end of the program when a number of FHP stores were completed, and 2) the determinants of impacts from the model depend critically on the condenser sizing ratio, which could not be readily determined from taking readings at stores. However, as part of the verification effort, data were collected from 10 FHP sites to confirm that head pressure was in fact floating rather than fixed.

3.2.2 Medium Temperature Anti-Sweat Heater Control

The calculation of impacts from medium temperature anti-sweat heater controls was complicated by the fact that the specific ASH measures supported by the program changed in 2005. The initial ASH measure encouraged by the 2004-2005 ESG program was a simple ASH bypass that could be overridden by a timer switch, which would turn the heaters on for up to 12 hours when needed.

During measure verifications visits in early 2005, it was found that some store owners and managers (particularly for liquor and convenience stores) were unclear about how and when the Medium Temperature ASH controls should be overridden. Specifically, condensation was found in several stores (and confirmed as a regular occurrence by store employees), but the override to turn on the ASH had never been used. It appeared that in some cases where the contractor did the installation without a formal audit provided by the ESG program (as was the case, for example, with many of the liquor stores participating in the program), adequate training on use of the ASH controls was not provided. It may be that the owner or manager in the store at the time of installation was informed, but other personnel did not receive that same information.

It was recommended that the program develop a one page user's guide as a leave-behind for the ASH control system, possibly to be placed on the wall next to the switch or on the walk-in door. More generally, it was recommended that any time measures are installed by vendors with minimal involvement of the ESG Energy Experts, special care should be taken to ensure that both the store decision maker and in-store staff have access to any information needed to properly operate, manage, or maintain the EE measures installed. Having vendors act on their own to sell and install technologies promoted by the program does offer an opportunity to leverage program resources and is an indicator of market transformation, but it is important to make sure that customers receive the support and education they need to make the measures successful.

To help forestall potential problems with the timer switch ASH controls, the ESG program instituted a number of quality control measures, including:

- A Pre-Installation Checklist for contractors

- Educational stickers to identify the timer and direct the store employees to the timer location

- Follow up phone calls for all timer installations

- A stamped, self-addressed follow up survey for all timer installations

- Follow up visits to 20% of all installations of any measure, with the Energy Expert completing a Post-Retrofit Checklist

In part because of these actions, the administrative burden of pre-approving and following up with all the ASH timer installations had grown excessive, and the program stopped paying rebates for this measure as of August 26, 2005.

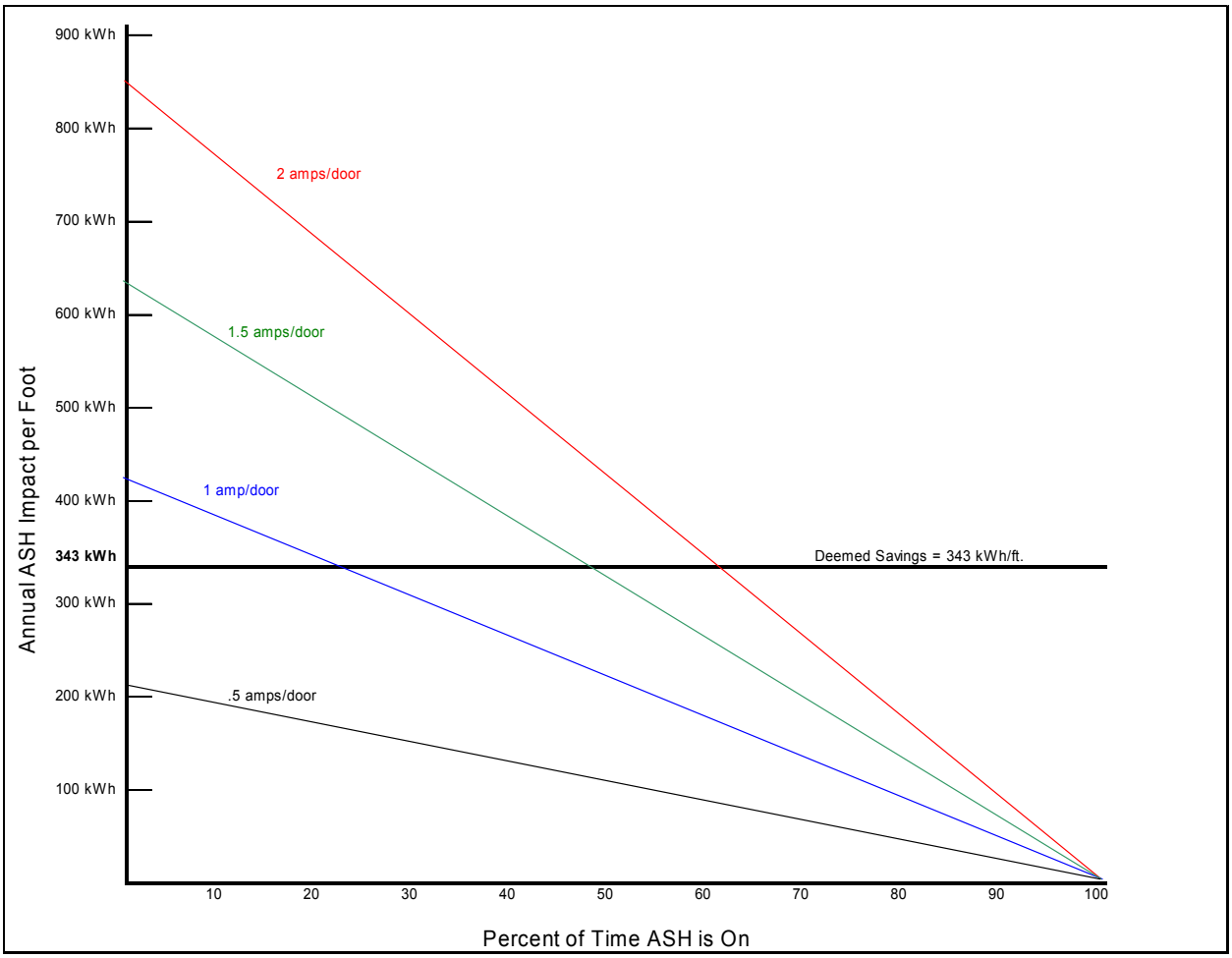
The program continued to pay rebates, however, for an alternative ASH control technology that automatically cycles the heaters based on temperature and humidity. These Altech installations, while automatically turning on the heaters when necessary (rather than when manually overridden) so that condensation would not form, were less enthusiastically received by owners because of their higher cost – particularly among the small independent convenience and liquor stores. However, a number of these installations were completed and rebated through the program.

For the impact evaluation effort, the switch to the newer technology came after a number of sites had been monitored with on-off loggers to determine the extent to which the ASHs were being turned on when needed to remove condensation. While a second round of logger installations in new stores had been planned, this was not done because 1) there were no new stores being fitted with the timer switch ASH control and 2) the ESG program had abandoned this version of the ASH control measure as impractical. (An effort was made to use the on-off loggers to collect data from Altech sites, but the frequency with which the heaters were cycled meant that the loggers typically used up all their storage capacity (up to 2,000 on-off "events") within 8-12 hours, thereby limiting the validity of the collected data.)

Nevertheless, data from those stores where loggers were installed provided useful data on the percentage of time that the ASH control was overridden for stores where this measure was installed. In addition, data were collected on the connected load of the ASH being turned off/cycled and the number of doors controlled at each of the stores.

The impact of ASH controls depends critically not only on the percentage of time the heaters are on, but also on the amount of the heating load. This is illustrated graphically in Exhibit 8, which shows impacts for different levels of heater load and different levels of heater control, and compares them to the deemed savings value of 343 kWh per foot.

Exhibit 8 – Determinants of ASH Control Impacts



As shown, actual impacts are a function of both connected load and the cycling percentage. (Note that the cost-effectiveness of ASH control installations improves with the number of feet controlled by a single controller, but this does not affect the impact per foot.)

The graph shows clearly that for low connected loads of .5 amps per door (only slightly lower than what newer doors with heaters were found to draw) the actual impacts will always be less than the deemed savings value even if the heaters are never turned on. At the other extreme, impacts for ASH with connected loads of 2 amps per door (found on some older coolers) will exceed the deemed savings estimate as long as the heater is turned off at least 35-40% of the time.

For the 1 and 1.5 amp per door cases, whether impacts are greater or less than deemed savings will depend entirely on the cycling strategy used. With the timer switches, impacts would be greater unless the owner very aggressively used the override function.

A review of data from stores where loggers were installed showed that:

- The mean connected load for ASH where controllers were installed was .37 amps per foot (or .92 amps per 30" door). These means are based on measured connected load, not nameplate data, and some of the lower connected loads for a large number of doors (as many as 19 doors were on the same circuit) may represent anti-sweat heaters that have stopped functioning.

- As far as the percentage of time heaters are turned on, results confirm the anecdotal evidence from store visits and conversations with store managers and employees: most ASH controls were only rarely overridden. For the 10 stores with logger data, the amount of time that the heater was turned on averaged less than 1%.

- Given the .37 amp/foot connected load and 99% reduction in ASH run time, annual impacts per linear foot for the timer controlled ASH controls can be calculated as 369 kWh (.37 amps * 115 volts/amp * 8760 * .99/1000.)

The same approach can be used to determine impacts with the Altech equipment and with centralized ASH control, since impacts with these technologies also depend on both connected load and the percentage of time the heaters are cycled on and off. To get in an indication of the cycling of the Altech controls, run time meters (as opposed to on-off loggers) were installed on three MT ASH control sites. These run time meters show the total hours of operation for the heaters since the installation of the meters, which allowed us to calculate the percentage of the time the heaters are on and, by extension, the savings attributable to the percentage of time the heaters are turned off. If, as our findings with the three run-time metered Altech installations indicate, the heaters are turned on only about 8% of the time, impacts would be right about at the deemed savings level for a 1 amp per door installation, and significantly above it for the 1.5 amp connected load. Using the same .37 amp/foot connected load and a 92% reduction in ASH run time, annual savings per linear foot for the Altech controls would amount to 343 kWh – exactly the deemed savings value.

Based on these results, we do not see any reason to revise the deemed savings estimate of impacts for medium temperature ASH controls.

While the impact of ASH control for low temperature cases was outside the scope of this evaluation, it is clear that the same relationship between connected load, run time, and impacts would apply. However, the connected load would generally be higher for low temp ASH, which would increase the likelihood that impacts exceed deemed savings. On the other hand, automated cycling might lead the anti-sweat heaters to be turned on more frequently. Because there exists potential for significant savings from low temperature ASH control, additional research on this technology is recommended.

In conclusion, we believe it makes sense to base the deemed savings for MT ASH control on the connected load of the doors on the case where the controls are installed, since this can be easily measured either by an auditor or by the installing contractor. The cycling percentage, on the other hand, cannot be easily measured prior to installation, and should be based on observed cycling percentages for technologies that turn the heaters on as needed based on temperature and humidity. While there will obviously be variation in this percentage based on the climate zone where the controls are installed and the time of year, the limited observations undertaken as part of this evaluation suggest that heaters will be on about one-tenth of the time and off

about 90 percent of the time. That would make the impact attributable to MT ASH control equal to the connected load per door in amps, divided by the number of feet per door (typically 2.5), multiplied by 907 (amps times 115 to get watts, times 8760 to get watt-hours, divided by 1000 to get kWh, multiplied by .9 to get savings).

3.2.3 Compact Fluorescent Bulbs

It was not originally planned to investigate impacts associated with compact fluorescents. However, the high rate of burn-outs/removals observed during an initial round of site inspections prompted a more detailed analysis of retention for this measure, and a subsequent adjustment of associated impacts.

In part in response to the findings of the site visits in the evaluation of the 2003 program, the ESG program made CFLs a direct install measure. Since that meant rebates were received only if the bulbs were installed by the ESG Energy Expert, CFL installations that could not be verified would presumably reflect the failure and/or removal of the bulbs.

Despite this extra step taken to ensure that rebated CFL bulbs were installed, we found a high rate of CFL failure or removal in stores where these bulbs were installed through the 2004-05 program. During an initial round of measure verifications visits to Northern California, a total of 43 stores were visited to confirm installation of measures, in addition to 30 stores visited earlier in SCE territory. Almost all of the measures were found to have been installed in accordance with the terms and conditions of the program; however the number of CFL bulbs counted at visited stores continued to be consistently less than the number of bulbs rebated through the program.

The results of the lighting counts for these initial verification visits are presented in the table below. Note that a relatively low percentage of stores had CFLs, in part because stores visited were drawn from the population of stores that did not have direct install measures only.

Exhibit 9 – CFL Verifications – First Round of Visits

Territory	Total Stores	Number With CFLs	Bulbs Rebated	Bulbs Verified	Failure/ removal rate
SCE	30	10	53*	29	45.3%
PG&E - Sacramento region	23	9	52	43	17.3%
PG&E - Bay Area, Napa	20	4	29**	14	51.7%
TOTAL	**73**	**23**	**134**	**86**	**35.8%**

* One store had 32 CFLs rebated, but only 14 could be verified (plus 3 burn-outs in sockets)
** One store had purchased a case of 12 CFLs but had not installed any

Overall, the low percentage of bulbs that could be verified is disturbing. As noted on the table, two stores – one each in SCE territory and the Bay Area/Napa – accounted for 30 of the 48 bulbs that could not be verified. Even without these stores, however, the percentage of burned out or removed bulbs is higher than the 12 percent reported in the evaluation of the 2003 program.

The ESG program previously addressed this issue by making all CFLs direct installations, and continued to work with the lighting supplier to make replacement bulbs available for those that burned out. Replacing the bulbs is important, not only to ensure that savings claimed by the program are in fact delivered but also because excessive bulb failure undermines the credibility of the whole energy efficiency message delivered by the program. For many stores, free CFLs are the Energy Expert's foot in the door. They introduce the store owner to the program and hopefully encourage him/her to pursue other opportunities. If the first measure installed by the program has a high failure rate, the likelihood of more extensive participation is reduced.

Because of the relatively low percentage of bulbs verified during these initial visits, a second round of verifications focusing exclusively on CFLs was conducted in early 2006. For these visits, all the CFLs had been installed at least one year earlier, with the install dates typically 12-18 months before the inspection visits. Attempts were made to verify a total of 200 bulbs in each utility territory, although, as shown in Exhibit 10, there were slightly fewer in PG&E territory and more in SDG&E territory.

Exhibit 10 – CFL Verifications – Second Round of Visits

Territory	Number of Stores	Number of CFLs rebated	Bulbs Verified	Retention Rate
PG&E	9	197	123	62.4%
SCE	15	200	98	49.0%
SDG&E	8	230	183	79.6%
TOTAL	**32**	**627**	**404**	**63.7%**

The percentage of CFLs still installed and operating ranged from zero to 100% at individual stores, but averaged less than two-thirds overall. This represents a high attrition/failure rate consistent with the results of the earlier store visits, and directly affects both the impacts attributable to this measure and the value of continuing to offer direct install CFLs for programs such as ESG.

As was the case with the evaluation of the 2003 program, problems with CFLs were observed at a number of different stores and in all three IOU service territories.

- A few store managers suggested that employees might have taken the bulbs home, but most said the removed CFLs had failed. It may be that the harsh environment of low temperature walk-ins may be causing some bulbs to fail. One ESG Energy Expert said that he had noted condensation in the ballasts of some CFL that had failed in walk-in freezers.

- An additional reason for missing bulbs was that a few of the smaller stores had changed hands, remodeled, or made other major changes since they had the program CFLs installed, so that some or all of the bulbs had been removed. Given the nature of the independent grocery business, such changes are not surprising. While additional changes of this kind should be expected over the projected life of the CFLs, we do not believe we have a solid basis for anticipating the percentage of CFLs that may be removed as a result.

- Whatever the reasons, the high rate of attrition or non-installation for CFLs suggests that impacts from this measure should be adjusted downward. Given the substantial numbers of sites with measure retention issues, we believe the impacts attributable to CFLs should be reduced by 36% in the first year and all subsequent years. While it is likely that there will be additional failures/removals in future years, we do not have a solid basis for estimating the percentage by which future impacts would be reduced, so we have reduced CFL impacts by 36% over the deemed life of the measure. If, however, the bulbs continued to fail at a rate of 36% of the remaining installations per year, the average life for installed bulbs would be about 1.6 years – which is consistent with the new DEER EUL of 1.3 years for CFLs in grocery stores.

3.2.4 Confirmation of Other Measures

In light of the deemed savings approach, the primary measurement and verification data collection effort consisted of on-site visits to participating stores where retrofits were carried out. We visited 125 stores where retrofits had been installed, selected at random from participating stores that installed more than just direct install measures. The site visits were allocated to the utility territories in approximate proportion to the number of participating stores; in addition, more than 20% of site visits were to stores outside urban areas, in accordance with the distribution of retrofit stores.

For most measures – particularly measures with significant impacts – both the installation and required operating conditions (e.g., hours of operation, energy efficient case model number, functioning auto closers) were confirmed, and two measures with possible concerns in the previous evaluation were found to be installed and operating as required.

Strip Curtains.— Education on the proper use of strip curtains appears to be paying off. In contrast to the 2003 evaluation, verification visits for the 2004-2005 program found only two instances where strip curtains on walk-in freezers and coolers had been temporarily tied back or otherwise disabled, and no stores where all or part of the strips in a curtain had been cut away. Store workers are still not overly enthusiastic about the curtains, however, and one described walking through a curtain into a produce cooler as "having cold slimy hands clawing your head and back."

Gaskets.—As one of the most popular (and highest overall impact) measures offered through the program, gaskets for case doors are an excellent example of a low cost measure that can deliver significant energy savings. Rebated gaskets on glass case doors all appeared to be in very good or excellent condition during the verification visits. On the other hand, a few (less than 5% of those inspected) gaskets installed on walk-in doors to replace previously damaged gaskets had been subject to (presumably) the same source of damage that affected the previous installation (e.g., fork lifts, carts, boxes). While the deemed savings calculations assume a useful life of 4 years for gaskets, several store managers noted that some gaskets may be ready for replacement before that time. Additional research on the appropriate lifetime for this measure is needed.

3.2.3 Impact Adjustments

As noted previously, the two measures for which we made adjustments to the deemed savings based on field data collection are screw-in CFLs and Floating Head Pressure Control.

- For CFLs, first year kW and KWh impacts were reduced by 38%; impacts in subsequent years were not subject to additional downward adjustment.

- For Floating Head Pressure control, we reduced kW and kWh impacts by 50% for both air cooled and evaporative condensers.

3.2.5 Confirmation of Impacts and Cost-effectiveness Calculations

Once the impacts for CFL and FHP control were adjusted and installation of measures was confirmed, energy and peak demand impacts were calculated by year in accordance with the CPUC workbook format. Savings by IOU service territory are presented in Appendix B as well as in a separate workbook, while statewide savings by year are presented in Exhibit 11. Note that therm impacts were not calculated for the ESG program.

Exhibit 11 – Deemed and Evaluation Savings – EnergySmart Grocer Program Total

Year	Calendar Year	Gross Program - Projected MWh Savings	Net Evaluation Confirmed Program MWh Savings	Gross Program - Projected Peak MW Savings	Evaluation Projected Peak MW Savings**
1	2004	24,281	21,479	8.00	7.46
2	2005	62,319	54,836	13.96	12.74
3	2006	62,319	54,836	13.96	12.74
4	2007	62,319	54,836	13.96	12.74
5	2008	52,078	45,037	12.80	11.62
6	2009	45,089	38,297	11.54	10.41
7	2010	43,722	36,982	10.64	9.55
8	2011	43,722	36,982	10.64	9.55
9	2012	40,767	34,615	10.24	9.20
10	2013	31,418	25,761	9.07	8.12
11	2014	31,418	25,761	9.07	8.12
12	2015	31,267	25,616	9.06	8.10
13	2016	30,145	24,539	8.94	7.99
14	2017	27,558	22,055	8.66	7.72
15	2018	24,714	20,643	8.28	7.53
16	2019	17,103	16,419	2.91	2.79
17	2020	10,711	10,290	1.50	1.44
18	2021	0	0	0	0
19	2022	0	0	0	0
20	2023	0	0	0	0
TOTAL	**2004-2023**	640,949	548,981		

As noted previously, Gross Program Projected Savings are greater than those reported by PECI because the latter include the CPUC-stipulated net-to-gross of 0.96, while the *ex ante* gross savings do not. While both floating head pressure and CFL impacts were adjusted based on evaluation results, most of the difference between the gross program projected and evaluation confirmed savings is accounted for by the application of the NTG of 0.96 and by the reduction

in FHP impacts for both air cooled and evaporative condensers. It was not part of the evaluation workplan to verify or adjust the stipulated NTG value.

Net energy impacts associated with the top 20 measures (after making the adjustment described previously) are presented in Exhibit 12. A detailed listing of measures and their associated impacts is presented in Appendix C.

Exhibit 12 – Top 20 Measures with Greatest Impact – EnergySmart Grocer Program Total

Rank	Measure	Percent of Impact	Cumulative Percent
1	Strip Curtains for Walk-ins	17.4%	17.4%
2	Controls - Anti-Sweat Heat (Medium Temp)	13.7%	31.1%
3	Gaskets - Cooler/Freezer Door Gaskets - Reach-in Glass Doors	9.3%	40.4%
4	Cases - Low Temp Reach-in to High Efficiency Reach-in	8.6%	49.0%
5	Multiplex - Efficient/oversized Air-cooled Condenser for Multiplex	6.8%	55.8%
6	Multiplex - Controls - Floating head pressure - evaporative condenser	4.8%	60.6%
7	Multiplex - Compressors - Air-cooled Condenser	3.7%	64.3%
8	Multiplex - Efficient/oversized water-cooled Condenser for Multiplex	3.7%	68.1%
9	Cases - Night covers - vertical display case	3.6%	71.6%
10	Multiplex - Controls - Floating head pressure - air cooled condenser	3.2%	74.8%
11	Cases - Low Temp Open to Reach-in	2.5%	77.3%
12	Multiplex - Compressors - Evaporative Condenser	2.4%	79.7%
13	Controls - Anti-Sweat Heat (Low Temp)	2.4%	82.1%
14	Gaskets - Cooler/Freezer Door Gaskets - Walk-in Solid Doors	1.7%	83.8%
15	Auto-Closers for Glass Reach-in Doors -- Cooler	1.3%	85.2%
16	Cases - Low Temp Coffin to High Efficiency Reach-in	1.2%	86.4%
17	Air-cooled to evap-cooled condenser, multiplex	1.2%	87.6%
18	Cases - Medium Temp Open Case to New High Efficiency Open Case	1.1%	88.7%
19	Multiplex - Controls - Floating suction pressure - evaporative condenser	1.0%	89.7%
20	Lighting - 27 W CFL lamps in Walk-in, Direct install	1.0%	90.6%

Just 20 of the 83 different measures rebated by the program accounted for more than 90% of evaluation verified impacts.

- Low cost measures – specifically strip curtains, ASH control, and gaskets – accounted for more than 40% of total impacts.

- Despite the lower impacts calculated by the evaluation, floating head pressure control still represented 8% of overall impacts, while efficient/oversized air- and water cooled condensers for multiplex together accounted for 10.5%.

- Among the top 20 measures, efficient low temp cases made up 12.3% of impacts, while medium temp cases accounted for 1.1% (other categories of cases represented less than 1% each).

3.3 PROCESS EVALUATION

Data collection to support the process evaluation was conducted through document review, interviews with program staff, program participants, and other market actors involved in the program. This enabled us to determine whether the program was being delivered in an effective and timely manner, reaching its target market, and engaging other market actors who could influence the sustainability of observed changes in the market.

The goal of the process evaluation activities was to provide ESG Program Managers at PECI with ongoing feedback that could be used to make timely adjustments in program design or delivery. Important findings were passed along to PECI in phone calls and documented in memos to ensure that maximum benefit could be derived from the EM&V activities.

Interviews and field observations generally confirmed earlier findings regarding the efficacy of program delivery and the critical role played by the ESG Energy Experts. As the program has evolved, however, so has the role of the Energy Experts. While they remain key players both in the delivery of the program and in the development of relationships between independent grocers and vendors, the growing number of retrofits conducted directly by contractors without a previous store audit has diminished the role of the Energy Experts. On the other hand, Energy Expert interaction with contractors and other vendors has increased.

Store managers, owners, and other decision makers encountered during the on-site visits and surveyed by telephone continued to express a high degree of satisfaction with the ESG program in general and the Energy Experts in particular. To quantify these impressions, specific aspects of respondent satisfaction were investigated using the results of the telephone survey. First, respondent were asked to rate the quality of various aspects of the ESG program. Results of the analysis of responses to this question are presented in Exhibit 13.

Results are summarized for two categories of stores: those that received rebates and those that received audits and direct install measures only. Direct install stores generally received only compact fluorescent lamps (CFLs), although a few also received single installations of Cooler Miser beverage case controllers (which had a $90 rebate) and the medium temperature ASH control discussed earlier.

Exhibit 13
Mean Respondent Rating of Program Elements

	Non-Direct Install		Direct Install Only		Contractors
	Unweighted	Weighted	Unweighted	Weighted	
Program promotional materials	4.7	4.9	4.7	4.8	4.0
Quality of the store audit	5.0	4.6	4.7	4.7	5.2
Technical knowledge of the program staff	5.2	5.2	4.7	4.4	4.7
Responsiveness of the program staff	5.1	5.6	4.4	4.3	5.1
Level of incentives provided by the program	4.9	5.4	4.5	4.6	5.1
Paperwork and procedures required to receive incentives	5.0	5.7	4.8	4.7	4.9
Quality of vendors	4.8	5.1	4.5	4.6	
Performance of measures installed though the program	5.0	5.7	4.5	4.6	4.7
	n=56 resp., 303 stores		n=35 resp., 56 stores		n=20

The results show that store decision makers are quite satisfied with the program overall, with all of the program elements receiving ratings of 4.3 or higher on a 1 to 56 scale. Stores receiving more than direct install measures tended to assign higher ratings to all of the program elements, although the differences were statistically significant at the 90% confidence level only for the technical knowledge of the program staff and the responsiveness of the program staff. Weighted results for ratings by non-direct install stores are also generally higher than the un-weighted results (with the exception of the quality of the store audit,) probably reflecting the higher degree of involvement in the program for decision makers responsible for multiple stores, although it should be noted that the weighted results are heavily influenced by a single respondent with responsibility for 160 stores.

It is also worth noting that grocers who received the highest rebates assigned the highest ratings to the level of incentives, to the ease of paperwork and procedures required to receive those incentives and to the performance of rebated measures, as reflected by the higher values for responses weighted by the number of stores. In contrast, direct-install only participants were more likely to give lower ratings to the level of incentives and the amount of paperwork. It may be that grocers who did not pursue further rebates through the program assigned lower ratings to incentive levels and paperwork and procedures because they exaggerated the difficulty of obtaining rebates or because they were unwilling to install other measures that would require any out of pocket expense on their part.

Contractor perspectives on the various program elements, also presented in the table, reflect a high level of satisfaction with most program elements, particularly the quality of the store audit, the responsiveness of program staff, and the level of incentives. Contractors were less satisfied with program promotional materials, which received the lowest mean rating. While contractors gave the paperwork and procedures required to receive incentives a relatively high rating of 4.9, four respondents cited paperwork as the aspect of the program they found least helpful or would like to see changed (most had no aspects of the program they found least helpful.)

Respondents were also asked to rate the value of various program elements in helping them overcome barriers to the installation of energy efficient equipment in their stores. Results are presented in Exhibit 14.

Exhibit 14
Perceived Value of Program Elements

	Non-Direct Install		Direct Install	
	Unweighted	Weighted	Unweighted	Weighted
Audits	4.9	5.1	4.3	4.0
Technical assistance	4.8	5.0	4.3	4.1
Informational brochures	4.2	4.7	4.3	4.2
Demonstration stores	3.6	3.3	3.9	3.9
Rebates/incentives	5.2	5.7	4.7	4.8
Web-based information	3.4	4.4	3.5	3.3
Training for staff	3.4	3.8	3.5	3.4
Financing	3.6	2.3	3.7	3.6

* Respondents were asked: On a scale of 1 to 6, where 1 is not at all helpful and 6 is very helpful,

Consistent with the ratings of ESG program elements analyzed above, non-direct install respondents gave the high ratings to the value of rebates incentives, followed by audits and technical assistance. For stores that received rebates, weighted means were higher than the unweighted means for all program elements except financing and demonstration stores. These results reflect the responses of one large and several medium sized chains, which are less likely to need financing or to feel the need to learn from other stores. Since direct install stores – which tend to include more small convenience stores and liquor stores – placed a relatively high value on financing, there may be opportunities to incorporate this program feature into future offerings targeted to smaller stores.

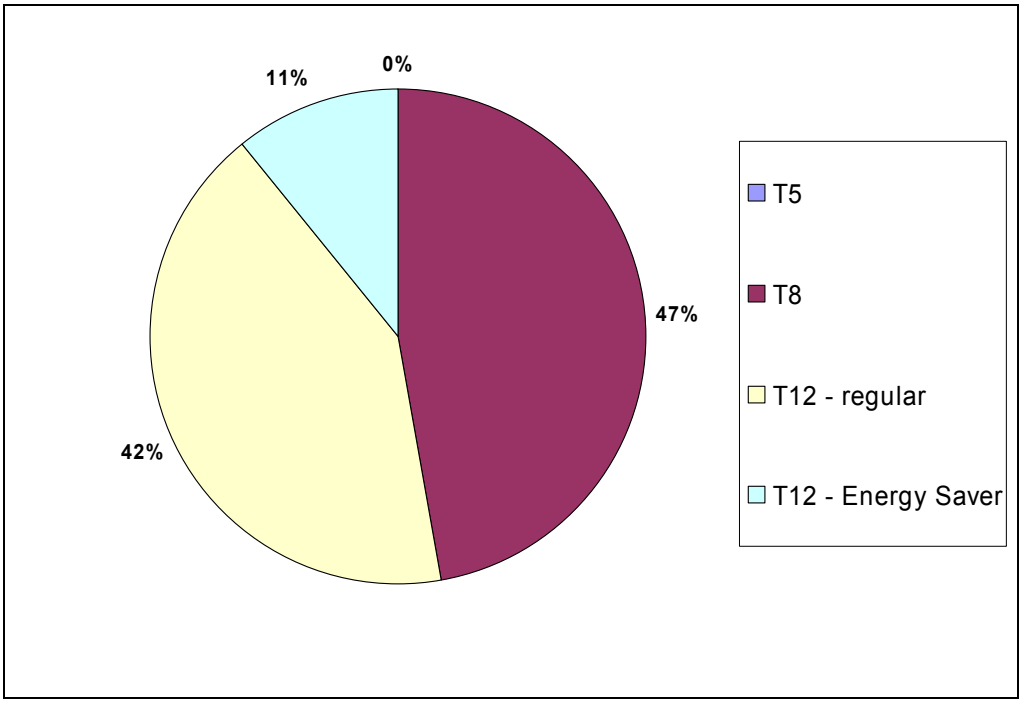
Among the less highly regarded program elements for direct install stores were web-based information (store decision makers say they are extremely busy and do not have the time to review large volumes of information) and training for staff, while stores that received rebates assigned the lowest values to financing (since most larger stores self-finance improvements), demonstration stores, and training for staff.

3.4 MARKET BASELINE AND MARKET EVALUATION

Both audit data and contractor reported estimates of the percentage of stores with specific technologies were used to assess the baseline technologies currently in place.

The audit database created by the ESG Program includes existing lighting, HVAC and refrigeration equipment, operating hours, proposed measures, selected measures, rebate, and contractor information. This Microsoft Access database developed for more than 1,000 stores audited through the program in 2003-2005 provided extensive data on the measures currently installed in California independent groceries, with separate reports for all lighting installations, refrigerated cases, and walk-in cases. These reports were analyzed, and results are summarized in the tables below for lighting, refrigerated cases, and walk-in coolers/freezers. For fluorescent lighting, results were converted into the number of lamp-feet for each of the fluorescent technologies commonly used in groceries: T8, T12 standard, T12 Energy Saver, and T5, as shown in Exhibit 15.

Exhibit 15- Linear Feet of Fluorescent Lighting in Audited Stores



While the total feet of T12 lamps (more than 7 million feet) exceeds the total of T8 lamps, the number of T8s (47%) exceeds either the standard (42%) or energy saver T12s (11%) individually, while there are virtually no T5s (<.05%). These results suggest that there are still significant opportunities within the independent grocer sector to improve energy efficiency through lighting retrofits. (It should be noted that the total number of lamp-feet of T12 to T8 replacements for the 2003 and 2004/05 programs combined amounted to approximately 47,000 feet (plus about 8,000 feet of delamping), or less than 1% of the potential for the audited stores.)

When the total lighting load is broken down by lighting types, using wattage for incandescent bulbs and estimates of watts per foot for each of the fluorescent lighting types (10 watts per foot for regular T12, 8.5 watts for ES T12s, and 7 watts for T8s,) about 90% of the lighting usage in audited stores is accounted for by T8 and T12 fluorescent fixture. There were only 209 CFL bulbs reported in more than 1,000 audited stores, compared to about 5,000 standard incandescent and 3,600 other incandescent bulbs, including halogen, high and low pressure sodium, mercury vapor, and metal halide bulbs. These results, too, verify the opportunities that exist to replace standard incandescent lighting with more efficient alternatives and confirm that the level of CFL installations in the absence of the program would be minimal.

Refrigerated case audit data were analyzed separately for walk-ins and conventional cases. A summary of the walk-ins in audited stores is presented in Exhibit 16.

Exhibit 16 - Walk-in Freezers and Coolers in Audited Stores

Total Walk-ins	**4893**	
walk-in/reach-in	777	15.9%
walk-in	4116	84.1%
Temperature/content		
Medium	**3681**	75.2%
Dairy/beverage	1126	
Deli	478	
Fresh meat	1209	
Produce	868	
Low	**1188**	24.3%
Frozen food	1019	
Ice cream	169	
Strip Curtains		
Number with strip curtains	1590	32.5%
Gasket condition		
Number with "poor" door gaskets	1587	32.4%

Of the nearly 4,900 walk-in coolers and freezers in the audited stores, about 16% were walk-in/reach-in cases (for example, those cases often used to stock milk and drinks in convenience stores that can be stocked from inside and accessed by customers from the front) and 75% were medium temperature.

Audit results indicate that the walk-in cases represent numerous opportunities for increased energy efficiency that the ESG program has successfully exploited, but also illustrate the relatively modest penetration in terms of the percentage of potential realized.

- Only about one-third of walk-ins in audited stores had strip curtains, indicating that , at a minimum, more than 3,000 doors could have had strip curtains installed (many walk ins have more than one door, so the actual number of potential installations would be greater.) Strip curtains are rebated by the square foot, so the 14,734 square feet of strip curtains rebated by the program for 2004-05 represent approximately 700 3' x 7' doors, or less than one-fourth the potential identified in the audits.

- Similarly, about-one third of walk-ins were identified as having door gaskets that were in poor condition, representing some (1587 doors times 7+7+4) 26,000 linear feet of gaskets. The 2004/5 ESG program rebated 2100 linear feet of walk-in door gaskets, representing less than 10 percent of the gaskets on walk-ins identified as in poor condition.

- Moreover, most strip curtains and gaskets installed through the program were in stores that did not receive an audit, but were approached directly by a contractor.

Audit data were also collected on standard low temperature (freezer) and medium temperature (refrigerated) cases, as shown in Exhibit 17.

Exhibit 17 -- Refrigerated Case Inventory in Audited Stores

Type of Case	Linear Feet	% of Total
Vending Machines/Beverage Merchandisers	**7,339**	**2.2%**
Refrigerated vending machine	1,757	0.5%
Beverage merchandiser	5,582	1.7%
Medium Temp - Open	**179,594**	**54.5%**
Open island coffin	19,467	5.9%
Open multi deck	140,457	42.6%
Open single deck	19,670	6.0%
Medium Temp - Closed	**44,683**	**13.6%**
Closed coffin	297	0.1%
Closed rear entry (MT)	22,910	7.0%
Curved glass rear entry (MT)	11,610	3.5%
Reach in multi deck	9,866	3.0%
Low Temp - Open	**24,059**	**7.3%**
Open island Coffin	20,092	6.1%
Open multi deck	3,520	1.1%
Open single deck	448	0.1%
Low Temp - Closed	**73,845**	**22.4%**
Closed coffin	1,930	0.6%
Reach in multi deck	71,915	21.8%

While the efficiency of the refrigerated cases was not specified, there are clearly opportunities to replace open cases with closed, particularly the 7.3% of low temperature cases (roughly 3 open 8-foot cases per audited store) that currently do not have doors. In addition, most medium temperature cases are open, and replacing those with closed cases (as provided for by the Energy Smart Grocer program) offers significant potential savings.

Additional baseline data are provided by contractor estimates of the percentage of stores with specific energy saving technologies, presented in exhibit 18.

Exhibit 18 -- Contractor Estimates of Technology Penetration

Among the food stores that you service, approximately what percentage have each of the following technologies in place:	Percent of Stores
Energy Management Systems	55%
Floating head pressure controls	37%
Multiplexed compressors	44%
Night covers for refrigerated cases (for stores not open 24/7)	24%
Cycling of anti-sweat heaters/ controls for anti-sweat heaters	41%
Permanent Split Capacitor (PSC) evaporator fan motors	32%
Electronically commutated (ECM) evaporator fan motors	20%
What percent of freezer (low temperature) cases have doors?	70%
What percent of (MT) refrigerated cases have doors?	28%
What percent of case doors are low/no heat?	32%

As with the results of the audits, these findings indicate good penetration of many energy efficient technologies, but also highlight the extent to which further savings are possible. According to contractor estimates, fewer than 24% of stores put night covers on cases when they close, and 30% of freezer cases lack doors.

In conclusion, it appears from the current mix of technologies installed in stores that the ESG Program has targeted measures where ample opportunities existed for efficiency improvements and that the rebated measures do not constitute standard practice in the independent grocer market. Contractor responses also indicate that, on average, 60% of the energy efficient measures they installed over the past three years involved a utility program rebate, so that most of the high efficiency measures that had previously been installed in audited stores were the result of either the ESG program or other utility rebate programs. Moreover, the percentage installed without rebates includes larger chains serviced by these contractors, and many chains simply do not bother with incentives. One interviewed contractor who services hundreds of large chain stores explained that "With the chains they all would have done it anyway; the big guys, Kroger, Wal-Mart, Safeway, will do it and say 'I'm not going to wait for a rebate.' The rebate is much more helpful -- and necessary -- for independents."

Responses to questions regarding perceived barriers to energy efficiency among store decision makers are summarized in Exhibit 19 for stores that received rebates and those that received direct install measures only. Results are also compared to the results of surveys conducted for the 2003 evaluation.

Exhibit 19
Perceived Importance of Barriers to Energy Efficiency

Barriers	Rebates > $100	Rebates < $100	No Rebates	2004-5 Rebate	2004-05 Direct Install
	(mean ratings)*				
It's difficult to find reliable, unbiased estimates of potential energy savings	3.7	4.9	4.5	3.9	3.8
It is difficult to get delivery on efficient equipment				2.9	3.5
Energy efficient equipment might not be as reliable				3.0	4.1
Energy efficient equipment doesn't meet our payback requirements	3.7	4.8	4.6	3.6	4.2
Decisions are made at headquarters; energy efficiency is not a major concern to them	1.9	4.4	4.4	2.9	3.7
Efficient lighting would reduce attractiveness of store displays				3.4	3.7
Doors would inhibit customers from reaching into cases	3.2	3.8	4.1	3.7	3.8
It is difficult to get financing for improvements	2.1	3.8	3.8	3.0	3.4
It is difficult to get trustworthy technical advice or product specifications	3.3	4.0	4.3	3.1	3.8
Uncertainty whether store will be merged, sold, or put out of business				2.7	3.2

* Respondents were asked to rate the importance of each of these barriers when considering energy efficient equipment, using a 1 to 6 scale, where 1 is not at all important and 6 is very important

For participants who received rebates, perceptions of barriers to energy efficiency do not appear to be significantly different from those reported by participants in the 2003 ESG program, particularly with regard to such key issues as obtaining estimates of potential savings (3.7 for 2003 vs. 3.9 for 2004/5), payback concerns for efficient equipment (3.7 vs. 3.6), and the difficulty of getting trustworthy technical advice (3.3 vs. 3.1). Compared to 2003 respondents, 2004-2005 participants assigned somewhat higher importance ratings to the role of decisions made at corporate headquarters and the difficulty of obtaining financing.

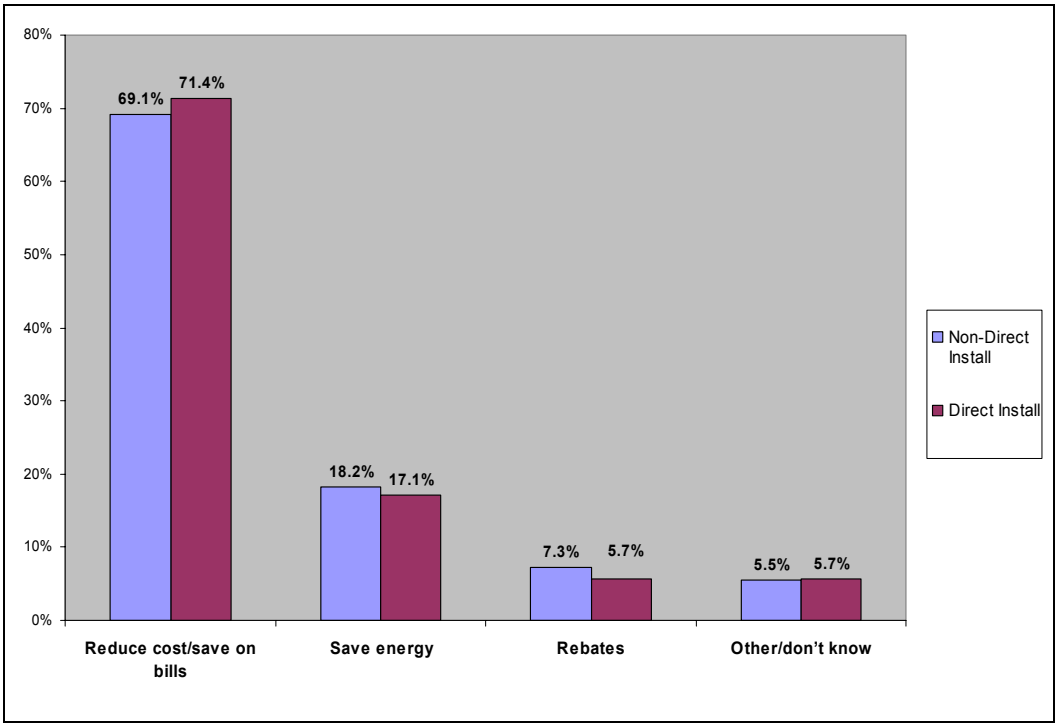
Direct-install-only participants in the 2004-2005 program appear to consider it less difficult to find reliable estimates of potential energy savings than did 2003 participants who received no rebates or rebates of less than $100 (3.8 vs. 4.9 and 4.5.) The 2004-2005 direct install participants also assigned somewhat less importance to the extra cost of efficient equipment, with a lower mean importance rating for worries that energy efficient equipment doesn't meet payback requirements.

The lower barriers for direct-install only participants are encouraging in that they suggest decision maker attitudes were changed at least somewhat by their involvement with the program. Unlike many of the 2004-2005 participants who received rebates, almost all of the

direct install participants had face-to-face interaction with the program's Energy Experts, which may have contributed to their reduced perceptions of the importance of barriers.

In addition to baseline issues, the market evaluation investigated decision making among program participants. Reasons for program participation were also investigated using survey results presented in Exhibit 20.

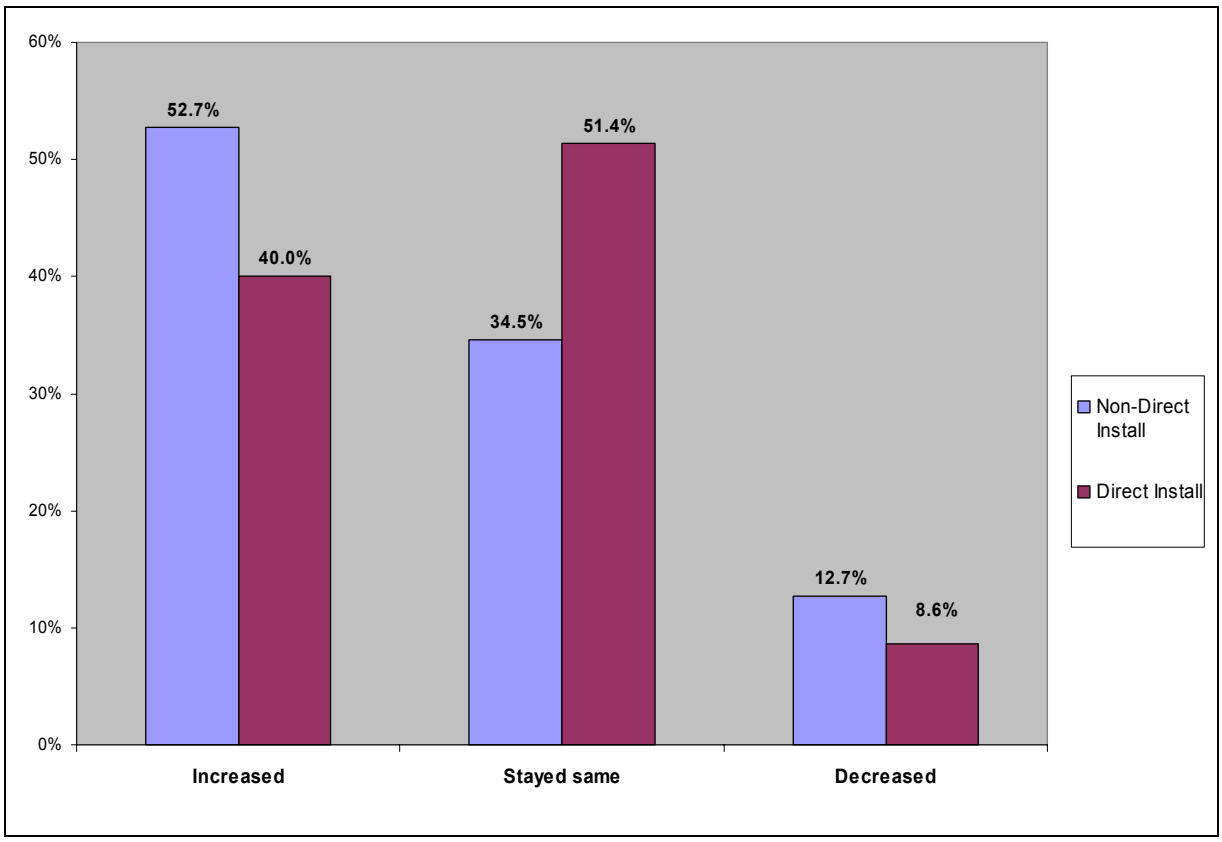
Exhibit 20 -- Main Reason for Program Participation



Overwhelmingly, both direct install stores and those who received rebates said they participated in the ESG program primarily to reduce their utility bills or, to a lesser extent, save energy. Fewer than 10% of respondents said they participated primarily to take advantage of the rebates.

Many participants in the program appear to recognize the growing importance of energy efficiency, as shown in exhibit 21.

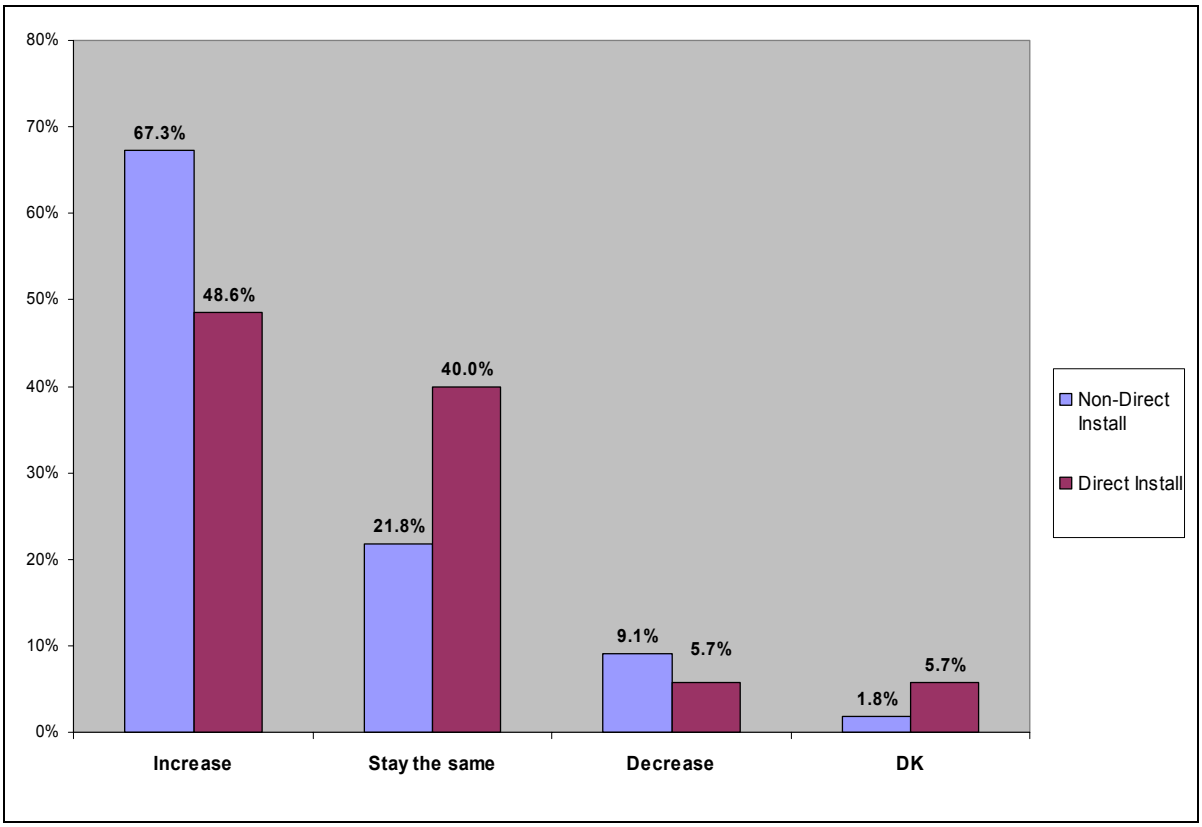
Exhibit 21 -- Over the past 2 to 3 years, has emphasis on managing energy usage increased, decreased, or remained the same?



Over half of respondents who received rebates say that their emphasis on energy has increased (compared to 40% of direct install participants,) which may help explain why they were motivated to take action through the ESG program.

Respondents who received rebates were also more likely to anticipate a greater proportion of energy efficient equipment in the future, as shown in Exhibit 22.

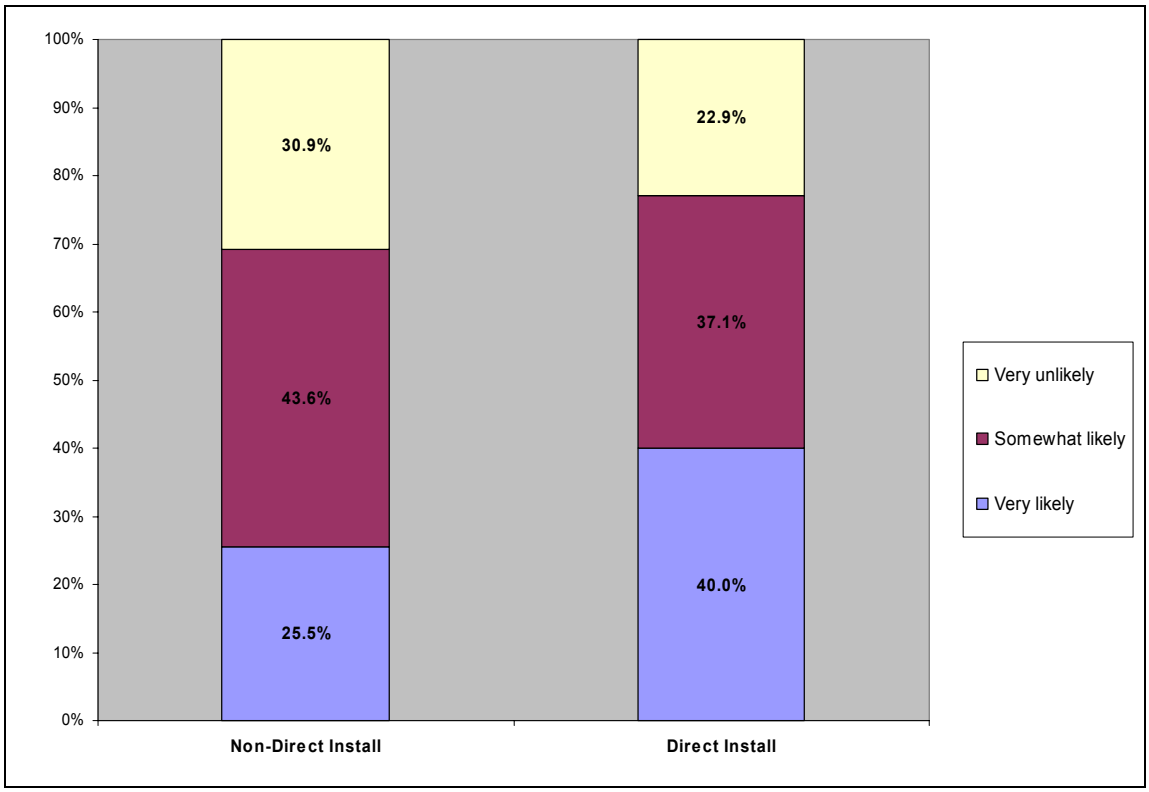
Exhibit 22-- Do you believe the percentage of high efficiency equipment installed in your stores in the next 3 to 5 years will increase, decrease, or stay about the same?



As shown in the exhibit, two-thirds of participants who received rebates expect a higher percentage of energy efficient equipment in their stores in the future, compared to fewer than half of direct install participants. This tends to support the view that decision makers with an out-of-pocket investment in energy efficiency are more likely to be committed to improving the overall efficiency of their stores in the future.

However, the percentage of respondents who expect a higher percentage of efficient equipment declined in comparison to 2003, when almost 90% of respondents said they expected the percentage of high efficiency equipment in their stores to increase over the next 3-5 years. Moreover, the commitment to improving energy efficiency appears to be at least partly dependent upon the availability of incentives, as shown in Exhibit 23.

Exhibit 23-- How likely would you be to undertake additional energy efficiency if the EnergySmart Grocer Program were no longer offered?



Only 25% of non-direct install customers and 40% of direct install participants said that they would be very likely to undertake additional energy efficiency actions if the ESG program were no longer offered, while 31% of non-direct install and 23% of direct install participant said they would be very unlikely to do so. The response from 40% of direct install participants who said they were very likely to take additional action is somewhat suspect, since these respondents took no additional actions even when the ESG program was available.

4. CONCLUSIONS AND RECOMMENDATIONS

The 2004-2005 ESG program built on the success of the 2003 program in that it installed measures in more than 1350 stores, provided audits to 359, and successfully reached both smaller stores (through contractors) and rural stores (through audits and direct installs). While the overall goal of the program – targeting independent grocery stores – remained unchanged in 2004-2005, we found that several aspects of the implementation and delivery of the ESG program differed from the 2003 program approach:

- Greater emphasis on impacts rather than reaching a hard-to-reach market, with no reporting of the percentage of rural stores contacted by the program (Although reporting was not in the contract, the program did track it internally and exceeded the rural goals.)

- Reliance on contractors rather than program staff to deliver low cost measures to many stores.

- The use of contractors extended program reach into many new stores (e.g., liquor stores, small convenience stores), but meant a more limited role for the ESG Energy Experts, and therefore less education and training of store owners and decision makers, with more potential savings left unrealized. (Annual deemed savings per rebated/retrofitted store averaged 44,087 kWh in 2004-2005, vs. 70,194 kWh in 2003.)

- Fewer audits and therefore less use of the GrocerSmart audit tool reduced the amount of information conveyed during the course of a "typical" retrofit.

The number of vendors offering qualifying measures to independent grocers grew significantly during the ESG program, and a growing proportion of retrofits was initiated by contractors in stores that had not had an audit. In all, more than 60% of the retrofits completed through the 2004-2005 program were done by vendors in stores that had never had an audit.

The program reached its goals in terms of the number of retrofits and in terms of the amount of deemed savings. However, evaluation confirmed impacts were 10% less than deemed savings, primarily because of the reduced level of savings calculated for Floating Head Pressure control by the impact analysis task. A number of factors may explain the lower impacts calculated by the modeling effort (climate zone, day-to-day weather variations, sizing of particular systems), and it is worth continuing to investigate this measure.

In addition to FHP, the evaluation found issues relating to several other measures. Specifically, the high rate of failures/removals for screw-in CFLs after just one year indicates that CFLs are not an appropriate measure as the lead-in to additional energy efficiency actions.

- The high failure rate, particularly in freezer applications, not only limits the actual savings from this measure but also provides support to the perception that energy efficient technologies are inherently unreliable.

- Impacts were reduced in proportion to the number of bulbs that were found to have failed or been removed after one year, which amounted to 36% of the total.

- We did not have data to estimate the amount of bulb failure/removal in subsequent years, and therefore did not reduce impacts further for those years, but it is likely that additional failures/removals before the end of the assumed measure life would be significant.

Such low cost measures as gasket repair, auto closers, ASH control and evaporator fan control offer opportunities for significant savings in the most difficult part of the market – liquor stores and convenience/gas station stores, where they can deliver savings that the owner can actually see on the bill.

- The ASH control timer switch was (correctly) pulled from some markets, but it still appears to make sense for some applications in dry climates, where it is an easily sold low cost application that can provide significant savings, as long as adequate support is provided. In addition, other ASH controls such as the Altech or similar systems remove the risk of store operators failing to turn on the heater when necessary.

- Because ASH control impacts depend critically on the connected load of the heater being controlled, we recommend that incentives associated with ASH control vary with the measured load of heaters on the doors being controlled.

Issues surrounding both screw-in CFLs and timer controlled ASH controls call attention to the importance of ongoing outside support and education for small store owners.

- The ESG provided this kind of support to a greater degree in 2003, when more stores were audited, giving the program's Energy Experts an opportunity to sit down and review all the measures and actions that a food store can take to save energy. That kind of support is, of course, expensive.

- The alternative – having contractors fill that role – is effective for knowledgeable contractors working with a (relatively) large chain, but it simply does not work for smaller stores. To make small, low cost measure jobs profitable, contractors have to minimize their selling and education time with managers at small stores; instead they rely on rebates to make the decision to install gaskets, door closers, or strip curtains essentially a no-brainer, so that they can go in, complete the job, and move on.

- In addition to lacking the time to educate and inform store decision makers, contractors also do not enjoy anything like the level of trust that the Energy Experts have developed over the past several years.

Overall, the Energy Smart Grocer program has been very successful in moving a traditionally underserved market segment toward greater energy efficiency through a mix of program elements and a highly responsive adaptive management strategy. Both the results achieved and the high degree of satisfaction expressed by respondents regarding the various program elements indicate that the 2004-2005 ESG program strategies have been successful. Indicators of this success include:

- To streamline the participation process, the ESG made numerous mid-course corrections to attempt to increase the amount of information transfer for stores that conducted retrofits through contractors, including contractor briefings, follow-up phone calls and visits, and leave behind information addressing operating considerations for the installed measures (particularly for timer-controlled ASH controls).

- Baseline data collected from stores and contractors indicate that the measures and technologies promoted by the ESG program are far from baseline practice in independent grocery stores; contractor and participant responses also suggest that most customers will not take energy efficiency actions in the absence of some kind of incentives.

- There is also evidence that program participation appears to reduce the level of barriers perceived by store owners, in that owners whose stores receive only direct install measures perceive somewhat higher barriers than those who pursue additional energy efficiency opportunities through the program. As another indication of the influence of the ESG program, perceived barriers were lower for customers who received direct install measures only in 2004-2005 than for customers who received rebates of less than $100 in 2003.

APPENDIX A– SURVEY INSTRUMENTS

2005 Interview Guide – Participants
ENERGY SMART GROCER EVALUATION

Store Name: _____

Contact Name: _____

Contact Title: _____

Phone Number: _____

Address: _____

Date: _____

Interviewer _____

Hello. I'm calling on behalf of the California Public Utilities Commission about the EnergySmart Grocer program. (IF NECESSARY: The EnergySmart Grocer program is an energy efficiency program offered to independent grocery stores.) Our records show that your store received an audit and had measures installed through the program, and we are interviewing stores who are participating or have participated in the program. The information we collect will help The Energy Smart Grocer Program and the Public Utilities Commission improve the program so that it continues to meet the needs of independent food stores. Are you the right person to answer questions regarding your store's participation in the program? (If NO) Who would be the best person to talk to?

Other Contact Name: _____
Other Contact Title: _____
Phone Number: _____

Do you have about 10 minutes to complete this interview? (If not, schedule a callback.)

Q12. How many stores do you/does your company operate in California?_____

Q14. How many outside the state? _____

Q16. How many of those stores are your responsibility as far as making energy related purchases and investment decisions? _____

Energy/Electricity Usage

Q112. Over the past 2-3 years, has your emphasis on controlling, managing, or reducing energy usage increased, decreased, or remained the same?
1. Increased 2. Decreased 3. Stayed about the Same

Q113. (IF INCREASED OR DECREASED) What were reasons behind those changes?

EnergySmart Grocer Program. Now I would like to ask you about the EnergySmart Grocer Program.

Q30. How did you find out about the program? _____

Q35. What were your main reasons for participating in the program? (DO NOT READ, CHECK ALL THAT APPLY)

a. To save energy
b. To reduce costs/save on utility bills
c. To take advantage of the rebates
d. To get access to unbiased technical information/assistance
e. To get a better understanding of our energy use
f. Recommended by a colleague/boss
g. Recommended by a vendor/supplier
h. Other (specify) _____

Q40. IF MORE THAN ONE: Which of those was the most important reason?

Q55. Now I would like you to rate various aspects of the EnergySmart Grocer program, using a 1 to 6 scale where 1 is very poor and 6 is excellent. (ROTATE)

a. Program promotional materials
b. Quality of the store audit
c. Technical knowledge of the program staff
d. Responsiveness of the program staff
e. The level of incentives provided by the program
f. Paperwork and procedures required to receive incentives
g. Quality of vendors who provide the recommended equipment/services
h. The performance of the measures installed through the program

Q57. Note any item with a 1 or 2 rating and ask, Why do you give that aspect a poor rating? (Enter verbatim)

Q58. Have any of the measures you had installed through the program stopped working or been removed? If so, which ones and how many?

Q60. What aspects of the program have you found most helpful? Why do you say that? (Enter verbatim)

Q65. What aspects of the program have you found least helpful? Why do you say that? (Enter verbatim)

Q70. Are there any specific changes that you would recommend for the program? (Enter verbatim)

MARKET BARRIERS

Q310. Next, I'm going to read some statements that describe problems store decision makers might face in installing more energy efficient equipment. Please rate the significance of each of the following potential problems on a six point scale, where 1 means "not at all significant" and 6 means "extremely significant": (As needed, after reading a statement, ask: How significant would that problem be on the 1 to 6 scale, where 1 is not at all significant and 6 is extremely significant.)

a. It is difficult to find reliable, unbiased estimates of potential energy savings _____
b. It is difficult to get delivery on efficient equipment _____
c. Energy efficient equipment might not be as reliable _____
d. Energy efficient equipment costs too much/doesn't meet payback requirements _____
e. Decisions made at headquarters; energy efficiency not a major concern to them _____
f. Efficient lighting would decrease attractiveness of in-store displays _____
g. Doors would inhibit customers from reaching into cases _____
h. It is difficult to get financing for improvements _____
i. It is difficult to get trustworthy technical advice or product specifications _____
j. Uncertainty about whether our stores will be sold, merged, or put out of business _____
k. Other barriers _____ _____

Q312. Do you believe the percentage of high efficiency equipment installed in your stores in the next 3 to 5 years will increase, decrease, or stay the about the same?

1. Increase
2. Decrease
3. Stay the same
99. Don't Know

Q316. On a scale of 1 to 6, where 1 is not at all helpful and 6 is very helpful, how helpful do you consider each of the following program features in promoting the use of energy efficient equipment at your stores:

a. Audits _____
b. Technical assistance _____
c. Informational brochures _____
d. Demonstration stores _____
e. Rebates/incentives _____
f. Web-based information _____
g. Training for staff _____
h. Financing _____
i. Other _____ _____

Q318. Next, I want to ask you about any energy investments or actions you may have undertaken in the past **two years** to improve the energy efficiency of your store/stores – APART FROM YOUR PARTICIPATION IN THE ENERGYSMART GROCER PROGRAM. Please tell me which of the following you have done or had done in the past two years:

a. An energy audit _____
b. A lighting retrofit _____
c. Compressor tune-up _____
d. Purchased one or more high efficiency cases _____
e. Installed more efficient case doors _____
f. Installed night covers on cases _____
g. Installed strip curtains on a walk-in cooler _____
h. Other (specify)_____ _____

Q320. How likely are you to undertake additional energy efficiency actions through the EnergySmart Grocer program at other stores operated by your company?

a. Very unlikely _____
b. Somewhat likely _____
c. Very likely _____
d. Have no other stores _____

Q322. (IF VERY UNLIKELY) Why are you unlikely to do so?

Q324. How likely would you be to undertake additional energy efficiency actions at this store or other stores if the EnergySmart Grocer Program were no longer offered?

a. Very unlikely _____
b. Somewhat likely _____
c. Very likely _____

Q330. Do you have any final comments about the EnergySmart Grocer program?

Those are all the questions I have for you today. Thank you very much for your time.

Interview Guide – Suppliers

ENERGY SMART GROCER EVALUATION

Company Name: _____

Contact Name: _____

Contact Title: _____

Phone Number: _____

Address: _____

Date: _____

Interviewer _____

Hello. I'm calling on behalf of the California Public Utilities Commission for an evaluation of the EnergySmart Grocer program. (IF NECESSARY: The EnergySmart Grocer program is an energy efficiency program offered to independent grocery stores. Our records show that your company is one of the suppliers offering products or services to stores that are participating in the program.) As part of this study, we are interviewing selected contractors who provide services to the independent grocers who are targeted by the program. Does this description apply to your organization?

NO : Thank and terminate

YES: Are you the right person to answer questions regarding trends in equipment usage, maintenance, and selection in independent grocery stores in California? (If NO) Who would be the best person to talk to?

Other Contact Name: _____

Other Contact Title: _____

Phone Number: _____

Do you have about 15 minutes to complete this interview? (If not, schedule a callback.)

Q18. What percentage of your company's business in California is accounted for by:

chain supermarkets? _____ (%) independent supermarkets? _____(%)

chain C-stores? _____(%) independent C-stores _____(%)

other _____(%)

Q20. What services does your company provide to food stores?

a. Equipment sales
b. design and planning
c. installation
d. scheduled maintenance
e. repairs
f. financing

g. other (1) _____
h. other (2) _____

Q25. About how would you break down the work you do for food stores between existing stores and new stores or major expansions?

Existing stores _____(%) New stores or expansions _____(%)

Next I would like to ask you about the EnergySmart Grocer Program.

Q30. How did you find out about the program?

Q35. What percentage of your business since you began participating in the program has been done through the program?

Q40. Since you began participating in the EnergySmart Grocer Program, to what extent have you increased your sale of energy efficient products or technologies to stores that are not participating in the program?

Q45. Since you began participating in the EnergySmart Grocer Program, how have you changed the types of products that you stock or that you offer to customers?

Q50. Since you began participating in the EnergySmart Grocer Program, to what extent have you developed new contacts with stores, wholesalers, or equipment manufacturers?

Q55. I'm going to ask you to rate various aspects of the EnergySmart Grocer program, using a 1 to 6 scale where 1 is very poor and 6 is excellent (ROTATE).

i. Program promotional materials
j. Quality of the store audit
k. Quality of the recommendations
l. Technical knowledge of the program staff
m. Responsiveness of the program staff
n. The specific measures covered by the program
o. The level of incentives provided by the program
p. Paperwork and procedures required to receive incentives

Q60. What aspects of the program have you found most helpful to your business? Why do you say that?

Q65. What aspects of the program have you found least helpful to your business? Why do you say that?

Q70. What aspects of the program would you change?

Energy Efficiency Installation Trends

Now, I would like to ask a few questions regarding installation of energy efficient equipment/lighting in food stores

Q116. Relative to your overall sales to the retail food sector, what percentage was accounted for by high efficiency lighting/refrigeration/HVAC equipment in 2003/2004?

Q116a. _____2003/4 High Efficiency Q116b. _____2003/4 Standard Efficiency

Q117. Of those jobs that involved high efficiency equipment, approximately what percentage involved a utility rebate, incentive, or financing?

Q305. Thinking about your sales approach to food store customers over the past 2-3 years, has your emphasis on controlling, managing, or reducing energy demand increased, decreased, or remained the same?

Q306 What have been the reasons behind those changes?

Q306 What specific energy efficient features/technologies are you currently emphasizing in the retail food sector?

Q312a. What are the major barriers you face in selling/installing high efficiency (refrigeration/HVAC/lighting) equipment today?

Q314. To what extent has the EnergySmart Grocer Program reduced those barriers?

Q315. How likely are companies that have participated in the EnergySmart Grocer program with one store to participate in the program at other stores?

a. Very unlikely _____
b. Somewhat likely _____
c. Very likely _____

Q316. (IF VERY UNLIKELY) Why are they unlikely to do so?

Q317. How likely is it that companies that have participated in the program with one store will undertake additional energy efficiency actions at other stores if the EnergySmart Grocer program is not available to them?

d. Very unlikely _____
e. Somewhat likely _____
f. Very likely _____

Q321. What kind of evaporator fan motors do you keep in stock:

1. Shaded pole motors
2. Permanent split capacitor motors
3. Electronically commutated motors (ECMs)

Q321a. Why do you not stock PSC or ECM motors?

Q322. Have you observed any differences in the overall approach to the repair or replacement of refrigeration equipment/systems among independent stores compared to the larger chains? What are those differences?

Q323. Among the food stores that you service, approximately what percentage have each of the following technologies in place:

Equipment Type	**% of Stores with Equipment**
Energy Management Systems	
Floating head pressure controls	
High efficiency compressors	
Multiplexed compressors	
Night covers for refrigerated cases	
Permanent Split Capacitor (PSC) evaporator fan motors	
Electronically commutated (ECM) evaporator fan motors	
"Smart" defrosting using sensors to trigger defrost cycle	
What percent of freezer (low temperature) cases have doors?	
What percent of (medium temperature) refrigerated cases have doors?	
What percent of case doors are low/no heat?	
Any other aspects of store design to minimize/manage energy use?____ _____	

IMPORTANCE OF ENERGY USAGE (ALL)

Q410. What payback do your retail food customers typically look for in an energy efficiency investment? _____ (years).

Q411. Does this differ for supermarkets chains (Q213)_____and independent grocers (Q214)_____?

Q420. Do you have any other observations regarding the potential for greater energy efficiency in the retail food sector?

Those are all the questions I have for you today. Thank you very much for your time.

APPENDIX B – IMPACTS BY UTILITY BY YEAR

SCE Program Energy Impact Reporting for 2004-2005 Programs

Program ID*:	1290-04					
Program Name:	Portland Energy Conservation, Inc. (PECI) - EnergySmart Grocer Program					
	Year	Calendar Year	Gross Program-Projected MWh Savings	Net Evaluation Confirmed Program MWh Savings	Gross Program-Projected Peak MW Savings	Evaluation Projected Net Peak MW Savings**
	1	2004	8,068	6,664	1.12	0.93
	2	2005	20,662	18,091	3.10	2.74
	3	2006	20,662	18,091	3.10	2.74
	4	2007	20,662	18,091	3.10	2.74
	5	2008	18,752	16,258	2.88	2.53
	6	2009	16,713	14,301	2.62	2.28
	7	2010	16,589	14,182	2.55	2.21
	8	2011	16,589	14,182	2.55	2.21
	9	2012	15,240	13,029	2.37	2.06
	10	2013	10,977	9,059	1.85	1.58
	11	2014	10,977	9,059	1.85	1.58
	12	2015	10,976	9,058	1.85	1.58
	13	2016	10,772	8,861	1.83	1.56
	14	2017	9,677	7,810	1.72	1.45
	15	2018	7,699	6,850	1.45	1.32
	16	2019	6,139	5,893	1.23	1.18
	17	2020	3,449	3,311	0.59	0.56
	18	2021	0	0	0.00	0.00
	19	2022	0	0	0.00	0.00
	20	2023	0	0	0.00	0.00
	TOTAL	**2004-2023**	224,606	192,791	0.00	0.00

PG&E Program Energy Impact Reporting for 2004-2005 Programs

Program ID*:	1314-04					
Program Name:	Portland Energy Conservation, Inc. (PECI) - EnergySmart Grocer Program					
	Year	Calendar Year	Gross Program-Projected MWh Savings	Net Evaluation Confirmed Program MWh Savings	Gross Program-Projected Peak MW Savings	Evaluation Projected Peak MW Savings**
	1	2004	11,335	10,759	4.15	3.97
	2	2005	28,713	24,899	6.98	6.34
	3	2006	28,713	24,899	6.98	6.34
	4	2007	28,713	24,899	6.98	6.34
	5	2008	21,783	18,246	6.19	5.59
	6	2009	20,198	16,724	5.65	5.07
	7	2010	19,154	15,722	4.95	4.40
	8	2011	19,154	15,722	4.95	4.40
	9	2012	18,212	14,941	4.83	4.29
	10	2013	16,500	13,421	4.61	4.10
	11	2014	16,500	13,421	4.61	4.10
	12	2015	16,500	13,421	4.61	4.10
	13	2016	15,959	12,902	4.55	4.04
	14	2017	14,749	11,740	4.42	3.92
	15	2018	14,749	11,740	4.42	3.92
	16	2019	9,044	8,682	1.32	1.27
	17	2020	6,720	6,451	0.83	0.80
	18	2021	0	0	0.00	0.00
	19	2022	0	0	0.00	0.00
	20	2023	0	0	0.00	0.00
	TOTAL	2004-2023	306,694	258,590		

SDG&E Program Energy Impact Reporting for 2004-2005 Programs

Program ID*:	1291-04					
Program Name:	Portland Energy Conservation, Inc. (PECI) - EnergySmart Grocer Program					
	Year	Calendar Year	Gross Program-Projected MWh Savings	Net Evaluation Confirmed Program MWh Savings	Gross Program-Projected Peak MW Savings	Evaluation Projected Peak MW Savings**
	1	2004	4,878	4,250	2.73	2.56
	2	2005	12,944	11,845	3.89	3.65
	3	2006	12,944	11,845	3.89	3.65
	4	2007	12,944	11,845	3.89	3.65
	5	2008	11,543	10,500	3.73	3.50
	6	2009	8,178	7,270	3.27	3.07
	7	2010	7,979	7,078	3.14	2.94
	8	2011	7,979	7,078	3.14	2.94
	9	2012	7,314	6,494	3.04	2.84
	10	2013	3,941	3,281	2.61	2.44
	11	2014	3,941	3,281	2.61	2.44
	12	2015	3,791	3,137	2.59	2.42
	13	2016	3,414	2,775	2.55	2.38
	14	2017	3,132	2,505	2.52	2.35
	15	2018	2,266	2,052	2.41	2.29
	16	2019	1,920	1,843	0.36	0.34
	17	2020	541	519	0.09	0.08
	18	2021	0	0	0.00	0.00
	19	2022	0	0	0.00	0.00
	20	2023	0	0	0.00	0.00
	TOTAL	2004-2023	109,649	97,600		

Sum Of Energy Impacts for The EnergySmart Grocer 2004-2005 Program

Program IDs*:	1290-04; 1314-04; 1291-04					
Program Name:	Portland Energy Conservation, Inc. (PECI) - EnergySmart Grocer Program					
	Year	Calendar Year	Gross Program - Projected MWh Savings	Net Evaluation Confirmed Program MWh Savings	Gross Program - Projected Peak MW Savings	Evaluation Projected Peak MW Savings**
	1	2004	24,281	21,479	8.00	7.46
	2	2005	62,319	54,836	13.96	12.74
	3	2006	62,319	54,836	13.96	12.74
	4	2007	62,319	54,836	13.96	12.74
	5	2008	52,078	45,037	12.80	11.62
	6	2009	45,089	38,297	11.54	10.41
	7	2010	43,722	36,982	10.64	9.55
	8	2011	43,722	36,982	10.64	9.55
	9	2012	40,767	34,615	10.24	9.20
	10	2013	31,418	25,761	9.07	8.12
	11	2014	31,418	25,761	9.07	8.12
	12	2015	31,267	25,616	9.06	8.10
	13	2016	30,145	24,539	8.94	7.99
	14	2017	27,558	22,055	8.66	7.72
	15	2018	24,714	20,643	8.28	7.53
	16	2019	17,103	16,419	2.91	2.79
	17	2020	10,711	10,290	1.50	1.44
	18	2021	0	0	0	0
	19	2022	0	0	0	0
	20	2023	0	0	0	0
	TOTAL	2004-2023	640,949	548,981		

APPENDIX C – IMPACTS BY MEASURE

Exhibit B-1 -- Impacts by Measure

	Number Rebated					Net Impact
Measure	PG&E	SCE	SDG&E	Grand Total	Units	Annual kWh
Auto-Closers for Glass Reach-in Doors -- Cooler	18.0	73.0	183.0	274.0	/closer	743,877
Auto-Closers for Glass Reach-in Doors -- Coolers/Freezers	37.0	24.0	11.0	72.0	/closer	195,471
Auto-Closers for Walk-in Coolers	6.0	20.0	18.0	44.0	/closer	149,318
Auto-Closers for Walk-in Freezers	7.0	9.0	3.0	19.0	/closer	64,478
Cases - Low Temp Coffin to High Efficiency Reach-in	841.9	52.0	20.5	914.4	/linear foot	682,917
Cases - Low Temp Open to Reach-in	905.6	233.2	33.3	1,172.0	/linear foot	1,359,145
Cases - Low Temp Open to Refurbished Reach-in		40.0		40.0	/linear foot	37,133
Cases - Low Temp Reach-in to High Efficiency Reach-in	2,788.8	1,929.8	431.3	5,149.9	/linear foot	4,775,820
Cases - Low Temp Reach-in to Refurbished High Efficiency Reach-in		75.0		75.0	/linear foot	55,584
Cases - Medium Temp Open Case to New High Efficiency Open Case	1,571.7	774.0	88.0	2,433.7	/linear foot	588,749
Cases - Medium Temp Open Case to New Reach In	194.6	210.0		404.6	/linear foot	235,757
Cases - Night covers - horizontal display case	1,310.0	180.0	473.3	1,963.3	/linear foot	111,199
Cases - Night covers - vertical display case	10,800.9	1,062.4	2,112.0	13,975.3	/linear foot	1,985,607
Cases - Special doors with low/no ASH	76.0			76.0	/door	54,647
Controls - Anti-Sweat Heat (Low Temp)	1,591.0	1,953.5	502.3	4,046.8	/linear foot	1,332,514
Controls - Anti-Sweat Heat (Medium Temp)	3,313.9	11,074.5	8,620.9	23,009.3	/linear foot	7,576,500
Controls - Evaporator Fan	15.0	35.0		50.0	/controller	53,232
Controls - Occupancy Sensor - Wall/Ceiling Mounted	9.0			9.0	/sensor	12,135
Controls - Occupancy Sensor - Wallbox	83.0		3.0	86.0	/sensor	34,425
Controls - Time Clock	4.0		35.0	39.0	/clock	60,402
Controls - Vending Machine	2.0			2.0	/controller	3,053
Controls - Visi Cooler	8.0		3.0	11.0	/controller	8,448
Controls - Visi Cooler, Direct Install	96.0	87.0	31.0	214.0	/controller	164,352
Cool Roof			8,020.0	8,020.0	/square foo	2,564
Energy Efficient compressor (low temp)		10.4		10.4	/ton	10,493
Evap motors: shaded pole to ECM/SSC	855.0	254.0	303.0	1,412.0	/motor	227,727
Evap motors: shaded pole to PSC	59.0			59.0	/motor	4,758
Gaskets - Cooler/Freezer Door Gaskets - Reach-in Glass Doors	7,423.8	20,271.0	25,901.0	53,595.8	/linear foot	5,145,193
Gaskets - Cooler/Freezer Door Gaskets - Walk-in Solid Doors	2,102.2	1,657.7	3,792.3	7,552.2	/linear foot	942,510
Glass Door Open Display Case	57.0			57.0	/door	63,202
Hardwired 14-26 watt CF Fixture	5.0			5.0	/fixture	1,886
Hardwired Fluorescent Fixtures 27-65W (from incandescent)	10.0	68.0		78.0	/fixture	68,707
High Output 4 or 6 Lamp T5 Fixture (High bay applications)	22.0			22.0	/fixture	30,453
Interior 0-35w Incan Base HID	6.0			6.0	/fixture	2,076
Interior 71-100w Incan Base HID	12.0	52.0		64.0	/fixture	55,783
LED Channel Signage Replacement-Outdoor Red >2 feet high	27.9			27.9	/linear foot	589
LED Exit Sign New Sign		36.0	5.0	41.0	/sign	11,691
Lighting - 27 W CFL lamps in Walk-in	194.0	176.0	55.0	425.0	/lamp	178,704
Lighting - 27 W CFL lamps in Walk-in, Direct install	617.0	489.0	150.0	1,256.0		528,123
Lighting - 27 W CFL Lamps, Direct Install	95.0	362.0	65.0	522.0	/lamp	197,942
Lighting - 4 ft T-8 fluorescent fixture (per lamp) for Walk-in	26.0	68.0	32.0	126.0	/lamp	75,963
Lighting - Case lighting T-10/12 to T8, 4 ft	32.0	94.0	22.0	148.0	/lamp	23,301
Lighting - Case lighting T-10/12 to T8, 5 ft			15.0	15.0	/lamp	4,723
Lighting - Case lighting T-10/12 to T8, 6 ft	83.0	11.0	12.0	106.0	/lamp	44,876
Lighting - Case lighting T-10/12 to T8, 8 ft	10.0	2.0		12.0	/lamp	3,882
Lighting - T-12, 5 ft Case lighting w/magnetic ballast to electronic	89.0			89.0	/lamp	12,047
Lighting - T-12, 6ft Case lighting w/magnetic ballast to electronic	8.0			8.0	/lamp	768

Exhibit B-1 -- Impacts by Measure (continued)

	Number Rebated					Net Impact
Measure	**PG&E**	**SCE**	**SDG&E**	**Grand Total**	**Units**	**Annual kWh**
Air-cooled to evap-cooled condenser, multiplex		367.5		367.5	/ton	670,320
Multiplex - Compressors - Air-cooled Condenser	325.3	257.6	197.4	780.3	/tons	2,059,992
Multiplex - Compressors - Evaporative Condenser	500.3	394.0	39.0	933.3	/tons	1,343,981
Multiplex - Controls - Floating head pressure - air cooled condenser	1,981.0	1,517.0	567.0	4,065.0	/hp	1,756,080
Multiplex - Controls - Floating head pressure - evaporative condenser	2,938.0	1,549.5	484.0	4,971.5	/hp	2,648,815
Multiplex - Controls - Floating suction pressure - air cooled condenser	1,061.0	1,332.5	277.0	2,670.5	/hp	497,354
Multiplex - Controls - Floating suction pressure - evaporative condenser	1,866.0	586.0	484.0	2,936.0	/hp	546,801
Multiplex - Efficient/oversized Air-cooled Condenser for Multiplex	1,378.3	595.1	531.0	2,504.4	/ton	3,748,215
Multiplex - Efficient/oversized water-cooled Condenser for Multiplex	1,232.3	1,054.4		2,286.7	/ton	2,059,128
Premium T8/T5 Lamp & Electronic Ballast - 2 ft (from T12)		3.0		3.0	/lamp	150
Premium T8/T5 Lamp & Electronic Ballast - 3 ft (from T12)		4.0		4.0	/lamp	326
Premium T8/T5 Lamp & Electronic Ballast - 4 ft (from T12)	2,321.0	5,268.0	802.0	8,391.0	/lamp	459,156
Premium T8/T5 Lamp & Electronic Ballast - 8 ft (from T12)	645.0	18.0		663.0	/lamp	42,008
Remove 2 Ft T-12 (De-Lamp)	22.0			22.0	/lamp	3,464
Remove 4 Ft T-12 (De-Lamp)	317.0	137.0	96.0	550.0	/lamp	148,896
Remove 4 Ft T-12 (De-Lamp, add reflector)	30.0	94.0	39.0	163.0	/lamp	44,127
Remove 8 Ft T-12 (De-Lamp)	80.0	6.0	10.0	96.0	/lamp	47,739
Remove 8 Ft T-12 (De-Lamp, add reflector)			557.0	557.0	/lamp	276,985
Remove 8 Ft T-8 (De-Lamp)	4.0			4.0	/lamp	1,382
Screw in >27 Watt CFL Lamp		54.0	6.0	60.0	/lamp	22,752
Screw in >27 Watt CFL Lamp (with reflector)	8.0			8.0	/lamp	3,034
Screw in 14-26 Watt CFL Lamp	238.0	172.0	137.0	547.0	/lamp	108,175
Screw in 14-26 Watt CFL Lamp (with reflector)	48.0			48.0	/lamp	9,492
Screw in 5-13 CFL Watt Lamp	21.0			21.0	/lamp	3,830
Setback Programmable Thermostats			13.0	13.0	/thermostat	51,081
Strip Curtains for Walk-ins	14,734.0	3,491.0	3,316.2	21,541.2	/square foo	9,615,999
Suction Line Insulation	2,500.0	90.0	9,600.0	12,190.0	/linear foot	187,238
T12 w/Electronic Ballast to T-8 w/Electronic Ballast, 4 ft	2.0	968.0	1,053.0	2,023.0	/lamp	59,399
T12 w/Electronic Ballast to T-8 w/Electronic Ballast, 8 ft	46.0			46.0	/lamp	3,763
Units <65 kBtu/hr (5.4 tons) air-cooled single package Tier 1	34.0			34.0	/ton	21,382
Units <65 kBtu/hr (5.4 tons) air-cooled single package Tier 3	15.0			15.0	/ton	12,522
Units 135-240 kBtu/hr (11.3-20 tons) air-cooled split-system/single pckg Tier	30.0			30.0	/ton	5,486
Units 65-135 kBtu/hr (5.4-11.3 tons) air-cooled split-system/single pckg Tier 2	7.5		7.5	15.0	/ton	4,248
VFD - Motors	75.0	228.0	53.0	356.0	/hp	317,837
VFD on HVAC fans	10.0	70.0	50.0	130.0	/hp	93,974
Walk-in Evap motors: shaded pole to ECM/SSC	12.0	31.0		43.0	/unit	37,978
Grand Total						**54,835,831.1**