

Evaluation, Measurement and Verification of the Davis Energy Efficiency Program

Final Report

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ADDENDUM

This addendum represents the application of the report's evaluation results to the final reported savings of the Davis Energy Efficiency Program (DEEP) as required by the CPUC program performance evaluation. The DEEP evaluation was based on program activity recorded as of March 31, 2004 in order to meet the CPUC report deadline of June 30, 2004. Therefore, the results of the evaluation report does not match the final program savings that account for program activity that was finalized through June 30, 2004 and reported in September 2004.

For this addendum, we have applied the Net Realization Rate by EEM to the final program numbers. The final adjusted results are presented in the tables below. We hope that this provides a clear and traceable path of the EM&V process.

The overall DEEP program level evaluation results are provided in Table A-1 for workbook and actual estimated savings. The DEEP workbook savings and actual savings differ for only two EEMs: EEM 9a Davis Lights and EEM 9b Customized Commercial. The workbooks savings refer to the deemed values used in the CPUC reporting workbook which only allows one deemed value per EEM. However, EEM 9a and 9b are prescriptive programs in which projects have varying energy savings based on the lighting measures installed. Thus, the actual savings refer to estimates based on the installed measures. The evaluation report analysis is based on DEEP actual savings. EEM level results are presented in Table A-2 and Table A-3.

Energy & Demand Results	Program Estimate		Net Realization Rate	Revised Program Estimate	
	Workbook	Actual		Workbook	Actual
Energy Savings (kWh)	5,365,990	4,784,118	74%	3,988,399	3,555,909
Energy Savings (therms)*	5,604	5,604	34%	1,929	1,929
Demand Reduction (kW)	1,257	1,115	83%	1,043	924

* Only two measures (EEM 3 and EEM 13) claimed therms savings

Table A-1: Final DEEP Program Savings¹

¹ RP = relative precision, RR = realization rate.

Final DEEP Program Workbook Savings by EEM	Final Program Savings Estimates			Net Realization Rate			Final Evaluated Savings Estimates		
	Energy Savings (kWh)	Energy Savings (therms)	Demand Reduction (kW)	Energy Savings (kWh)	Energy Savings (therms)	Demand Reduction (kW)	Energy Savings (kWh)	Energy Savings (therms)	Demand Reduction (kW)
EEM1-Single Family Houses Shadescreens	21,123	0	48	76%	-	76%	16,053	0	36
EEM2-Multi-Family Dwellings Shadescreens	13,599	0	11	100%	-	100%	13,599	0	11
EEM3-Single Family Duct Repair	7,548	1,700	11	79%	79%	79%	5,963	1,343	9
EEM4-Multi-Family Duct Repair	61,087	0	63	100%	-	100%	61,087	0	63
EEM5 - Small Commercial Exit Signs	76,820	0	9	92%	-	92%	70,674	0	8
EEM6 - Compact Fluorescent Lamp Commercial	98,350	0	17	52%	-	62%	51,142	0	10
EEM7-Compact Fluorescent Lamp Residential	1,138,500	0	99	19%	-	34%	216,315	0	34
EEM8-Single Family Window-Mnt Evap Cooler	92,600	0	100	51%	-	48%	47,226	0	48
EEM9a-Davis Lights	1,026,000	0	205	99%	-	99%	1,015,740	0	203
EEM9b-Customized Commercial Projects	2,590,000	0	555	89%	-	89%	2,305,100	0	494
EEM9c-City-School Partnership	75,000	0	36	75%	-	75%	56,250	0	27
EEM10-Multi-Family Swimming Pool Retrofit	2,430	0	1	100%	-	100%	2,430	0	1
EEM13-Multi-Family Laundry Retrofit Project	17,536	3,904	1	15%	15%	15%	2,630	586	0
EEM14-Torchiere Swap	78,111	0	3	75%	-	75%	58,583	0	2
EEM15-Single Family HVAC Charge and Airflow	33,605	0	50	95%	-	95%	31,924	0	47
EEM16-Multi-Family Charge and Airflow	33,682	0	50	100%	-	100%	33,682	0	50
Program Total	5,365,990	5,604	1,257	72%	34%	83%	3,988,399	1,929	1,043

Table A-2: Final DEEP Program Workbook Savings by EEM

Final DEEP Program Actual Savings by EEM	Final Program Savings Estimates			Net Realization Rate			Final Evaluated Savings Estimates		
	Energy Savings (kWh)	Energy Savings (therms)	Demand Reduction (kW)	Energy Savings (kWh)	Energy Savings (therms)	Demand Reduction (kW)	Energy Savings (kWh)	Energy Savings (therms)	Demand Reduction (kW)
EEM1-Single Family Houses Shadescreens	21,123	0	48	76%	-	76%	16,053	0	36
EEM2-Multi-Family Dwellings Shadescreens	13,599	0	11	100%	-	100%	13,599	0	11
EEM3-Single Family Duct Repair	7,548	1,700	11	79%	79%	79%	5,963	1,343	9
EEM4-Multi-Family Duct Repair	61,087	0	63	100%	-	100%	61,087	0	63
EEM5 - Small Commercial Exit Signs	76,820	0	9	92%	-	92%	70,674	0	8
EEM6 - Compact Fluorescent Lamp Commercial	98,350	0	17	52%	-	62%	51,142	0	10
EEM7-Compact Fluorescent Lamp Residential	1,138,500	0	99	19%	-	34%	216,315	0	34
EEM8-Single Family Window-Mnt Evap Cooler	92,600	0	100	51%	-	48%	47,226	0	48
EEM9a-Davis Lights	998,778	0	205	99%	-	99%	988,790	0	203
EEM9b-Customized Commercial Projects	2,035,350	0	412	89%	-	89%	1,811,462	0	367
EEM9c-City-School Partnership	75,000	0	36	75%	-	75%	56,250	0	27
EEM10-Multi-Family Swimming Pool Retrofit	2,430	0	1	100%	-	100%	2,430	0	1
EEM13-Multi-Family Laundry Retrofit Project	17,536	3,904	1	15%	15%	15%	2,630	586	0
EEM14-Torchiere Swap	78,111	0	3	75%	-	75%	58,583	0	2
EEM15-Single Family HVAC Charge and Airflow	33,605	0	50	95%	-	95%	31,924	0	47
EEM16-Multi-Family Charge and Airflow	33,682	0	50	100%	-	100%	33,682	0	50
Program Total	4,784,118	5,604	1,115	72%	34%	83%	3,467,811	1,929	916

Table A-3: Final DEEP Program Actual Savings by EEM

EXECUTIVE SUMMARY

This report presents the final results of an evaluation of the Davis Energy Efficiency Program. The Davis Energy Efficiency Program (DEEP) was a hybrid of both information and energy savings measures. DEEP provided rebates, giveaways, direct installations, technical assistance, information, marketing and training to the residences and businesses of Davis. The program was a comprehensive, multiple-market project, with goals to save energy, develop local infrastructure, educate and inform participants, and innovate delivery methods through the use of energy efficiency training and outreach and provision of rebates for the successful installation of energy saving measures. DEEP was anticipated to achieve annual net energy savings of 3,907,726 kWh, 5,230 therms, and 1,554 KW of demand reduction². As part of its portfolio of programs, DEEP implemented sixteen Energy Efficiency Measures (EEMs) to serve multiple customer classes, including:

1. Single Family Shadescreens
2. Multifamily Shadescreens
3. Single Family Duct Repair
4. Multifamily Duct Repair
5. Small Commercial Exit Signs
6. Commercial Compact Fluorescent Lamp
7. Residential Compact Fluorescent Lamp
8. Single Family Window-Mounted Evaporative Cooler
9. Davis Lights
10. Customized Commercial Projects
11. City School Partnership
12. Multifamily Swimming Pool Retrofit.
13. Multifamily Laundry Retrofit
14. Single Family Torchiere Swap
15. Single Family HVAC Charge and Airflow
16. Multifamily Charge and Airflow

The general purpose of this evaluation was to provide an ongoing analysis of the Davis Energy Efficiency Program and to document savings as required by the CPUC. The evaluation strategy was to develop an overall approach for the portfolio of residential and commercial measures. The M&V resources were

² p. 2, DCEEP Proposed Change Order, Number 2 – Corrections to Change Order 1.

allocated such that the measures with the largest energy savings received the most attention. However, the overall plan was also balanced so that all measures received adequate attention such that accurate demand and energy savings were estimated. The methodologies for gross and net results were designed specifically for each measure. Review of program deemed savings and on-site or telephone measure verification was conducted for each measure.

The net savings for each measure was determined through a decision-maker survey that assessed free-ridership. Free-ridership was calculated by determining participants' decisions prior to participating in the program and the importance of DEEP incentives (when applicable). The net-to-gross analysis estimated the portion of the savings directly credited to each measure. The decision-maker survey was also used to assess customer satisfaction with the program. The evaluation was not designed to address program spillover; therefore we were not able to quantify the market transformation aspects of this program.

One component of the program that we were not able to assess was the educational effort, which was a secondary thrust of the program. For several measures in particular, such as CFLs and multifamily washing machines, DEEP staff stressed the importance of quality, high efficiency products. These efforts, though not quantified will surely lead to improved consumer decision-making regarding energy efficient equipment.

Table E-1 provides the overall DEEP program level evaluation results. Overall the program achieved good gross savings, electric (kWh) and gas (therms), and demand reduction realization rates of 82%, 98% and 91% respectively. This result indicates that the program savings were slightly less than the verified results. The relatively high Net-to-Gross Ratio (NTGR) of 88%³ for kWh, and 90% for demand, indicate that the program is experiencing little free-ridership and influencing participants to install and properly use the measures. The overall net realization rate was 72% for energy (kWh) and 82% for demand. The relatively poor therm results are due to the results of one of the two EEMs claiming gas savings, which took 2% of the incentive dollars to reach a unique market.

Energy & Demand Results	Program Estimate	Gross Results			Net -to- Gross Ratio	Net Results		
		Verified Estimate	RP	RR		Verified Estimate	RP	RR
Energy Savings (kWh)	4,791,594	3,933,540	5%	82%	88%	3,466,138	8%	72%
Energy Savings (therms)*	5,396	5,284	3%	98%	35%	1,895	10%	35%
Demand Reduction (kW)	1,105	1,001	4%	91%	90%	905	6%	82%

* Only two measures (EEM 3 and EEM 13) claimed therms savings

Table E-1: DEEP Program Savings⁴

³ The default value assumed by the CPUC is 0.80.

⁴ RP = relative precision, RR = realization rate.

1. INTRODUCTION

This report presents the final results of an evaluation of the Davis Energy Efficiency Program. The report includes the evaluation methodology, analysis of the gross and net annual energy savings and peak load reduction, and the conclusions of customer satisfaction from the decision-maker survey.

Section 1 presents the evaluation methodology for the program. Section 2 summarizes the final results of the Davis Energy Efficiency Program. Section 3 presents results in detail for each measure. Section 4 lists the observations and recommendations for DEEP.

1.1 Program Description

The Davis Comprehensive Energy Efficiency Program⁵, now more commonly known as Davis Energy Efficiency Program (DEEP), was a comprehensive hybrid of both information and energy savings measures. DEEP provided rebates, giveaways, direct installations, technical assistance, information, marketing and training to the residences and businesses of Davis. The program was a comprehensive, multiple market project, with goals to save energy, develop local infrastructure, educate and inform participants, and innovate delivery methods through the use of energy efficiency training and outreach and provision of rebates for the successful installation of energy saving measures. DEEP was anticipated to achieve annual energy savings of 3,907,726 kWh, 5,230 therms, and 1,554 KW of demand reduction⁶. As part of its portfolio of programs, DEEP implemented sixteen Energy Efficiency Measures (EEMs) to serve multiple customer classes, including:

1. Single Family Shadescreens (EEM 1): The purpose of this measure was to incent homeowners to install shadescreens through rebates that were designed to cover a percentage of the measure cost.
2. Multifamily Shadescreens (EEM 2): The purpose of this measure was to incent property owners of multifamily dwellings to install shadescreens in housing units through rebates that were designed to cover a percentage of the measure cost.
3. Single Family Duct Repair (EEM 3): This measure provides rebates to homeowners who have contracted to have their duct systems tested to improve the efficiency of the duct forced air heating and cooling system.

⁵ City of Davis, Davis Comprehensive Energy Efficiency Program (DCEEP), CPUC Local Program No. 116-02, 2002-03.

⁶ p. 2, DCEEP Proposed Change Order, Number 2 – Corrections to Change Order 1.

4. Multifamily Duct Repair (EEM 4): This measure provides rebates to property owners who have contracted to have the duct systems in their housing units tested to improve the efficiency of the duct forced air heating and cooling system.
5. Small Commercial Exit Signs (EEM 5): This measure promotes the installation of EnergyStar® LED Exit Signs in the small commercial sector through rebates which cover the entire measure cost.
6. Commercial Compact Fluorescent Lamp (EEM 6): This measure promoted the use of screw-in compact fluorescent bulbs in the small commercial sector. Program delivery occurred through direct give-away of the measure.
7. Residential Compact Fluorescent Lamp (EEM 7): This measure promoted the use of screw-in compact fluorescent bulbs in the residential sector. Program delivery occurred through direct give-away of the measure.
8. Single Family Window-Mounted Evaporative Cooler (EEM 8): This measure provided direct installation of advanced whole house evaporative coolers for the low-income single family sector.
9. Davis Lights (EEM 9a): The purpose of this measure was to promote the installation of prescribed energy efficient lighting measures in the small commercial sector. Incentives were typically paid directly to contractors, and were designed to cover a high percentage of the installed cost.
10. Customized Commercial Projects (EEM 9b): The purpose of this measure was to incent the installation of energy-efficient measures in the small commercial sector. The measure consisted almost entirely of prescribed energy efficiency lighting measures, similar to the Davis Lights (EEM 9a) although it allowed and encouraged non-lighting measures as well. This measure provided a different rebate structure for the prescribed lighting measures than the Davis Lights measure to allow for more customized commercial lighting projects.
11. City School Partnership (EEM 9c): This measure provides financial assistance to the Davis Joint Unified School District (DJUSD) to complete energy efficient retrofit projects in its buildings. Projects include lighting retrofits and installation of cool roofs.
12. Multifamily Swimming Pool Retrofit Project (EEM 10): This measure provides customized assistance to property owners of multifamily dwellings to improve the energy efficiency of their developments' pools and/or spas. Possible items include pump improvements, controls, covers, and other measure to reduce evaporative heat loss.

13. Multifamily Laundry Retrofit Project (EEM 13): This measure provides incentives to property owners of multifamily dwellings to install energy efficient clothes washers in their units.
14. Single Family Torchiere Swap (EEM 14): This measure allowed participants to trade in halogen torchiere lamps for EnergyStar® compact fluorescent torchieres.
15. Single Family HVAC Charge and Airflow (EEM 15): This measure provided homeowners free or DEEP subsidized testing of the refrigerant charge and air flow of their HVAC system.
16. Multifamily Charge and Airflow (EEM 16): This measure provided free or DEEP subsidized testing of the refrigerant charge and air flow of HVAC systems in multifamily dwellings.

The general purpose of this evaluation was to provide an ongoing analysis of the Davis Energy Efficiency Program and to document savings as required by the CPUC. The evaluation strategy was to develop an overall approach for the portfolio of residential and commercial programs. The M&V resources were allocated such that the programs with the largest energy savings received the most attention. However, the overall plan was also balanced so that all programs received adequate attention such that accurate demand and energy savings were estimated.

1.2 Overall DEEP Portfolio M&V Results Summary

The EM&V activities were performed in parallel to the program implementation activities due to concurrent deadlines for program implementation completion and EM&V completion. Hence, HMG used the DEEP Quarter 4, 2003 report as a basis for conducting the EM&V.

The evaluation analysis was completed using program to date data as reported in DEEP's Quarter 1, 2004 reports. DEEP's Quarter 2 2004 information was not completed during the time of the analysis, as the analysis was conducted during the 1st and 2nd Quarters of 2004.

Table 1 presents the overall electric energy (kWh) savings of the DEEP program. DEEP exceeded its anticipated goals for customers for certain EEMs and hence, the total program estimated kWh savings were higher than the earlier program estimates (4.8MWh instead of 3.9 MWh). The evaluation analysis shows total program gross level energy savings of 3,933,540 kWh corresponding to a gross realization rate of 82%. The total program net level energy savings are 3,466,138 kWh corresponding to a net realization rate of 72%. The program-level net-to-gross ratio (NtGR) is 88%. Overall these are good portfolio level results. There were only four (4) EEMs with net realization rates less than 75%. For two EEMs (6 & 8) the low net realization rate was due to low gross realization rates resulting from participants not installing or removing measures. For EEM 13 the low net

realization rate was due to a low net-to-gross ratio because participants said they would have installed the measure even without the program influence. For EEM 7, the low net realization rate was a result of both a low gross realization rate and a low NTGR, for the reasons given.

As seen in Table 1, the evaluation plan aimed for a very low margin of error as seen in the low relative precision numbers for most of the measures. The relative precision of an estimate measures the percentage error associated with the estimate at a given level of confidence⁷.

⁷ For example, suppose that for a given EEM, the evaluated energy savings is estimated at 10,000 kWh, with a relative precision of $\pm 5.0\%$ at the 90% confidence level. The associated 90% confidence interval is $(10,000 - (0.05*10,000), 10,000 + (0.05*10,000))$ kWh, or (9,500, 10,500) kWh. This implies there is a 90% chance that the actual energy savings of the EEM is contained in the interval (9,500, 10,500) kWh.

Energy Savings (kWh)	Program Estimated	Gross Results			NtGR	Net Results		
		Estimated	Relative Precision	Realization Rate		Estimated	Relative Precision	Realization Rate
EEM1-Single Family Houses Shadescreens	21,329	19,621	4%	92%	83%	16,251	10%	76%
EEM2-Multi-Family Dwellings Shadescreens	246	246	0%	100%	100%	246	0%	100%
EEM3-Single Family Duct Repair	7,437	6,941	10%	93%	85%	5,888	15%	79%
EEM4-Multi-Family Duct Repair	61,807	61,807	0%	100%	100%	61,807	0%	100%
EEM5 - Small Commercial Exit Signs	78,490	78,490	0%	100%	92%	72,259	14%	92%
EEM6 - Compact Fluorescent Lamp Commercial	98,350	57,860	14%	59%	89%	51,249	25%	52%
EEM7-Compact Fluorescent Lamp Residential	1,138,500	571,646	14%	50%	37%	212,950	27%	19%
EEM8-Single Family Window-Mnt Evap Cooler	92,600	50,658	23%	55%	93%	46,975	26%	51%
EEM9a-Davis Lights	1,009,414	1,020,907	7%	101%	98%	998,762	20%	99%
EEM9b-Customized Commercial Projects	2,041,501	1,824,099	7%	89%	99%	1,811,740	7%	89%
EEM9c-City-School Partnership	75,000	75,000	0%	100%	75%	56,250	0%	75%
EEM10-Multi-Family Swimming Pool Retrofit	6,739	6,739	0%	100%	100%	6,739	0%	100%
EEM13-Multi-Family Laundry Retrofit Project	16,714	16,714	0%	100%	15%	2,557	0%	15%
EEM14-Torchiere Swap	78,111	78,111	0%	100%	75%	58,583	21%	75%
EEM15-Single Family HVAC Charge and Airflow	32,521	31,866	3%	98%	97%	31,047	4%	95%
EEM16-Multi-Family Charge and Airflow	32,835	32,835	0%	100%	100%	32,835	0%	100%
Program Total	4,791,594	3,933,540	5%	82%	88%	3,466,138	8%	72%

Table 1: DEEP Program kWh Energy Savings Results⁸

Table 2 presents the overall gas energy (therms) savings of the DEEP program. DEEP expected gas savings from two EEMs only EEM 3 and EEM 13). The total program estimated kWh savings were slightly higher than the earlier program estimates (5,396 therms instead of 5,230 therms). The evaluation analysis shows total program gross level energy savings of 5,284 therms corresponding to a gross realization rate of 98%. The total program net level energy savings are 1,895 therms corresponding to a net realization rate of 35%. The program-level net-to-gross ratio (NtGR) is 36%. The low results are due to the free-ridership associates with EEM13 as discussed above.

⁸ For EEM 9a-Davis Lights and EEM9b-Customized Commercial Projects, the program estimated savings is the actual deemed savings estimate and not the CPUC workbook savings estimate.

Energy Savings (therms)	Program Estimated	Gross Results			NtGR	Net Results		
		Estimated	Relative Precision	Realization Rate		Estimated	Relative Precision	Realization Rate
EEM1-Single Family Houses Shadescreens	0	-	-	-	-	-	-	-
EEM2-Multi-Family Dwellings Shadescreens	0	-	-	-	-	-	-	-
EEM3-Single Family Duct Repair	1,675	1,563	10%	93%	85%	1,326	15%	79%
EEM4-Multi-Family Duct Repair	0	-	-	-	-	-	-	-
EEM5 - Small Commercial Exit Signs	0	-	-	-	-	-	-	-
EEM6 - Compact Fluorescent Lamp Commercial	0	-	-	-	-	-	-	-
EEM7-Compact Fluorescent Lamp Residential	0	-	-	-	-	-	-	-
EEM8-Single Family Window-Mnt Evap Cooler	0	-	-	-	-	-	-	-
EEM9a-Davis Lights	0	-	-	-	-	-	-	-
EEM9b-Customized Commercial Projects	0	-	-	-	-	-	-	-
EEM9c-City-School Partnership	0	-	-	-	-	-	-	-
EEM10-Multi-Family Swimming Pool Retrofit	0	-	-	-	-	-	-	-
EEM13-Multi-Family Laundry Retrofit Project	3,721	3,721	0%	100%	15%	569	0%	15%
EEM14-Torchiere Swap	0	-	-	-	-	-	-	-
EEM15-Single Family HVAC Charge and Airflow	0	-	-	-	-	-	-	-
EEM16-Multi-Family Charge and Airflow	0	-	-	-	-	-	-	-
Program Total	5,396	5,284	3%	98%	36%	1,895	10%	35%

Table 2: DEEP Program therms Energy Savings Results⁹

Table 3 presents the overall demand reduction of the DEEP program. The total program gross level energy savings are 1,000.7 kW corresponding to a gross realization rate of 91%. The total program net level energy savings are 904.6 kW corresponding to a net realization rate of 82%. The total program-level net-to-gross ratio is 90%. Measure-specific results are similar to the KWh energy savings results. For measures with a relative precision of 0% and a realization rate of 100%, the entire program population was used for the analysis allowing for no uncertainty or error associated with the results.

⁹ For EEM 9a-Davis Lights and EEM9b-Customized Commercial Projects, the program estimated savings is the actual deemed savings estimate and not the CPUC workbook savings estimate.

Demand Reduction (kW)	Program Estimated	Gross Results			NtGR	Net Results		
		Estimated	Relative Precision	Realization Rate		Estimated	Relative Precision	Realization Rate
EEM1-Single Family Houses Shadescreens	48.0	44.1	4%	92%	83%	36.6	10%	76%
EEM2-Multi-Family Dwellings Shadescreens	0.2	0.2	0%	100%	100%	0.2	0%	100%
EEM3-Single Family Duct Repair	10.7	10.3	10%	93%	85%	8.5	15%	79%
EEM4-Multi-Family Duct Repair	62.5	62.5	0%	100%	100%	62.5	0%	100%
EEM5 - Small Commercial Exit Signs	9.4	9.4	0%	100%	92%	8.7	14%	92%
EEM6 - Compact Fluorescent Lamp Commercial	16.9	11.7	14%	70%	89%	10.4	25%	62%
EEM7-Compact Fluorescent Lamp Residential	99.0	86.3	15%	87%	39%	34.0	30%	34%
EEM8-Single Family Window-Mnt Evap Cooler	100.0	60.5	26%	61%	80%	48.1	38%	48%
EEM9a-Davis Lights	207.2	210.0	7%	101%	97%	204.6	20%	99%
EEM9b-Customized Commercial Projects	413.0	368.5	6%	89%	99%	366.2	7%	89%
EEM9c-City-School Partnership	36	36	0%	100	75%	27	0%	75%
EEM10-Multi-Family Swimming Pool Retrofit	1.0	1.0	0%	100%	100%	1.0	0%	100%
EEM13-Multi-Family Laundry Retrofit Project	1.6	1.6	0%	100%	15%	0.3	0%	15%
EEM14-Torchiere Swap	3.0	3.0	0%	100%	75%	2.2	21%	75%
EEM15-Single Family HVAC Charge and Airflow	48.1	47.1	4%	98%	97%	45.9	4%	95%
EEM16-Multi-Family Charge and Airflow	48.5	48.5	0%	100%	100%	48.5	0%	100%
Program Total	1,105.1	1,000.7	4%	91%	90%	904.6	6%	82%

Table 3: DEEP Program Demand Reduction Results¹⁰

¹⁰ For EEM 9a-Davis Lights and EEM9b-Customized Commercial Projects, the program estimated demand reduction is the actual deemed demand reduction estimate and not the CPUC workbook demand reduction estimate.

2. EM&V METHODOLOGY

The evaluation methodology consisted of utilizing various approaches to analyze the program. It included sample design, on-site data collection, decision-maker surveys, and analysis of energy savings. Savings for single family and commercial measures were estimated for statistically representative samples, and expanded to their respective populations using sampling weights. Since statistically representative samples were used to estimate the savings for single family and commercial measures, there is some error associated with the savings estimates, which is measured by the relative precisions of the savings estimates¹¹. For most multifamily measures, the entire participant population was used to calculate the savings achieved by the EEM. Therefore, for most multifamily measures, there is no error associated with the verified savings, as reflected by a relative precision of 0%. The methodologies for gross and net results were designed specifically for each measure. Review of program deemed savings and on-site or phone measure verification was conducted for each measure.

The decision-maker survey was utilized to establish the baseline for customer free-ridership. The net-to-gross analysis estimated the portion of the savings directly credited to each measure. To do this, we attempted to understand the free-ridership rate associated with each participant, based on responses from a decision-maker survey. The survey was also used to assess customer satisfaction with the program. The evaluation was not designed to address program spillover, therefore we were not able to quantify the market transformation aspects of this program.

2.1 Sample Design

Our sample design approach consisted of a combination of stratified sampling and simple random sampling techniques. We stratified the program population in each EEM where feasible (e.g. all commercial programs, Single Family Shadescreens, etc.) and used simple random sampling in the remaining EEMs (e.g. Compact Fluorescent Lamp Residential, Torchiere Swap, etc.). Our ability to stratify the program population in a given EEM was directly related to whether each participant in the DEEP program tracking database had a project-specific estimate of energy savings or not. Specifically, if each participant had a project-specific estimate of energy savings, we were able to utilize stratified sampling techniques. There were no other variables in the DEEP program tracking

¹¹ The relative precision of an estimate of a characteristic of a population of interest measures the percentage error associated with the estimate at a given level of confidence. For example, suppose that for a given EEM, the evaluated energy savings is estimated at 10,000 kWh, with a relative precision of $\pm 5.0\%$ at the 90% confidence level. The associated 90% confidence interval is $(10,000 - (0.05 \cdot 10,000), 10,000 + (0.05 \cdot 10,000))$ kWh, or (9,500, 10,500) kWh. This implies there is a 90% chance that the actual energy savings of the EEM is contained in the interval (9,500, 10,500) kWh.

database that could be leveraged to accurately predict the energy savings of a given project. So, if each participant in a given EEM had a project-specific estimate of energy savings, we stratified the population of participants by the DEEP-estimated energy savings. Otherwise, we utilized traditional simple random sampling techniques to guide our sample selection.

One of the difficulties with devising a sampling plan faced by this evaluation was that evaluation activities were scheduled to occur in parallel with the on-going program implementation. In other words, we were required to devise a sampling plan and select a sample for the evaluation before the program population was fully defined. As a way to attempt to ensure that the sample was statistically representative of the final program population, we waited until we believed the program was approximately 75% committed and paid prior to devising a specific sampling plan for the program.

2.1.1 Sampling Plan

Theoretical Background

Sampling arises whenever we need to collect information about a sample of units in a population (EEM) in order to estimate the collective characteristics of all units in the population (EEM). The central challenge of sample design is to guide the selection of projects so that findings from a sample can be extrapolated to a target population without bias and with measurable statistical precision. In addition, sample design helps to identify the size of the sample needed for a given level of precision, or to identify the statistical precision to be expected from a given sample size.

There are two key components to determining the sample size required by a study: the desired level of relative precision and the analysis model(s) used to achieve the study objectives. When you cannot take advantage of stratified sampling techniques, assuming the population size is large relative to the sample size and assuming the 90% level of confidence, the formula for estimating the

expected relative precision for a given sample size is $rp = \frac{1.645 * cv}{\sqrt{n}}$, where $cv =$

coefficient of variation of the target variable in target population¹², $rp =$ expected level of relative precision, and $n =$ planned sample size. Since most EEMs did not have a population size large relative to the sample size, we must also take the Finite Population Correction factor (FPC) into account, or

$rp = \frac{1.645 * cv}{\sqrt{n}} * \sqrt{1 - \frac{n}{N}}$, where $cv =$ coefficient of variation of the target variable in

target population, $rp =$ expected level of relative precision, $n =$ planned sample size, and $N =$ population size. When you can utilize stratified sampling techniques and the ratio model for estimation, assuming the 90% level of

¹² The coefficient of variation (cv) is defined to be $cv = \frac{\delta}{\mu}$, or the population standard deviation divided by the population mean for a given variable of interest.

confidence and taking into account the FPC, the formula for estimating the

expected relative precision for a given sample size is $rp = \frac{1.645 * er}{\sqrt{n}} * \sqrt{1 - \frac{n}{N}}$,

where er = error ratio¹³, rp = expected level of relative precision, n = planned sample size, and N = population size.

For planning purposes for each EEM, we must assume a value for either the cv or the er, depending on the planned analysis model. For planning, the values of these parameters are selected based on past experience evaluating programs of a similar nature. At the conclusion of each study, we calculate the values of these parameters as applicable based on our actual sample and population so that we can utilize the values for planning future studies of a similar nature.

Original Sampling Plan

Table 4 shows our original sampling plan by EEM. Our sampling strategy called for trying to maintain a relative precision of approximately 20% or less at the 90% level of confidence for each EEM, while at the same time attempting to secure a relative precision of no more than approximately 10-11% at the 90% level of confidence for each of the commercial portfolio and the residential portfolio, and a relative precision of approximately 7.5% for the entire DEEP portfolio.

Measure Description	Est. kWh Savings	Pop. Size (# of cust.)	Error Ratio / CV	Survey Type	Sample Size	Rel. Prec.	Error Bound
EEM5 - Small Commercial Exit Signs	56,780	27	0.5	On-Site	7	19.0%	10,788
EEM6 - Compact Fluorescent Lamp Commercial	80,150	32	0.5	On-Site	10	20.3%	16,270
EEM9a-Davis Lights	845,531	139	0.5	On-Site	25	14.9%	125,984
EEM9b-Customized Commercial Projects	1,487,583	61	0.4	On-Site	12	16.6%	246,939
EEM9c-City-School Partnership	100,000	4	0.4	On-Site	4	0.0%	
Commercial (EEM 5, 6, 9a-c)	2,570,044					10.8%	
EEM2-Multi-Family Dwellings Shadescreens	69,400	2		Phone	2		
EEM4-Multi-Family Duct Repair	25,400	3		Phone	3		
EEM10-Multi-Family Swimming Pool Retrofit	17,550	2		Phone	2		
EEM12 Multi Family Cool Roof Project	6,400	2		Phone	2		
EEM13-Multi-Family Laundry Retrofit Project	16,440	8		Phone	2		
EEM16-Multi-Family Charge and Airflow	113,601	4		Phone	2		
Multi-family (EEM 2,4,10,12,13,16)*	248,791	21			13		
EEM1-Single Family Houses Shadescreens	18,329	130	0.8	Phone	35	17.8%	3,263
EEM3-Single Family Duct Repair	4,551	41	0.8	Phone	15	13.4%	611
EEM7-Compact Fluorescent Lamp Residential	1,138,500	3,300	1	Phone	125	11.8%	134,909
EEM8-Single Family Window-Mnt Evap Cooler	92,600	100	0.6	On-Site	20	12.2%	11,297
EEM14-Torchiere Swap	78,111	297	1	Phone	10	42.5%	33,177
EEM15-Single Family HVAC Charge and Airflow	32,339	161	0.8	Phone	50	15.8%	5,110
Single Family (EEM 1, 3, 7, 8, 14, 16)	1,364,430					10.2%	
Total Portfolio	4,183,265					7.4%	

Table 4: Original Sampling Plan

¹³ The error ratio (er) measures the strength of the association between the dependent variable (i.e. achieved energy savings) and the independent variable (i.e. DEEP-estimated energy savings) in the ratio model. A more detailed explanation of the error ratio as well as the formula is included in the Appendix to this report.

The estimated kWh savings are the DEEP estimated program savings based upon the number of customers DEEP had incented or committed. The error ratio and coefficient of variation (CV) are measures of the amount of variation anticipated in actual savings per site compared to the program anticipated average savings per site.

2.1.2 Final Sample

Table 5 shows our final sample design. As shown in the table, we achieved a relative precision of 4.8% for the overall DEEP portfolio gross energy savings, with a relative precision of 8.3% for the overall DEEP portfolio net energy savings. We achieved relative precisions in the commercial portfolio that are significantly better than those in the residential portfolio. This is likely a function of the fact that for the commercial programs, we were able to utilize stratified sampling techniques, whereas for the residential programs, we often had to utilize simple random sampling (SRS) techniques.

Multifamily Shadescreens (EEM 2) was not evaluated due to small amount of participation that occurred. There was only one customer who installed one shadescreen by the time the EM&V was conducted. The shadescreen was installed in the company office and not in any of the multifamily units. Therefore, the program estimated savings were used for the MV results.¹⁴

A sampling plan was prepared for EEM 12 as reflected in Table 4, but since there were no program participants for this EEM, no EM&V was conducted, as reflected in Table 5.

¹⁴ The EM&V activities were conducted parallel to the program implementation, and one more customer was incented by the program just before the program close date, but this was after the EM&V had been conducted for the program.

Measure Description	Prog. kWh Savings	Pop. Size (# of cust.)	Survey Type	Sample Size	Gross Rel. Prec.	Net Rel. Prec.
EEM5 - Small Commercial Exit Signs	78,490	35	On-Site	7	0.0%	14.2%
EEM6 - Compact Fluorescent Lamp Commercial	98,350	38	On-Site	10	13.5%	25.4%
EEM9a-Davis Lights	1,009,414	172	On-Site	25	6.8%	19.8%
EEM9b-Customized Commercial Projects	2,041,501	74	On-Site	12	7.0%	7.4%
EEM9c-City-School Partnership	75,000	1	On-Site	1	0.0%	0.0%
Commercial (EEM 5, 6, 9a-c)	3,302,755				4.8%	7.6%
EEM2-Multi-Family Dwellings Shadescreened	246	1	Phone	1	0.0%	0.0%
EEM4-Multi-Family Duct Repair	61,807	4	Phone	4	0.0%	0.0%
EEM10-Multi-Family Swimming Pool Retrofit	6,739	2	Phone	2	0.0%	0.0%
EEM13-Multi-Family Laundry Retrofit Project	16,714	9	Phone	9	0.0%	0.0%
EEM16-Multi-Family Charge and Airflow	32,835	6	Phone	6	0.0%	0.0%
Multi-family (EEM 2,4,10,12,13,16)*	118,341	22		22	0.0%	0.0%
EEM1-Single Family Houses Shadescreens	21,329	150	Phone	35	4.3%	10.0%
EEM3-Single Family Duct Repair	7,437	63	Phone	15	10.4%	14.8%
EEM7-Compact Fluorescent Lamp Residential	1,138,500	3,300	Phone	125	14.4%	27.3%
EEM8-Single Family Window-Mnt Evap Cooler	92,600	100	On-Site	22	22.9%	25.7%
EEM14-Torchiere Swap	78,111	297	Phone	10	0.0%	20.5%
EEM15-Single Family HVAC Charge and Airflow	32,521	162	Phone	50	2.9%	4.4%
Single Family (EEM 1, 3, 7, 8, 14, 16)	1,370,497				12.0%	22.8%
Total Portfolio	4,791,594				4.8%	8.4%

Table 5: Final Sample Design

2.2 Decision-maker Surveys

Decision-maker surveys were used to verify deemed savings assumptions, establish the baseline for customer free-ridership, and determine customer satisfaction with the program. Decision-maker surveys were completed for each EEM with each survey specifically tailored for the measure. The majority of surveys were completed by telephone, with the exception of EEMs where on-site data collection occurred.

2.2.1 Gross Savings Component

For the majority of residential and multifamily EEMs, decision-maker surveys were used to confirm measure installation and collect data on measure operating conditions. Savings per customer were calculated based on the reported and confirmed quantity and usage of the measures. In the absence of actual operating conditions, standard operating hour assumptions consistent with other programs were used.

2.2.2 Net Savings Component

The net savings for each EEM was determined by the decision-maker surveys through assessment of free-ridership rates. Free-ridership was calculated by determining participants' decisions prior to participating in the program and the importance of DEEP incentives. Specifically, we questioned participants about the importance of the actions they would have taken prior to learning about the program. If they had already decided to install a measure before receiving the

DEEP incentive, these respondents were then asked at what time they would have completed the installation. Also, participants were asked to rate the importance of the DEEP incentive in their decision. Answers were rated on a one to five scale, where a one represents very unimportant and a five represents very important. The combinations of responses were used to calculate the free-ridership rate per participant.

2.2.3 Satisfaction Component

The decision-maker survey was also used to determine customer satisfaction with the program. The survey asked a number of questions designed to gauge participant satisfaction levels with various aspects of the program, including the contractor, the program process, DEEP direct contact, and the measure. Participant satisfaction levels were rated on a one to five scale, where a one represents very dissatisfied and a five represents very satisfied. If respondents indicated that they were dissatisfied we asked them to explain why they were dissatisfied.

2.3 On-site Data Collection

On-site surveys were conducted for five commercial programs – Small Commercial Exit Sign (EEM 5), Compact Fluorescent Lamp Commercial (EEM 6), Davis Lights (EEM 9a), Customized Commercial Programs (EEM 9b), City School Partnership (EEM 9c) – and one residential program – Single Family Evaporative Cooler Program (EEM 8).

On-site engineering analysis was the primary method used to assess the savings associated with the measures listed above. The focus of the on-site engineering assessments was the development of an independent estimate of the energy savings associated with the installed measures. The on-site survey consisted of a comprehensive inventory of incented measures, which included measure identification and quantification.

While the commercial programs were mutually exclusive, a number of projects participated in more than one commercial program. There was no overlap among the Davis Lights (EEM 9a), Customized Commercial (EEM 9b), and City School Partnership (EEM 9c) projects, but some sites in either of these programs also had participated in Small Commercial Exit Sign (EEM 5) and Compact Fluorescent Lamp Commercial (EEM 6). For the lighting measures, light fixtures from the different programs were counted separately and savings were attributed to the appropriate programs.

2.3.1 Davis Lights (EEM 9a) and Customized Commercial (EEM 9b)

The Davis Lights program consisted of lighting measures only, whereas the customized commercial program was intended to promote other energy efficiency measures such as HVAC measures in addition to lighting. However, only one site in the customized commercial program incented a non-lighting

measure, and this site was incented after the EM&V had been conducted. It is interesting to note that the Davis Lights program offered higher rebates than the customized commercial program for the same measure.

DEEP program savings estimate spreadsheets were used as a reference to generate a data collection form. After approval from the DEEP program managers, the data collection form was finalized and site visits were scheduled for each of the sites in the sample. The data collection form included detailed records of the installed light fixtures including quantity and type of lamps and ballasts, delamping and new reflectors for all incented fixtures in the retrofitted space. Most of the sites had retrofits done for all the fixtures, but a few had partial retrofits, and in such a case the onsite form included details on only the retrofitted fixtures. The surveyors confirmed the lamp and ballast types and counts onsite. Any differences observed between the installed fixtures and the program spreadsheets were noted on the onsite form. While on site, the surveyors also conducted a decision-maker survey with the customer. The decision-maker survey was used to establish the baseline for customer free-ridership and determine customer satisfaction with the program.

2.3.2 Small Commercial Exit Sign (EEM 5) and Compact Fluorescent Lamp Commercial (EEM 6)

For EEM 5 and 6, a data collection form similar to that used for Davis Lights (EEM9a) was prepared. Surveyors confirmed the count of incented fixtures and lamps onsite. Where there was a difference in the program estimates and the lamp count onsite, the surveyors followed up with the customer to ascertain reasons for the disparity.

2.3.3 City School Partnership (EEM 9c)

EEM 9c provides incentives to the Davis Unified School District to incorporate energy efficient measures in their modernization plans. Projects included one lighting retrofit project and the installation of two cool roofs. The data collection for the lighting retrofit project followed the same approach used in Davis Lights and Customized Commercial. Data collection included noting the lamp and ballast types and counts. For the cool roof projects, data collection consisted of on-site verification of roofing materials and review that the purchased cool roof materials matched the inputs used in the energy savings analysis.

2.3.4 Single Family Evaporative Cooler Program (EEM 8)

The Single Family Evaporative Cooler Program offered a unique challenge in that a large number of participants were non-English (Spanish) speakers. In order to overcome this language barrier, surveyors from HMG teamed up with DEEP staff members who were fluent in Spanish to conduct the surveys.

The survey team collected details on the evaporative cooler make and model number and schedule of operation of the unit. The onsite survey form also

collected similar details on HVAC units that were onsite before the evaporative cooler program, and were still operational after the new unit was installed. A majority of the sites had old units that were still installed and operational.

While on site, the surveyors also conducted a decision-maker survey with the customer. The decision-maker survey was used to establish the baseline for customer free-ridership and determine customer satisfaction with the program.

2.4 Gross Savings Analysis – Deemed Savings Review

DEEP used a deemed savings approach to estimate the savings from the various measures incented by the program. These savings were based upon recorded or calculated savings from similar energy efficiency programs run by California utilities and other third party programs. The majority of the EEMs were based upon estimates from the 2001 DEER (Database for Energy Efficiency Resources) Update Study¹⁵ (2001 DEER Study) conducted by Xenergy, Inc and funded by the California Energy Commission (CEC) or the 2002 Express Efficiency Workpapers¹⁶ (PG&E Workpapers) for Pacific Gas & Electric Company. The key purpose of these studies was to create a common set of cost and savings data across the state's major utilities to improve the consistency of information and assumptions used in energy-efficiency analyses.

Following is a brief summary of the deemed savings verification for various EEMs. Gross energy savings and demand reduction results for each EEM are presented in Section 3.

2.4.1 Single Family Houses Shadescreen (EEM 1) and Multifamily Dwellings Shadescreen (EEM 2)

The measure savings for installing shadescreens on single family and multifamily residential windows were based upon estimates from the 2001 DEER Study. Energy savings estimates for the shade screen measure were developed with DOE-2 simulations of a prototype house with equal window areas on all orientations. Simulations were conducted for various vintages of buildings and for various CEC forecasting climate zones. The DEER study calculates savings from shade screens on all four orientations and averages the savings to get unit savings numbers (kWh/sq.ft of window shade screened).

DEEP provided incentives for installing shadescreens on non-north windows only. DEEP assumed that savings from shading the north windows would be negligible and hence the unit savings should really be based on the non-north orientations only. In order to account for this difference in approach, DEEP took

¹⁵ Xenergy, Inc. 2001. "Database for Energy Efficiency Resources Update Study". For the California Energy Commission.

¹⁶ Pacific Gas & Electric Company. 2001. "2002 Energy Efficiency Program Selection R.01-08-028, Energy Efficiency Proposal, Statewide Nonresidential Retrofit Express Efficiency".

the DEER unit savings number and multiplied it by 1.25 to get their unit savings number for non-north window shading.

This seems like a reasonable approach considering that there is rarely direct solar penetration from the north windows, and shadescreens would not save much. While it could be debated whether 1.25 is the appropriate multiplier, the approach overall seemed reasonable, and HMG used the same assumptions for their EM&V analysis.

For EEM 1, gross savings were determined for a sample of the units and then expanded to the population. For EEM 2, there was only one site in the population.

2.4.2 Single Family Duct Repair (EEM 3) and Multifamily Duct Repair (EEM 4)

The 2001 DEER Study was used for the deemed savings value for EEM 3 and EEM 4. The 2001 DEER Study estimated the energy savings from duct repair measures by conducting DOE-2 simulations for a prototype building with the basecase having 20% duct leakage and the proposed measure reducing duct leakage to 6%. Analysis was conducted for various CEC forecast climate zones and vintages of the prototype building. DEEP averaged the unit savings for the appropriate CEC forecast climate zones (2 and 6) and vintages to get the deemed savings for the duct repair measure.

HMG used the deemed savings as the gross savings for sites where the customer confirmed the duct repair service. For EEM 3, gross savings were determined for a sample of the units and then expanded to the population. For EEM4, gross savings were calculated for the three sites in the population.

2.4.3 Small Commercial Exit Sign (EEM 5)

Deemed savings for this EEM were based on the PG&E Workpapers. The PG&E Workpapers give the estimated life of a specific lighting retrofit measure in commercial application along with the peak demand and energy savings from those measures. For both the LED exit sign retrofit kit and installation of new LED exit signs, the PG&E Workpapers assume a demand saving of 0.043 kW and energy savings of 355 kWh per year.

DEEP assumed the same numbers for the program deemed savings. HMG used the deemed savings as the gross savings for sites where the measure installation was verified. Gross savings were determined for a sample of the units and then expanded to the population.

2.4.4 Compact Fluorescent Lamp Commercial (EEM 6)

Deemed savings for this EEM were based on the PG&E Workpapers. The PG&E Workpapers give the estimated peak demand and energy savings for various CFL measures, and savings are categorized by wattage of the CFL installed (bins of less than 14 watts, 14-26 watts, 27 watts and above). Savings range

from 0.045 kW/lamp to 0.069 kW/lamp, and 211 kWh/lamp to 452 kWh/lamp, depending on CFL replacement wattage and occupancy type.

DEEP assumed 0.06 kW/lamp and 350 kWh/lamp for the program deemed savings. These numbers are on the high side of the estimated savings from the PG&E Workpapers, and the kWh/lamp deemed savings are in fact higher than the PG&E Workpapers estimates. According to DEEP staff, this value represents an average savings across all relevant occupancy types anticipated for the program.

The kW/lamp savings used by DEEP and HMG are provided in Table 6. To estimate gross savings, HMG used the actual lamp wattage and occupancy to calculate appropriate savings per the PG&E Workpapers, as shown in Table 7.

CFL Wattage	DEEP	HMG
<14	0.06	0.045
14-26	0.06	0.057
>26	0.06	0.069

Table 6: Commercial CFL (EEM 6) Fixture Wattages

Occupancy	CFL Wattage		
	<14	14-26	>26
Office	211	267	323
Retail	222	282	341
Grocery	295	374	452
Restaurant	238	302	365

*From PG&E Express Efficiency Workpapers, Dec. 2001.

Table 7: Commercial CFL (EEM 6) Energy Savings

The on-site survey verified the quantity and wattage of the lamps. Savings were calculated based on the installed lamps. If the measure was not installed on-site, gross savings were assumed to be zero. Gross savings were determined for a sample of the units and then expanded to the population.

2.4.5 Compact Fluorescent Lamp Residential (EEM 7) and Torchiere Swap (EEM14)

DEEP based the deemed savings for EEM 7 and EEM 14 on the PG&E Workpapers, as described for EEM 6. Since the PG&E Workpapers consider only non nonresidential applications, DEEP discounted the savings for the CFL measure (EEM7), since the lamps are used less often in residential than in commercial applications, especially during peak hours. DEEP used deemed savings of 0.01 kW/lamp and 115 kWh/lamp for the program.

For Compact Fluorescent Lamp Residential (EEM 7), HMG estimated gross savings (kWh) and gross demand reduction (kW) for a sample of the population. The kW reduction was determined by multiplying the number of installed bulbs as

reported in the decision-maker surveys with the noncoincident demand savings of 0.057 kW used in the PG&E Workpapers¹⁷. Gross savings were calculated by taking the kW reduction and the annual usage as reported in the decision-maker surveys. The average energy savings per site was 173 kWh. The gross demand reduction (kW) was calculated based on the Residential Measure Energy Savings Tables from the 2001 DEER Study, based on the number of operating hours per day. The savings were 2.7W, 13.6W or 32W, for an average of 10.8W. A summary of the values used by DEEP and HMG is provided in Table 8.

Savings	DEEP	HMG
Lamp kW	0.01	0.057
kWh/lamp	115	173
Peak kW/lamp	0.01	0.018

Table 8: Residential CFL (EEM 7) Wattage and Energy Savings

For Torchiere Swap (EEM 14), HMG estimated gross savings using results from the decision-maker phone survey for a sample of the population. Participants were asked to confirm installation and to provide annual operating usage. HMG used the wattages used for the DEEP calculations. Results were then expanded to the population.

2.4.6 Single Family Window-Mounted Evaporative Cooler (EEM 8)

DEEP used a particular manufacturer model number (Phoenix HE2911) for this program. The deemed demand and energy savings for the Phoenix unit was measured at PG&E's Stockton energy center in comparison to a EER 5.0 window mounted unit. For the new unit, DEEP estimated the energy savings to be 926 kWh, assuming full load hours of the older window unit of 900 hours and the new unit to be run less at 800 full load hours. However, based on a review of the deemed savings calculation, we recalculated the energy savings to be 929 kWh. If an older unit was already installed, the program did not require the occupant to disconnect or discontinue use of the existing unit. Gross savings were determined by using the deemed savings calculation method along with decision-maker survey responses on usage of the old unit, if applicable, and the new DEEP unit.

2.4.7 Davis Lights (EEM 9a) and Customized Commercial (EEM 9b)

Deemed savings for EEM 9a and EEM 9b were based on the PG&E Workpapers using the estimated life of a given lighting retrofit measures in commercial applications along with the peak demand and energy savings from those measures.

DEEP used the appropriate demand and peak savings from the PG&E Workpapers to calculate deemed savings for the lighting retrofit measures.

¹⁷ for 14–26W CFLs.

HMG used the same assumptions for demand and energy savings as in the PG&E Workpapers and based the gross savings on the lamp count recorded onsite. CFL measure savings were estimated by lamp wattage, as described in EEM 6 above. The LED measure savings are estimated per EEM 5.

Savings from fluorescent measures were estimated by the type of retrofit: fixture replacement, or delamping. Both demand savings and energy savings were expressed for each lamp length (2 ft, 3 ft, 4 ft, 8 ft) for various occupancies. For each site, energy savings were further stratified by space type to account for different hours of operation. These results were expanded to the population.

2.4.8 City School Partnership (EEM 9c)

EEM 9c provided incentives to the Davis Unified School District to incorporate energy efficient measures in their modernization plans. Three projects were completed for this measure: a lighting retrofit project and two cool roofs project. Deemed savings for the lighting measure for this EEM were based on the same assumptions as the Davis Lights program explained above. HMG used the same assumptions for demand and energy savings as in the PG&E Workpapers and based the gross savings on the lamp count recorded onsite.

For the cool roof projects, deemed savings were based on DOE-2 analysis completed by the Davis Energy Group. HMG used deemed savings for gross savings based on on-site installation confirmation.

2.4.9 Multifamily Swimming Pool Retrofit Project (EEM 10)

Deemed savings were based on analysis completed by Davis Energy Group for the two pool pumps in the population. Deemed savings were used for gross savings based on confirmation of installation by the participants.

2.4.10 Multifamily Laundry Retrofit Project (EEM 13)

Deemed savings were based on values used by the Lightwash program, a CPUC third party program run by Energy Solutions that offers rebates for the installation of qualifying commercial clothes washers in Multifamily and institutional common area laundry facilities, businesses with on-premise laundry and/or coin laundry stores. HMG used deemed savings for gross savings upon confirmation of installation by the participants.

2.4.11 Single Family HVAC Charge and Airflow (EEM 15) and Multifamily Charge and Airflow (EEM 16)

Deemed savings were based on analysis completed by Proctor Engineering for their CheckMe! Program. Deemed savings were used for gross savings based on confirmation of installation by the participants.

2.5 Net Savings Analysis

The decision-maker surveys were used to determine the amount of free-ridership occurring in the program, or equivalently, the net savings of the program. Individual responses were examined to determine the level of free-ridership occurring on a participant specific basis. For EEMs where a sample of the population was used for the evaluation, Model-Based Statistical Sampling or MBSS™ was used to extrapolate the results to the target population. A description of MBSS extrapolation methodology is provided in Appendix B: Theoretical Foundation of Savings Estimation. Net energy savings and demand reduction results for each EEM are calculated in the next section.

3. EVALUATION RESULTS

This section summarizes the gross savings, net savings, and the associated net-to-gross ratios for the Davis Energy Efficiency Program by measure.

3.1 Single Family Shadescreens (EEM 1)

This section summarizes the savings results for Single Family Shadescreens (EEM 1). A sample of 35 participants was used to estimate the savings performance of the 150 participants of the program. There were a total of 168 shadescreens installed at the homes of the 150 participants since participants were allowed to submit multiple applications per site or individual.

3.1.1 Gross Results

Table 9 presents the program level gross energy savings and demand reduction. Overall, the Single Family Shadescreen Program achieved annual energy savings of 19,621 kWh, corresponding to a gross realization rate of 92%, suggesting that the program is correctly estimating energy savings. The associated relative precision at the 90% level of confidence is 4.3%, resulting in a 90% confidence interval of (18,795, 20,456) kWh¹⁸.

Overall, the Single Family Shadescreen Program achieved gross demand reduction of 44.1 kW, corresponding to a gross realization rate of 92%. The associated relative precision at the 90% level of confidence is 4.3%, resulting in a 90% confidence interval of (42.3, 46.0) kW.

Gross Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	19,621	44.1
Program Estimated	21,329	48.0
Realization Rate	92%	92%

Table 9: Single Family Shadescreens (EEM 1) Gross Energy Savings and Demand Reduction

3.1.2 Net Results

Table 10 presents the program-level net annual energy savings and demand reduction. Overall, the Single Family Shadescreen Program achieved annual net

¹⁸ The 90% confidence interval for a given estimate is calculated as estimate \pm rp*(estimate), or (estimate - rp*(estimate), estimate + rp*(estimate)), where rp = relative precision at 90% confidence level. The values in parentheses provide a minimum estimate and a maximum estimate for the actual savings of the population.

energy savings of 16,251 kWh, resulting in a net realization rate of 76% and a net-to-gross ratio of 83%. The associated relative precision at the 90% level of confidence is 10.0%, resulting in a 90% confidence interval of (14,631, 17,871) kWh. Overall, the program achieved net demand reduction of 36.6 kW, resulting in a net realization rate of 76% and a net-to-gross ratio of 83%. The associated relative precision at the 90% level of confidence is 10.0%, resulting in a 90% confidence interval of (32.9, 40.2) kW.

Net Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	16,251	36.6
Program Estimated	21,329	48.0
Realization Rate	76%	76%
Net to Gross Ratio	83%	83%

Table 10: Single Family Shadescreens (EEM 1) Net Energy Savings and Demand Reduction

3.1.3 Program Process & Customer Satisfaction Results

This section summarizes participants' responses to questions regarding the program process and customer satisfaction.

All survey respondents were asked how they first became aware of DEEP's Single Family Shadescreen program. Table 11 summarizes the results. Nearly 40% of participants learned of the program through direct mail, with approximately another 25% of participants learning of the program through a friend or colleague.

Awareness of Program	% of Respondents
Direct Mail	38%
Friend / Colleague	26%
Newspaper Ad	15%
DEEP Staff	10%
Energy Center	6%
DEEP Web Site	3%
Farmer's Market	2%

Table 11: Single Family Shadescreens (EEM 1) Participant Awareness of Program

Table 12 presents the incidence of program participants having direct contact with a DEEP staff member. Most participants dealt only with the contractor in regards to the program. Just about one-third, or 33%, of participants report having direct contact with a DEEP staff member.

Direct Contact With Deep Staff	% of Respondents
Yes	33%
No	67%

Table 12: Single Family Shadescreens (EEM 1) Incidence of Respondents having Direct Contact with DEEP Staff

Table 13 lists the satisfaction results for several program areas, including the program process, communication with DEEP staff¹⁹, and the installation contractor. Because a majority of participants only dealt with the contractor and had no communication with DEEP staff, contractor satisfaction reflected on overall satisfaction with the DEEP program. Nearly all participants are either somewhat or very satisfied, with at least 85% of respondents very satisfied with each program area. Overall, most participants were very satisfied with the Single Family Shadescreen Program.

Satisfaction	DEEP Program (n=34)	DEEP Staff (n=11)	Contractor (n=34)
Very Satisfied	91%	100%	85%
Somewhat Satisfied	6%	0%	13%
Neither Satisfied nor Dissatisfied	4%	0%	2%

Table 13: Single Family Shadescreens (EEM 1) Satisfaction Results

3.2 Multifamily Houses Shadescreens (EEM 2)

This program was not evaluated due to small amount of participation that occurred. There was only one customer who installed one shadescreen at the time the EM&V was conducted. The shadescreen was installed in the company office and not in any of the multifamily units.

3.3 Single Family Duct Repair (EEM 3)

This section summarizes the savings results for EEM 3: Single Family Duct Repair. A sample of 15 participants was used to estimate the savings performance of the 67 duct repairs conducted for 63 participants.

3.3.1 Gross Results

Table 14 presents the program level gross energy savings, both therms and kWh, and demand reduction. Overall, the Single Family Duct Repair Program achieved annual energy savings of 6,941 kWh and 1,563 therms, corresponding

¹⁹ Only those participants who stated they had direct contact with a DEEP staff member were asked to rate their satisfaction with their communication with DEEP staff.

to a gross realization rate of 93%. The associated relative precision at the 90% level of confidence is 10.4%, resulting in a 90% confidence interval of (6,223, 7,660) kWh for electric energy savings and (1,402, 1,725) therms for gas savings.

Overall, the Single Family Duct Repair Program achieved gross demand reduction of 10.0 kW, corresponding to a gross realization rate of 93%. The associated relative precision at the 90% level of confidence is 10.4%, resulting in a 90% confidence interval of (9.0, 11.0) kW.

Gross Results	Energy Savings		Demand Reduction
	therms	kWh	kW
Evaluation Estimated	1,563	6,941	10.0
Program Estimated	1,675	7,437	10.7
Realization Rate	93%	93%	93%

Table 14: Single Family Duct Repair (EEM 3) Gross Energy Savings and Demand Reduction

3.3.2 Net Results

Table 15 presents the program-level net annual energy savings both therms and kWh, and demand reduction. Overall, the Single Family Duct Repair Program achieved annual net energy savings of 5,888 kWh and 1,326 therms, resulting in a net realization rate of 79% and a net-to-gross ratio of 85%. The associated relative precision at the 90% level of confidence is 14.8%, resulting in a 90% confidence interval of (5,019, 6,756) kWh and (1,130, 1,522) therms.

Overall, the program achieved net demand reduction of 8.5 kW, resulting in a net realization rate of 79% and a net-to-gross ratio of 85%. The associated relative precision at the 90% level of confidence is 14.8%, resulting in a 90% confidence interval of (7.2, 9.7) kW.

Net Results	Energy Savings		Demand Reduction
	therms	kWh	kW
Evaluation Estimated	1,326	5,888	8.5
Program Estimated	1,675	7,437	10.7
Realization Rate	79%	79%	79%
Net to Gross Ratio	85%	85%	85%

Table 15: Single Family Duct Repair (EEM 3) Net Energy Savings and Demand Reduction

3.3.3 Program Process & Customer Satisfaction Results

This section summarizes participants' responses to questions regarding the program process and customer satisfaction.

All survey respondents were asked how they first became aware of DEEP's Single Family Duct Repair program. Table 16 summarizes the results. Just over 40% of participants learned of the program through a newspaper ad, with approximately another 20% of participants learning of the program through direct mail.

Awareness of Program	% of Respondents
Newspaper Ad	43%
Direct Mail	21%
Friend / Colleague	14%
Davis Energy Center	7%
DEEP Web Site	7%
Don't Know / Refused	7%

Table 16: Single Family Duct Repair (EEM 3) Participant Awareness of Program

Table 17 presents the incidence of program participants having direct contact with a DEEP staff member. Over 90% of participants report having direct contact with a DEEP staff member.

Direct Contact With Deep Staff	% of Respondents
Yes	93%
No	7%

Table 17: Single Family Duct Repair (EEM 3) Incidence of Respondents Having Direct Contact with A DEEP Staff Member

Table 18 lists the satisfaction results for several program areas, including the program process, communication with DEEP staff²⁰, and the installation contractor²¹. About 80% or more of participants report being very satisfied. Participants appear to be slightly more satisfied with communication with DEEP staff and the installation contractor than with the DEEP program process itself. Overall, most participants were quite satisfied with the Single Family Duct Repair Program.

²⁰ Only those participants who stated they had direct contact with a DEEP staff member were asked to rate their satisfaction with their communication with DEEP staff.

²¹ Participants were asked to rate their satisfaction with the installation contractor in order to assess if contractor satisfaction reflected on satisfaction with the DEEP program, especially in cases where the participant did not have direct contact with DEEP staff.

Satisfaction	DEEP Program (n=14)	DEEP Staff (n=13)	Contractor (n=14)
Very Satisfied	79%	92%	93%
Somewhat Satisfied	14%	8%	7%
Neither Satisfied nor Dissatisfied	7%	0%	0%

Table 18: Single Family Duct Repair (EEM 3) Satisfaction Results

All respondents were asked to indicate how the energy cost savings they have experienced compares with their expectations. Table 19 summarizes the responses. Half of respondents (50%) do not know how their experienced energy savings compared with their expectations. Among respondents who could make this comparison, nearly all report they are saving slightly more energy than they expected, with the remainder stating they are experiencing the same energy savings as they expected.

Energy Savings Compared to Expectations	% of Respondents
Significantly Less	0%
Slightly Less	0%
The Same	7%
Slightly More	43%
Significantly More	0%
Don't Know / Refused	50%

Table 19: Single Family Duct Repair (EEM 3) Program Energy Cost Savings Compared to Participant Expectations

When participants were asked to compare their experienced improved comfort with their expectations, over 60% of respondents could not make this comparison, as shown in Table 20. Among respondents who could make this comparison, most report they are experiencing slightly more improved comfort than they expected, with the remainder stating either they are experiencing the same improved comfort as they expected or significantly more.

Improved Comfort Compared to Expectations	% of Respondents
Significantly Less	0%
Slightly Less	0%
The Same	7%
Slightly More	21%
Significantly More	7%
Don't Know / Refused	64%

Table 20: Single Family Duct Repair (EEM 3) Program Improved Comfort Compared to Participant Expectations

3.4 Multifamily Duct Repair (EEM 4)

This section summarizes the savings results for Multifamily Duct Repair (EEM 4). The entire program population was used for the analysis. The program had three participants which accounted for 481 duct repairs.

3.4.1 Gross Results

Table 21 presents the program level gross energy savings. Overall, the Multifamily Duct Repair Program achieved annual energy savings of 61,087 kWh, corresponding to a gross realization rate of 100%. The Multifamily Duct Repair Program achieved gross demand reduction of 62.53 kWh, corresponding to a gross realization rate of 100%.

Gross Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	61,087	62.53
Program Estimated	61,087	62.53
Realization Rate	100%	100%

Table 21: Multifamily Duct Repair (EEM 4) Gross Energy Savings and Demand Reduction

3.4.2 Net Results

Table 22 presents the program level net energy savings. Overall the Multifamily Duct Repair Program achieved annual net energy savings of 61,087 kWh, which corresponds to a net realization rate of 100%. The overall net-to-gross ratio for the program is 100%. The Multifamily Duct Repair Program was achieving net demand reduction of 62.53 kW, which corresponds to a net realization rate of 100%. The overall net-to-gross ratio for the program is 100%.

Net Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	61,087	62.53
Program Estimated	61,087	62.53
Realization Rate	100%	100%
Net to Gross Ratio	100%	100%

Table 22: Multifamily Duct Repair (EEM 4) Net Energy Savings and Demand Reduction

3.4.3 Customer Satisfaction Results

This section summarizes participants' responses to questions regarding customer satisfaction. Table 23 lists the satisfaction results for several program areas, including the program process, communication with DEEP, and the

contractor. Two contractors (referred to here as Contractor A and Contractor B) served the program. All of the participants were very satisfied with the DEEP program process and communication with DEEP. While the participants rated their satisfaction with Contractor B as Very Satisfied, the one participant who had contact with Contractor A rated his satisfaction as Somewhat Dissatisfied. The reasons for dissatisfaction were primarily due to scheduling difficulties with the contractor. Overall, most participants were satisfied with the Multifamily Duct Repair program.

Satisfaction	DEEP Program	DEEP Contact	Contractor
Very Satisfied	100%	100%	75%
Somewhat Dissatisfied	0%	0%	25%

Table 23: Multifamily Duct Repair (EEM 4) Satisfaction Results

3.5 Small Commercial Exit Sign (EEM 5)

This section summarizes the savings results for Small Commercial Exit Sign (EEM 5). A sample of seven (7) participants was used to estimate the savings performance of the 35 participants of the program, who installed a total of 235 units.

3.5.1 Gross Results

Table 24 presents the program level gross energy savings and demand reduction. Overall, the Small Commercial Exit Sign Program achieved annual energy savings of 78,490 kWh, corresponding to a gross realization rate of 100%. The associated relative precision at the 90% level of confidence is 0.0%²².

Overall, the Small Commercial Exit Sign Program achieved gross demand reduction of 9.4 kW, corresponding to a gross realization rate of 100%. The associated relative precision at the 90% level of confidence is 0.0%.

Gross Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	78,490	9.4
Program Estimated	78,490	9.4
Realization Rate	100%	100%

Table 24: Small Commercial Exit Sign (EEM 5) Gross Energy Savings and Demand Reduction

²² The relative precisions associated with the estimates of gross energy savings and demand reduction are 0.0% because we did not encounter any situations where the exit signs were not installed.

3.5.2 Net Results

Table 25 presents the program-level net annual energy savings and demand reduction. Overall, the Small Commercial Exit Sign Program achieved annual net energy savings of 72,259 kWh, resulting in a net realization rate of 92% and a net-to-gross ratio of 92%. The associated relative precision at the 90% level of confidence is 14.2%, resulting in a 90% confidence interval of (60,778, 83,741) kWh.

Overall, the program achieved net demand reduction of 8.7 kW, resulting in a net realization rate of 92% and a net-to-gross ratio of 92%. The associated relative precision at the 90% level of confidence is 14.2%, resulting in a 90% confidence interval of (7.3, 10.0) kW.

Net Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	72,259	8.7
Program Estimated	78,490	9.4
Realization Rate	92%	92%
Net to Gross Ratio	92%	92%

Table 25: Small Commercial Exit Sign (EEM 5) Net Energy Savings and Demand Reduction

3.5.3 Program Process and Customer Satisfaction Results

This section summarizes participants' responses to questions regarding the program process and customer satisfaction.

All survey respondents were asked how they first became aware of DEEP's Small Commercial Exit Sign program. Table 26 summarizes the results. Just over 40% of participants report learning of the program through DEEP staff. Just over 33% of participants heard of the program through the contractor and another 20% became aware of the program through a friend, business colleague, or professional association.

Awareness of Program	% of Respondents
DEEP Staff	43%
Contractor	34%
Friend / Business Colleague / Professional Association	17%
DEEP Marketing / Advertising	6%

Table 26: Small Commercial Exit Sign (EEM 5) Participant Awareness of Program

Table 27 presents the incidence of participants having direct contact with a DEEP staff member. Approximately 66% of participants report having direct contact with a DEEP staff member.

Direct Contact With DEEP Staff	% of Respondents
Yes	66%
No	34%

Table 27: Small Commercial Exit Sign (EEM 5) Incidence of Direct Contact with DEEP Staff

Table 28 lists the satisfaction results for several program areas, including the program process, interaction with DEEP staff, and the performance of the resultant lighting system. Approximately 66% of participants are very satisfied with the program process; over 90% are very satisfied with their interaction with DEEP staff. All of the participants were at least somewhat satisfied with the contractor or resulting lighting system. Only about 30% are very satisfied with the contractor's performance. Over 40% are very satisfied with the resultant lighting system, with the remaining participants being somewhat satisfied.

Satisfaction	DEEP Program (n=7)	DEEP Staff (n=5)	Contractor (n=7)	Lighting System (n=7)
Very Satisfied	66%	91%	29%	43%
Somewhat Satisfied	17%	9%	71%	57%
Neither Satisfied nor Dissatisfied	17%	0%	0%	0%

Table 28 Small Commercial Exit Sign (EEM 5) Satisfaction Results

Survey respondents were asked to compare their expectations of energy cost savings to those experienced as a result of the Small Commercial Exit Sign Program. As shown in Table 29, approximately 50% of participants cannot make this comparison. Those who can make the comparison state they are experiencing either the same or slightly more energy savings than they expected.

Energy Savings Vs. Expectations	% of Respondents
Significantly Less	0%
Slightly Less	0%
The Same	35%
Slightly More	18%
Significantly More	0%
Don't Know / Refused	47%

Table 29: Small Commercial Exit Sign (EEM 5) Energy Savings Compared to Participant Expectations

3.6 Commercial Compact Fluorescent Lamp (EEM 6)

This section summarizes the savings results for Compact Fluorescent Lamp Commercial (EEM 6). A sample of 10 participants was used to estimate the savings performance of the 38 participants of the program, who installed a total of 281 CFLs.

3.6.1 Gross Results

Table 30 presents the program level gross energy savings and demand reduction. Overall, the Compact Fluorescent Lamp Commercial Program achieved annual energy savings of 57,860 kWh, corresponding to a gross realization rate of 59%. The associated relative precision at the 90% level of confidence is 13.5%, resulting in a 90% confidence interval of (50,025, 65,696) kWh. The realization rate for this EEM is fairly low due to the fact that the number of bulbs verified on-site as being installed, was less than identified in the program records.

Overall, the Compact Fluorescent Lamp Commercial Program achieved gross demand reduction of 11.7 kW, corresponding to a gross realization rate of 70%. The associated relative precision at the 90% level of confidence is 13.5%, resulting in a 90% confidence interval of (10.1, 13.3) kW.

Gross Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	57,860	11.7
Program Estimated	98,350	16.9
Realization Rate	59%	70%

Table 30: Compact Fluorescent Lamp Commercial (EEM 6) Gross Energy Savings and Demand Reduction

3.6.2 Net Results

Table 31 presents the program-level net annual energy savings and demand reduction. Overall, the Compact Fluorescent Bulb Commercial Program achieved annual net energy savings of 51,249 kWh, resulting in a net realization rate of 52%. The net-to-gross ratio for the program was 89%. With a high net-to-gross ratio, the low net realization rate is tied to the gross results where on-site surveys were not able to confirm installation of bulbs, as reported above. The associated relative precision at the 90% level of confidence is 25.4%²³, resulting in a 90% confidence interval of (38,246, 64,252) kWh.

²³ Because the program accounted for a small portion of the overall commercial program energy savings, we allowed for a relative precision higher than the originally designed 20%.

Overall, the program achieved net demand reduction of 10.4 kW, resulting in a net realization rate of 62% and a net-to-gross ratio of 89%. The associated relative precision at the 90% level of confidence is 25.2%, resulting in a 90% confidence interval of (7.8, 13.0) kW.

Net Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	51,249	10.4
Program Estimated	98,350	16.9
Realization Rate	52%	62%
Net to Gross Ratio	89%	89%

Table 31: Compact Fluorescent Lamp Commercial (EEM 6) Net Energy Savings and Demand Savings

3.6.3 Program Process and Customer Satisfaction Results

This section summarizes participants' responses to questions regarding the program process and customer satisfaction.

All survey respondents were asked how they first became aware of DEEP's Compact Fluorescent Bulb Commercial program. Table 32 summarizes the results. Nearly 85% of participants report learning of the program through DEEP staff. The remaining 15% of participants heard of the program through DEEP marketing and advertising. All participants said they had direct contact with DEEP staff.

Awareness of Program	% of Respondents
DEEP Staff	84%
DEEP Marketing / Advertising	16%

Table 32: Compact Fluorescent Lamp Commercial (EEM 6) Participant Awareness of Program

Table 33 lists the satisfaction results for several program areas, including the program process, interaction with DEEP staff, and the performance of the CFL bulbs themselves. Approximately 50% of participants are very satisfied with each of the program process, nearly 70% are very satisfied with their interaction with DEEP staff, and just over 90% are very satisfied with the performance of the CFL bulbs.

Satisfaction	DEEP Program (n=10)	DEEP Staff (n=10)	CFL Bulbs (n=10)
Very Satisfied	50%	68%	91%
Somewhat Satisfied	50%	26%	5%
Neither Satisfied nor Dissatisfied	0%	0%	4%
Somewhat Dissatisfied	0%	0%	0%
Extremely Dissatisfied	0%	0%	0%
Don't Know/No Opinion	0%	5%	0%

Table 33: Compact Fluorescent Lamp Commercial (EEM 6) Satisfaction Results

Survey respondents were asked to compare their expectations of energy cost savings to those experienced as a result of the Compact Fluorescent Bulb Commercial Program. As shown in Table 34, approximately 75% of participants cannot make this comparison. Those who can make the comparison state they are experiencing either the same or slightly more energy savings than they expected.

Energy Savings Vs. Expectations	% of Respondents
Significantly Less	0%
Slightly Less	0%
The Same	16%
Slightly More	11%
Significantly More	0%
Don't Know / Refused	74%

Table 34: Compact Fluorescent Lamp Commercial (EEM 6) Energy Savings Compared to Participant Expectations

3.7 Residential Compact Fluorescent Lamp (EEM 7)

This section summarizes the savings results for Compact Fluorescent Lamp Residential (EEM 7). A sample of 125 participants was used to estimate the savings performance of the 3,300 participants of the program, representing 9,900 CFLs.

3.7.1 Gross Results

Table 35 presents the program level gross energy savings and demand reduction. Overall, the Residential Compact Fluorescent Lamp Program achieved annual energy savings of 571,646 kWh, corresponding to a gross realization rate of 50%. The low realization rate resulted from two factors. First, participants were installing, on average, only two of the three bulbs they were given. Second, our deemed savings review indicated that the program was over-

estimating the kW reduction used to calculate the program estimated savings.²⁴ The associated relative precision at the 90% level of confidence is 14.4%, resulting in a 90% confidence interval of (489,456, 653,856) kWh.

Overall, the Residential Compact Fluorescent Lamp Program achieved gross demand reduction of 86.3 kW, corresponding to a gross realization rate of 87%. The associated relative precision at the 90% level of confidence is 15.1%, resulting in a 90% confidence interval of (77.3, 99.3) kW.

Gross Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	571,646	86.3
Program Estimated	1,138,500	99.0
Realization Rate	50%	87%

Table 35: Compact Fluorescent Lamp Residential (EEM 7) Gross Energy Savings and Demand Reduction

3.7.2 Net Results

Table 36 presents the program-level net annual energy savings and demand reduction. Overall, the Compact Fluorescent Bulb Residential Program achieved annual net energy savings of 212,950 kWh, resulting in a net realization rate of 19% and a net-to-gross ratio of 37%. The majority of participants indicated they would have bought compact fluorescent bulbs within the same timeframe as they were given the bulbs. The associated relative precision at the 90% level of confidence is 27.3%, resulting in a 90% confidence interval of (154,774, 271,125) kWh.

Overall, the program achieved net demand reduction of 34.0 kW, resulting in a net realization rate of 34% and a net-to-gross ratio of 39%. The associated relative precision at the 90% level of confidence is 30.4%, resulting in a 90% confidence interval of (27.3, 44.4) kW.

Net Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	212,950	34.0
Program Estimated	1,138,500	99.0
Realization Rate	19%	34%
Net to Gross Ratio	37%	39%

Table 36: Residential: Compact Fluorescent Bulb (EEM 7) Net Energy Savings and Demand Reduction

²⁴ The kW reduction used to estimate the program estimated savings is not the same value used for the program estimated kW demand reduction.

3.7.3 Program Process and Customer Satisfaction Results

This section summarizes participants' responses to questions regarding the program process and customer satisfaction.

All survey respondents were asked how they first became aware of DEEP's Compact Fluorescent Lamp Residential program. Table 37 summarizes the results. Nearly 25% of participants report learning of the program through the Farmers Market. Another 20% (approximately) report learning of the program through a newspaper ad, another community event, or the DEEP staff/office. About 10% of participants heard of the program through a friend or colleague.

Awareness of Program	% of Respondents
Farmers Market	24%
Newspaper Ad	21%
Community Event	18%
DEEP Staff/Office	18%
Friend / Colleague	9%
DEEP Web Site	2%
Movie Ad	1%
Don't Know / Refused	8%

Table 37: Compact Fluorescent Lamp Commercial (EEM 7) Participant Awareness of Program

Table 38 lists the satisfaction results for several program areas, including the program process and the performance of the CFL bulbs themselves. Approximately 50% of participants are very satisfied with both the program process and the performance of the CFL bulbs, with the majority of the remaining participants reporting being somewhat satisfied.

Satisfaction	DEEP Program (n=113)	CFL Bulbs (n=107)
Very Satisfied	50%	47%
Somewhat Satisfied	43%	47%
Neither Satisfied nor Dissatisfied	7%	4%
Somewhat Dissatisfied	0%	3%

Table 38: Compact Fluorescent Lamp Commercial (EEM 7) Satisfaction Results

3.8 Single Family Window-Mounted Evaporative Cooler (EEM 8)

This section summarizes the savings results for Single Family Window-Mounted Evaporative Cooler (EEM 8). A sample of 22 participants was used to estimate

the savings performance of the 100 participants of the program who installed 100 units.

3.8.1 Gross Results

Table 39 presents the program level gross energy savings and demand reduction. Overall, the Single Family Window-Mounted Evaporative Cooler Program achieved annual energy savings of 50,658 kWh, corresponding to a gross realization rate of 55%. The associated relative precision at the 90% level of confidence is 22.9%, resulting in a 90% confidence interval of (39,054, 62,261) kWh.

Overall, the Single Family Window-Mounted Evaporative Cooler Program achieved gross demand reduction of 60.5 kW, corresponding to a gross realization rate of 61%. The associated relative precision at the 90% level of confidence is 31.7%, resulting in a 90% confidence interval of (41.3, 79.7) kW.

The low gross realization rates for gross energy savings and demand reduction resulted from program estimated savings incorrectly predicting system operation. Program estimated savings were calculated based on the assumption that the DEEP unit would replace an older unit, thereby generating savings. However, our on-site visits indicated that participants were not disconnecting their old units and were actually using them in addition to the new DEEP unit, reducing possible savings, but potentially increasing comfort. When the participants reported that they were using the old unit less after the installation of the new DEEP unit, we credited the program and calculated the savings based on the reduced operating hours of the existing unit.

Gross Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	50,658	60.5
Program Estimated	92,600	100.0
Realization Rate	55%	61%

Table 39: Single Family Evaporative Cooler (EEM 8) Gross Energy Savings and Demand Reduction

3.8.2 Net Results

Table 40 presents the program-level net annual energy savings and demand reduction. Overall, the Single Family Evaporative Cooler Program achieved annual net energy savings of 46,975 kWh, resulting in a net realization rate of 51% and a net-to-gross ratio of 93%. The associated relative precision at the 90% level of confidence is 25.7%, resulting in a 90% confidence interval of (34,896, 59,054) kWh.

Overall, the program achieved net demand reduction of 48.1 kW, resulting in a net realization rate of 48% and a net-to-gross ratio of 80%. The associated

relative precision at the 90% level of confidence is 38.3%, resulting in a 90% confidence interval of (29.7, 66.6) kW.

Net Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	46,975	48.1
Program Estimated	92,600	100.0
Realization Rate	51%	48%
Net to Gross Ratio	93%	80%

Table 40: Single Family Evaporative Cooler (EEM 8) Net Energy Savings and Demand Reduction

3.8.3 Program Process & Customer Satisfaction Results

This section summarizes participants' responses to questions regarding the program process and customer satisfaction.

All survey respondents were asked how they first became aware of DEEP's Single Family Evaporative Cooler program. Table 41 summarizes the results. Nearly 70% of participants learned of the program through DEEP staff, with approximately another 20% of participants learning of the program through a friend or colleague.

Awareness of Program	% of Respondents
DEEP Staff	68%
Friend / Colleague	18%
Other	9%
Don't Know / Refused	5%

Table 41: Single Family Evaporative Cooler (EEM 8) Participant Awareness of Program

Table 42 lists the satisfaction results for several program areas, including the program process, communication with DEEP staff, and the installation contractor. Overall, most participants were satisfied with the program. All participants are either somewhat or very satisfied, with at least 60% of respondents very satisfied in each program area.

Satisfaction	DEEP Program (n=22)	DEEP Staff (n=22)	Contractor (n=22)
Very Satisfied	59%	64%	68%
Somewhat Satisfied	41%	36%	27%
Don't Know/No Opinion			5%

Table 42: Single Family Evaporative Cooler (EEM 8) Satisfaction Results

In order to assess if energy savings were being realized and noticed, we first asked respondents if they were responsible for the electricity bills. Ninety-five percent of respondents were responsible for the electric bills.

Survey respondents who were responsible for the electric bills were asked if they have noticed any changes in their summer electric bills since the installation of the new evaporative cooler. As shown in Table 43, nearly 25% of respondents report they are paying less and just over 40% of respondents state they are paying the same on their summer electric bills. One-third (33%) of respondents do not know if their summer electric bill has changed.

Change in Summer Electric Bill	% of Respondents
Yes, I am paying less	24%
Yes, I am paying more	0%
No, I'm paying the same	43%
Don't Know / Refused	33%

Table 43: Single Family Evaporative Cooler (EEM 8) Changes in Summer Electric Bills among Respondents Responsible for the Electric Bills

3.9 Davis Lights (EEM 9a)

This section summarizes the savings results for Davis Lights (EEM 9a). A sample of 25 participants was used to estimate the savings performance of the 173 projects for the 172 program participants.

3.9.1 Gross Results

Table 44 presents the program level gross energy savings and demand reduction. Overall, the Davis Lights Program achieved annual energy savings of 1,020,907 kWh, corresponding to a gross realization rate of 101%. The associated relative precision at the 90% level of confidence is 6.8%, resulting in a 90% confidence interval of (951,174, 1,090,639) kWh.

Overall, the Davis Lights Program achieved gross demand reduction of 210.0 kW, corresponding to a gross realization rate of 101%. The associated relative precision at the 90% level of confidence is 7.2%, resulting in a 90% confidence interval of (164.4, 244.9) kW.

Gross Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	1,020,907	210.0
Program Estimated	1,009,414	207.2
Realization Rate	101%	101%

Table 44: Davis Lights (EEM 9a) Gross Energy Savings and Demand Reduction

3.9.2 Net Results

Table 45 presents the program-level net annual energy savings and demand reduction. Overall, the Davis Lights Program achieved annual net energy savings of 998,762 kWh, resulting in a net realization rate of 99% and a net-to-gross ratio of 98%. The associated relative precision at the 90% level of confidence is 19.8%, resulting in a 90% confidence interval of (800,508, 1,197,015) kWh.

Overall, the program achieved net demand reduction of 204.6 kW, resulting in a net realization rate of 99% and a net-to-gross ratio of 97%. The associated relative precision at the 90% level of confidence is 19.7%, resulting in a 90% confidence interval of (164.4, 244.9) kW.

Net Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	998,762	204.6
Program Estimated	1,009,414	207.2
Realization Rate	99%	99%
Net to Gross Ratio	98%	97%

Table 45: Davis Lights (EEM 9a) Net Energy Savings

3.9.3 Program Process and Customer Satisfaction Results

This section summarizes participants' responses to questions regarding the program process and customer satisfaction.

All survey respondents were asked how they first became aware of DEEP's Davis Lights program. Table 46 summarizes the results. Nearly 60% of participants learned of the program through DEEP staff, with approximately another 20% of participants learning of the program through a DEEP marketing and advertising.

Awareness of Program	% of Respondents
DEEP Staff	59%
DEEP Marketing / Advertising	23%
Contractor	10%
Friend / Business Colleague / Professional Association	9%

Table 46: Davis Lights (EEM 9a) Participant Awareness of Program

Table 47 presents the incidence of direct contact with DEEP staff. As shown in the table, approximately 70% of program participants had direct contact with DEEP staff.

Direct Contact With Deep Staff	% of Respondents
Yes	69%
No	27%
Don't Know / Refused	3%

Table 47: Davis Lights (EEM 9a) Incidence of Direct Contact with DEEP Staff

Table 48 lists the satisfaction results for several program areas, including the program process, communication with DEEP staff, the installation contractor, and the resultant lighting system. Participants appear to be more satisfied with communication with DEEP staff, DEEP program process itself, and the resultant lighting system (over 70% very satisfied) than with the installation contractor (about 50% very satisfied). Overall, most participants were quite satisfied with the Davis Lights Program.

Satisfaction	DEEP Program (n=25)	DEEP Staff (n=17)	Contractor (n=25)	Lighting System (n=25)
Very Satisfied	76%	72%	52%	71%
Somewhat Satisfied	23%	24%	33%	15%
Neither Satisfied nor Dissatisfied	2%		10%	14%
Somewhat Dissatisfied			3%	
Don't Know/No Opinion		3%		

Table 48: Davis Lights (EEM 9a) Davis Lights Satisfaction Results

Survey respondents were asked to compare their expectations of energy cost savings to those experienced as a result of the Davis Lights Program. As shown in Table 49, approximately 75% of participants cannot make this comparison. The majority of those who can make the comparison state they are experiencing slightly more energy savings than they expected.

Energy Savings Vs. Expectations	% of Respondents
Significantly Less	0%
Slightly Less	0%
The Same	9%
Slightly More	18%
Significantly More	2%
Don't Know / Refused	72%

Table 49: Davis Lights (EEM 9a) Davis Lights Energy Savings Compared to Participant Expectations

3.10 Customized Commercial Projects (EEM 9b)

This section summarizes the savings results for the Customized Commercial Projects (EEM 9b). A sample of 12 participants was used to estimate the savings performance of the 74 participants of the program.

3.10.1 Gross Results

Table 50 presents the program level gross energy savings and demand reduction. Overall, the Custom Commercial Projects Program achieved annual energy savings of 1,824,099 kWh, corresponding to a gross realization rate of 89%. The associated relative precision at the 90% level of confidence is 7.0%, resulting in a 90% confidence interval of (1,695,938, 1,952,260) kWh.

Overall, the Custom Commercial Projects Program achieved gross demand reduction of 368.5 kW, corresponding to a gross realization rate of 89%. The associated relative precision at the 90% level of confidence is 6.0%, resulting in a 90% confidence interval of (346.2, 390.8) kW.

Gross Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	1,824,099	368.5
Program Estimated	2,041,501	413.0
Realization Rate	89%	89%

Table 50: Customized Commercial Projects (EEM 9b) Gross Energy Savings and Demand Reduction

3.10.2 Net Results

Table 51 presents the program-level net annual energy savings and demand reduction. Overall, the Custom Commercial Projects Program achieved annual net energy savings of 1,811,740 kWh, resulting in a net realization rate of 89% and a net-to-gross ratio of 99%. The associated relative precision at the 90%

level of confidence is 7.4%, resulting in a 90% confidence interval of (1,678,286, 1,945,194) kWh.

Overall, the program achieved net demand reduction of 366.2 kW, resulting in a net realization rate of 89% and a net-to-gross ratio of 99%. The associated relative precision at the 90% level of confidence is 6.5%, resulting in a 90% confidence interval of (342.3, 390.0) kW.

Net Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	1,811,740	366.2
Program Estimated	2,041,501	413.0
Realization Rate	89%	89%
Net to Gross Ratio	99%	99%

Table 51: Customized Commercial Projects (EEM 9b) Net Energy Savings

3.10.3 Program Process and Customer Satisfaction Results

This section summarizes participants' responses to questions regarding the program process and customer satisfaction.

All survey respondents were asked how they first became aware of DEEP's Custom Commercial Projects program. Table 52 summarizes the results. Over 50% of participants learned of the program through DEEP staff, with approximately another 25% of participants learning of the program through a contractor.

Awareness of Program	% of Respondents
DEEP Staff	54%
Contractor	25%
DEEP Marketing / Advertising	8%
Other	8%
Don't Know / Refused	6%

Table 52: Customized Commercial Projects (EEM 9b) Participant Awareness of Program

Table 53 presents the incidence of direct contact with DEEP staff. As shown in the table, approximately 85% of program participants had direct contact with DEEP staff.

Direct Contact With Deep Staff	% of Respondents
Yes	86%
No	14%

Table 53: Customized Commercial Projects (EEM 9b) Incidence of Direct Contact with DEEP Staff

Table 54 lists the satisfaction results for several program areas, including the program process, communication with DEEP staff, the installation contractor, and the resultant lighting system. Participants appear to be significantly more satisfied with communication with DEEP staff (78% very satisfied) than with the other program areas. Over 50% of participants are very satisfied with both the DEEP program process itself and the resultant lighting system. Participants were least satisfied with the installation contractor, with only 36% very satisfied, and 20% of participants stating they are either somewhat or very dissatisfied with the installation contractor. Dissatisfaction with the contractor resulted from scheduling problems or incorrect cost estimates. Overall, most participants were satisfied with the Custom Commercial Projects Program.

Satisfaction	DEEP Program (n=12)	DEEP Staff (n=10)	Contractor (n=12)	Lighting System (n=12)
Very Satisfied	62%	78%	36%	51%
Somewhat Satisfied	26%	22%	26%	38%
Neither Satisfied nor Dissatisfied	14%	0%	19%	12%
Somewhat Dissatisfied	0%	0%	8%	0%
Extremely Dissatisfied	0%	0%	12%	0%

Table 54: Customized Commercial Projects (EEM 9b) Satisfaction Results

Survey respondents were asked to compare their expectations of energy cost savings to those experienced as a result of the Custom Commercial Projects Program. As shown in Table 55, approximately 65% of participants could not make this comparison. The majority of those who can make the comparison state they are experiencing either slightly less than or the same energy savings as they expected.

Energy Savings Vs. Expectations	% of Respondents
Significantly Less	0%
Slightly Less	12%
The Same	19%
Slightly More	7%
Significantly More	0%
Don't Know / Refused	64%

Table 55: Customized Commercial Projects (EEM 9b) Energy Savings Compared to Participant Expectations

3.11 City School Partnership (EEM 9c)

This section summarizes the savings results for the City School Partnership (EEM 9c). The entire program population was used to estimate the savings. Davis Joint Unified School District was the sole participant of the program. Three projects were completed: two cool roof projects and one relocatable classroom lighting retrofit. The district was very satisfied with the DEEP program process and their contact with the DEEP staff.

3.11.1 Gross Results

Table 56 presents the program level gross energy savings and demand reduction. Overall, the City School Partnership Program achieved annual energy savings of 75,000 kWh, corresponding to a gross realization rate of 100%. The Custom Commercial Projects Program achieved gross demand reduction of 36.0 kW, corresponding to a gross realization rate of 100%.

Gross Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	75,000	36.00
Program Estimated	75,000	36.00
Realization Rate	100%	100%

Table 56: City School Partnership (EEM 9c) Gross Energy Savings and Demand Reduction

3.11.2 Net Results

Table 57 presents the program-level net annual energy savings and demand reduction. The district stated that they probably would have installed the cool roofs even without the program incentives, although at a later time. Therefore the net-to-gross ratio was calculated to be 75% and resulting in a net realization rate of 75%. Overall, the City School Partnership Program achieved annual net energy savings of 56,250 kWh, and net demand reduction of 27.0 kW.

Net Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	56,250	27.00
Program Estimated	75,000	36.00
Realization Rate	75%	75%
Net to Gross Ratio	75%	75%

Table 57: City School Partnership Program (EEM 9c) Net Energy Savings

3.12 Multifamily Swimming Pool Retrofit Project (EEM 10)

This section summarizes the savings results for the Multifamily Swimming Pool Retrofit Project (EEM 10). The analysis is based on the two projects completed for one participant.

3.12.1 Gross Results

Table 58 presents the program level gross energy savings, both electric and gas, and demand reduction. Overall, the Multifamily Swimming Pool Retrofit Project achieved annual energy savings of 6,739 kWh, corresponding to a gross realization rate of 100%. The Multifamily Swimming Pool Retrofit Project achieved gross demand reduction of 0.96 kW, corresponding to a gross realization rate of 100%.

Gross Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	6,739	0.96
Program Estimated	6,739	0.96
Realization Rate	100%	100%

Table 58: Multifamily Swimming Pool Retrofit Project (EEM 10) Gross Energy Savings and Demand Reduction

3.12.2 Net Results

Net results are provided for both annual energy savings and peak demand reduction. Table 59 presents the program level net energy savings. Overall the Multifamily Swimming Pool Retrofit Project annual net energy savings of 6,739 kWh, which corresponds to a net realization rate of 100%. The overall net-to-gross ratio for the program is 100%. The Multifamily Swimming Pool Retrofit Project was achieving net demand reduction of 0.96 kW, which corresponds to a net realization rate of 100%. The overall net-to-gross ratio for the program is 100%.

Net Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	6,739	0.96
Program Estimated	6,739	0.96
Realization Rate	100%	100%
Net to Gross Ratio	100%	100%

Table 59: Multifamily Swimming Pool Retrofit Project (EEM 10) Net Energy Savings and Demand Reduction

3.12.3 Customer Satisfaction Results

This section summarizes the participant's responses to questions regarding the program process and customer satisfaction. The program participant was very satisfied with the DEEP program process and somewhat satisfied with communication with DEEP. However, the participant rated her experience with the contractor as somewhat dissatisfied. The reason for dissatisfaction was primarily due to scheduling difficulties with the contractor. Recommendations included having available contractors from the area and improving responsiveness from the DEEP staff. Overall, the participant was satisfied with the Multifamily Swimming Pool Retrofit Project.

3.13 Multifamily Laundry Retrofit Project (EEM 13)

This section summarizes the savings results for Multifamily Laundry Retrofit Project (EEM 13). The entire program population was used for the analysis. Nine participants installed a total of 61 units.

3.13.1 Gross Results

Table 60 presents the program level gross energy savings, both electric and gas, and demand reduction. Overall, the Multifamily Laundry Retrofit Project achieved annual energy savings of 16,714 kWh and 3,721 therms, corresponding to a gross realization rate of 100%. The Multifamily Laundry Retrofit Project achieved gross demand reduction of 1.63 kWh, corresponding to a gross realization rate of 100%.

Gross Results	Energy Savings		Demand Reduction
	therms	kWh	kW
Evaluation Estimated	3,721	16,714	1.63
Program Estimated	3,721	16,714	1.63
Realization Rate	100%	100%	100%

Table 60: Multifamily Laundry Retrofit Project (EEM 13) Gross Energy Savings and Demand Reduction

3.13.2 Net Results

Net results are shown for both annual energy savings and peak demand reduction. Table 61 presents the program level net energy savings. Overall the Multifamily Laundry Retrofit Project annual net energy savings of 2,557 kWh and 569 therms, which corresponds to a net realization rate of 15%. The overall net-to-gross ratio for the program is 15%.

Most participants indicated they would have installed the energy efficient clothes washers within the same timeframe regardless of the program. One possible explanation for the high free-ridership could be the relative definition of energy efficient washing machines. DEEP suggests that the energy efficient washers the participants would have installed are typically less efficient than the DEEP rebated units, and it was part of DEEP's program delivery to explain the differences in the efficiency of the DEEP approved unit versus other efficient washers in the market. The evaluation was not designed to distinguish between different efficiency levels of the equipment; therefore HMG could not confirm this explanation.

Net Results	Energy Savings		Demand Reduction
	therms	kWh	kW
Evaluation Estimated	569	2,557	0.25
Program Estimated	3,721	16,714	1.63
Realization Rate	15%	15%	15%
Net to Gross Ratio	15%	15%	15%

Table 61: Multifamily Laundry Retrofit Project (EEM 13) Net Energy Savings and Demand Reduction

3.13.3 Customer Satisfaction Results

This section summarizes participants' responses to questions regarding customer satisfaction.

Table 62 lists the satisfaction results for several program areas, including the program process, communication with DEEP, and the contractor. Overall, the participants were satisfied with the Multifamily Laundry Retrofit Project. All program participants were very satisfied with the DEEP program process and communication with DEEP. They were very to somewhat satisfied with the contractors who installed the clothes washers.

Satisfaction	DEEP Program	DEEP Contact	Contractor
Very Satisfied	100%	100%	89%
Somewhat Satisfied	0%	0%	11%

Table 62: Multifamily Laundry Retrofit Project (EEM 13) Satisfaction Results

3.14 Single Family Torchiere Swap (EEM 14)

This section summarizes the savings results for Single Family Torchiere Swap (EEM 14). A sample of 11 participants was used to estimate the savings performance of the 297 participants of the program.

3.14.1 Gross Results

Table 63 presents the program level gross energy savings and demand reduction. Overall, the Single Family Torchiere Swap Program achieved annual energy savings of 78,111 kWh, corresponding to a gross realization rate of 100%. All respondents stated that their torchiere was in use, there was no variation in the gross savings sample data. Consequently, the associated relative precision at the 90% level of confidence is 0.0%.

Overall, the Single Family Torchiere Swap Program achieved gross demand reduction of 3.0 kW, corresponding to a gross realization rate of 100%. Similar to the gross energy savings results, the associated relative precision at the 90% level of confidence is 0.0%.

Gross Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	78,111	3.0
Program Estimated	78,111	3.0
Realization Rate	100%	100%

Table 63: Single Family Torchiere Swap (EEM 14) Gross Energy Savings and Demand Reduction

3.14.2 Net Results

Table 64 presents the program-level net annual energy savings and demand reduction. Overall, the Single Family Torchiere Swap Program achieved annual net energy savings of 58,583 kWh, resulting in a net realization rate of 75% and a net-to-gross ratio of 75%. The associated relative precision at the 90% level of confidence is 20.5%, resulting in a 90% confidence interval of (46,561, 70,606) kWh.

Overall, the program achieved net demand reduction of 2.2 kW, resulting in a net realization rate of 75% and a net-to-gross ratio of 75%. The associated relative precision at the 90% level of confidence is 20.5%, resulting in a 90% confidence interval of (1.8, 2.7) kW.

Net Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	58,583	2.2
Program Estimated	78,111	3.0
Realization Rate	75%	75%
Net to Gross Ratio	75%	75%

Table 64: Single Family Torchiere Swap (EEM 14) Net Energy Savings and Demand Reduction

3.14.3 Program Process and Customer Satisfaction Results

This section summarizes participants' responses to questions regarding the program process and customer satisfaction.

All survey respondents were asked how they first became aware of DEEP's Single Family Torchiere Swap program. Table 65 summarizes the results. Just over 50% of participants learned of a newspaper ad, with approximately another 25% of participants learning of the program through a friend or colleague.

Awareness of Program	% of Respondents
Newspaper Ad	55%
Friend / Colleague	27%
Direct Mail	9%
Other	9%

Table 65: Single Family Torchiere Swap (EEM 14) Participant Awareness of Program

Table 66 lists the satisfaction results for the program, including the program process and the torchiere itself. Nearly 75% of participants are very satisfied with the program process, with the remaining 25% reporting they are somewhat satisfied. Participants appear to be less satisfied with the torchieres themselves than they were with the program process, as only 36% of participants report being very satisfied with the torchiere itself.

Satisfaction	DEEP Program (n=11)	Torchiere (n=11)
Very Satisfied	73%	36%
Somewhat Satisfied	27%	64%

Table 66: Single Family Torchiere Swap (EEM 14) Satisfaction Results

3.15 Single Family HVAC Charge and Airflow (EEM 15)

This section summarizes the savings results for Single Family HVAC Charge and Airflow (EEM 15). A sample of 50 participants was used to estimate the savings performance of the 162 participants of the program, who had a total of 180 HVAC units serviced.

3.15.1 Gross Results

Table 67 presents the program level gross energy savings and demand reduction. Overall, the Single Family HVAC Charge and Airflow Program achieved annual energy savings of 31,866 kWh, corresponding to a gross realization rate of 98%. The associated relative precision at the 90% level of confidence is 2.9%, resulting in a 90% confidence interval of (30,951, 32,780) kWh.

Overall, the Single Family HVAC Charge and Airflow Program achieved gross demand reduction of 47.1 kW, corresponding to a gross realization rate of 98%. The associated relative precision at the 90% level of confidence is 4.3%, resulting in a 90% confidence interval of (45.7, 48.4) kW.

Gross Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	31,866	47.1
Program Estimated	32,521	48.1
Realization Rate	98%	98%

Table 67: Single Family HVAC Charge & Airflow (EEM 15) Gross Energy Savings and Demand Reduction

3.15.2 Net Results

Table 68 presents the program-level net annual energy savings and demand reduction. Overall, the Single Family HVAC Charge and Airflow Program achieved annual net energy savings of 31,047 kWh, resulting in a net realization rate of 95% and a net-to-gross ratio of 97%. The associated relative precision at the 90% level of confidence is 4.4%, resulting in a 90% confidence interval of (29,673, 32,421) kWh.

Overall, the program achieved net demand reduction of 45.9 kW, resulting in a net realization rate of 95% and a net-to-gross ratio of 97%. The associated relative precision at the 90% level of confidence is 4.4%, resulting in a 90% confidence interval of (43.9, 47.9) kW.

Net Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	31,047	45.9
Program Estimated	32,521	48.1
Realization Rate	95%	95%
Net to Gross Ratio	97%	97%

Table 68: Single Family HVAC Charge & Airflow (EEM 15) Net Energy Savings and Demand Reduction

3.15.3 Program Process and Customer Satisfaction Results

This section summarizes participants' responses to questions regarding the program process and customer satisfaction.

All survey respondents were asked how they first became aware of DEEP's Single Family HVAC Charge and Airflow program. Table 69 summarizes the results. Nearly 35% of participants learned of the program through direct mail, with approximately another 15% of participants learning of the program through the farmer's market, the DEEP web site, a newspaper ad, or DEEP staff.

Awareness of Program	% of Respondents
Direct Mail	34%
Farmer's Market	17%
DEEP Web Site	16%
Newspaper Ad	14%
DEEP Staff	13%
Friend / Colleague	3%
Don't Know / Refused	3%

Table 69: Single Family HVAC Charge & Airflow (EEM 15) Participant Awareness of Program

Table 70 presents the incidence of program participants having direct contact with a DEEP staff member. Nearly two-thirds, or 63%, of participants report having direct contact with a DEEP staff member.

Direct Contact With Deep Staff	% of Respondents
Yes	63%
No	34%
Don't Know	3%

Table 70: Single Family HVAC Charge & Airflow (EEM 15) Incidence of Respondents Having Direct Contact with A DEEP Staff Member

Table 71 lists the satisfaction results for several program areas, including the program process, communication with DEEP staff, and the installation contractor. Participants appear most satisfied with their interaction with DEEP staff, with 96% very satisfied, and least satisfied with the installation contractor, where only about 50% of participants report being very satisfied and a full 15% report being neither satisfied nor dissatisfied. Overall, most participants were either very satisfied or somewhat satisfied with these areas of the Single Family HVAC Charge and Airflow Program.

Satisfaction	DEEP Program (n=49)	DEEP Staff (n=30)	Contractor (n=49)
Very Satisfied	75%	96%	51%
Somewhat Satisfied	21%	4%	34%
Neither Satisfied nor Dissatisfied	4%	0%	15%

Table 71: Single Family HVAC Charge & Airflow (EEM 15) Satisfaction Results

3.16 Multifamily Charge and Airflow (EEM 16)

This section summarizes the savings results for Multifamily HVAC Charge and Airflow (EEM 16). The entire program population was used for the analysis. Six participants represent 165 projects.

3.16.1 Gross Results

Table 72 presents the program level gross energy savings. Overall, the Multifamily HVAC Charge and Airflow Program achieved annual energy savings of 32,835 kWh, corresponding to a gross realization rate of 100%. The Multifamily HVAC Charge and Airflow Program achieved gross demand reduction of 48.46 kW, corresponding to a gross realization rate of 100%.

Gross Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	32,835	48.46
Program Estimated	32,835	48.46
Realization Rate	100%	100%

Table 72: Multifamily HVAC Charge & Airflow (EEM 16) Gross Energy Savings and Demand Reduction

3.16.2 Net Results

Table 73 presents the program-level net annual energy savings. Overall, the Multifamily HVAC Charge and Airflow Program achieved annual net energy savings of 32,835 kWh, resulting in a net realization rate of 100% and a net-to-

gross ratio of 100%. The program achieved net demand reduction of 48.5 kW, resulting in a net realization rate of 100% and a net-to-gross ratio of 100%.

Net Results	Energy Savings (kWh)	Demand Reduction (kW)
Evaluation Estimated	32,835	48.46
Program Estimated	32,835	48.46
Realization Rate	100%	100%
Net to Gross Ratio	100%	100%

Table 73: Multifamily HVAC Charge & Airflow Net Energy Savings (EEM 16)

3.16.3 Customer Satisfaction Results

This section summarizes participants' responses to questions regarding customer satisfaction.

Table 74 lists the satisfaction results for several program areas, including the program process, communication with DEEP, and the contractor. All program participants were very satisfied with communication with DEEP. However, only one participant was satisfied with the contractor and the DEEP program process. The majority of respondents indicated great displeasure with the contractor, citing scheduling difficulties, technicians leaving a mess behind at the properties, failing to reconnect wires, and huge intrusion of the service on their residents. One participant indicated that the problems created by the contractor made her very wary in participating in other energy efficiency programs.

Satisfaction	DEEP Program	DEEP Contact	Contractor
Very Satisfied	17%	100%	17%
Neither Satisfied nor Dissatisfied	83%		
Somewhat Dissatisfied			33%
Extremely Dissatisfied			50%

Table 74: Multifamily HVAC Charge & Airflow (EEM 16) Satisfaction Results

4. PROGRAM OBSERVATIONS & RECOMMENDATIONS

The program observations and recommendations are composed of evaluation findings based on the impact and process results and review of program records. This section provides suggestions to improve the program process.

4.1 Maximizing Energy Savings Opportunities

Overall, DEEP achieved high gross and net realization rates, suggesting evaluated results closely matched program estimated savings and demand reduction. In particular, DEEP's commercial prescriptive lighting programs, Davis Lights (EEM9a) and Customized Commercial (EEM 9b), accounted for a significant portion of DEEP's success. As the largest programs in the DEEP portfolio, Davis Lights (EEM9a) and Customized Commercial (EEM 9b) attained high gross and net realization rates. The two programs combined generated 81% of DEEP's net savings. However, other DEEP programs were not as effective.

The multifamily programs only generated 3% of DEEP's net savings. It seems the market conditions were different than what was anticipated by DEEP, and the multifamily building owners did not find the rebates attractive. Multifamily programs often have to deal with the split incentives where the owners pay for the retrofits, but the tenants reap the rewards of the energy savings for any future program offerings. We recommend DEEP conduct a thorough review of the market conditions before developing their EEMs for this sector, and tailor the benefits such that owners find the program attractive. With such a large difference of success between programs, we recommend that DEEP concentrate resources on programs which provide the best net savings opportunities.

Program savings can also be improved with changes to the delivery mechanism. Compact Fluorescent Lamp Residential (EEM7) promoted the use of screw-in compact fluorescent bulbs in the residential sector through direct give-away of the measure. Participants were provided with a pack of three compact fluorescent bulbs of varying wattages. The program achieved a gross realization rate of 50%, resulting from lower than expected installation rates. An average of two out of the three bulbs was installed. Similar results were found in a 2002 KEMA-Xenergy Study²⁵ evaluating the 2001 California IOU CFL give-away programs. The report analyzed the various program delivery methods. One of their findings was that CFL give-away programs which gave one CFL per participant achieved the highest installation rates. Programs that gave away more than one CFL per resident achieved a lower overall installation rate with the exception of the reduced-price program, which achieved a 90% installation rate, even though, on average, participants purchased six CFLs each.

²⁵ KEMA-Xenergy. 2002. "Phase 4 Market Effects Study of California Residential Lighting and Appliance Program". For San Diego Gas & Electric Company.

The lesson learned is that the significant decline in installation rates as the number of CFLs provided increases is much more gradual when the participant shares in the cost and can choose the style and size of the CFL. Given that DEEP chose the targeted give-away approach, it may have generated better gross savings by providing either fewer lamps per customer or a better mix of CFLs that targets typical incandescent lamp wattages or specific applications.

Net realization rates for the Compact Fluorescent Lamp Residential (EEM7) program could also be improved with changes in the program delivery. The program achieved a net realization rate of 19%. Davis residents has a fairly high awareness of energy efficiency, relative to other communities, and a number of participants indicated that they had planned to buy compact fluorescent bulbs and were simply taking advantage of the free bulbs that the program offered. Targeted delivery methods could be used to reach more participants who would be unlikely to buy compact fluorescent bulb on their own. These may include hard-to-reach, low-income or senior customers. Another aspect of the project was to push the EnergyStar branding. The presence of low cost CFLs available at local retailer outlets has created difficulty in pushing for higher cost, higher quality lamps. The DEEP program included an educational effort that explained the source of the low cost (the Statewide IOUs buy-down programs) and the benefit of the ENERGYSTAR labeled, and explain the source of the low cost. This aspect of the program was not assessed during this evaluation.

For example, the Single Family Window-Mounted Evaporative Cooler (EEM8) targets low-income households. The program uses door-to-door recruitment by DEEP staff to gather participants. DEEP leveraged the delivery mechanism of this program in coordination with the Compact Fluorescent Lamp Residential (EEM7) program by offering the CFLs to residents at the same time they are recruiting for the Single Family Window-Mounted Evaporative Cooler (EEM8) program.

4.2 Improving Marketing Strategies and Program Reporting

Based on surveys of program participants, the majority of individuals became aware of DEEP's programs primarily through five delivery methods:

- ◆ Newspaper advertisements
- ◆ Direct mailings
- ◆ Direct contact with DEEP staff (Door-to-door, Energy Center, Farmers Market or other city events))
- ◆ Word-of-mouth (Friends, family, colleagues)
- ◆ Contractors

We suggest marketing efforts should concentrate solely on the above listed methods. Other marketing methods included movie theater advertisements, radio advertisements, DEEP website, and City of Davis website.

Improvements should also be made in the program tracking datasets. With a large number of programs, the reporting software, MS Excel, was ill equipped to handle DEEP's reporting needs. The dataset design allowed for too many input errors, especially in monthly and quarterly calculations. Also, the dataset design lacked the ability to provide comparisons across programs, such as reviewing if individuals participated in multiple programs. The use of relational database software with greater automated abilities would have better served the program.

4.3 Improve Deemed Savings Calculations

DEEP used a deemed savings approach to estimate the savings from the various measures incented by the program. These savings were based upon recorded or calculated savings from similar energy efficiency programs run by California utilities and third party programs. However, in some cases, DEEP modified the calculated savings based on program assumptions. For these cases, DEEP needs to carefully document the modified calculations and the reasoning behind those changes. It is important that the deemed savings calculation be easily replicable, defensible, and well-documented.

For example, the deemed savings for Compact Fluorescent Lamp Residential (EEM7) was modified from the calculations used the PG&E Workpapers, a source for commercial applications. DEEP discounted the savings from the CFL measure, since the lamps are used less often in residential than in commercial applications, but did not record the calculations for this modification. Thus, we used a different method in determining evaluated savings.

Similarly, the deemed savings calculation for Single Family Window-Mounted Evaporative Cooler (EEM8) was based on testing results completed at the PG&E Stockton energy center. The tests analyzed the replacement of an EER 5.0 window mounted unit with the more energy efficient DEEP unit, using the same assumed operating usage. The calculated energy savings based on the testing was modified to account for different operating usage between the DEEP unit and the replaced unit. However, documentation of revised energy savings was not kept. For our evaluation, we had to assume a different deemed savings.

The program assumptions of the deemed savings calculations should also be based on actual program conditions. As described in the results section, the deemed savings for Single Family Window-Mounted Evaporative Cooler (EEM8) was based on the DEEP unit replacing an older, inefficient unit. However, the replacement units were not uninstalled as part of the program process due to possible liability problems and there was no program mechanism set up to make certain that the existing units would be disabled for use. When surveyed, a number of participants indicated they did not completely stop using the

replacement unit after the DEEP unit was installed, negating possible savings. Perhaps the deemed savings calculation should account for only partial savings.

4.4 Maintain High Customer Satisfaction Levels

Overall, participants rated their satisfaction with the DEEP program process and the services and information provided by the DEEP staff highly. For the most part, contractors were also well received. However, in some cases, participants were displeased with the quality of the work provided by their contractor, which may cause them to reflect badly on the program. DEEP is aware of these actual and potential problems with contractors and will increase their oversight on all contractors who assist with future program offerings.

5. APPENDIX A: THEORETICAL FOUNDATION OF SAMPLE DESIGN

MBSS™ (Model-Based Statistical Sampling) methodology was used where feasible to develop an efficient sample design and to assess the likely statistical precision associated the planned sample. In the situations where we could not utilize MBSS methodology, we made use of traditional simple random sampling (SRS) techniques. The following paragraphs describe MBSS methodology.

The target variable of analysis, denoted y , is the actual energy savings of the lighting project. The primary stratification variable, the tracking system estimated energy savings of the project, will be denoted x . A ratio model was formulated to describe the relationship between y and x for all units in the population, e.g., all program participants.

The MBSS™ ratio model consists of two equations called the primary and secondary equations:

$$\begin{aligned} y_k &= \beta x_k + \varepsilon_k \\ \sigma_k &= sd(y_k) = \sigma_0 x_k^\gamma \end{aligned}$$

Here $x_k > 0$ is known throughout the population. k denotes the sampling unit, i.e., the site. $\{\varepsilon_1, \dots, \varepsilon_N\}$ are independent random variables with zero expected value, and β , σ_0 , and γ (gamma) are parameters of the model. The primary equation can also be written as

$$\mu_k = \beta x_k$$

Under the MBSS ratio model, it is assumed that the expected value of y is a simple ratio or multiple of x .

Here, y_k is a random variable with expected value μ_k and standard deviation σ_k . Both the expected value and standard deviation generally vary from one unit to another depending on x_k , following the primary and secondary equations of the model. In statistical jargon, the ratio model is a (usually) heteroscedastic regression model with zero intercept.

One of the key parameters of the ratio model is the error ratio, denoted er . The error ratio is a measure of the strength of the association between y and x . The error ratio is suitable for measuring the strength of a heteroscedastic relationship and for choosing sample sizes. It is *not* equal to the correlation coefficient. It is somewhat analogous to a coefficient of variation except that it describes the association between two or more variables rather than the variation in a single variable.

Using the model discussed above, the error ratio, *er*, is defined to be:

$$er = \frac{\sum_{k=1}^N \sigma_k}{\sum_{k=1}^N \mu_k} = \frac{\frac{1}{N} \sum_{k=1}^N \sigma_k}{\frac{1}{N} \sum_{k=1}^N \mu_k}$$

Table 75 gives some typical examples of ratio models with different error ratios. An error ratio of 0.2 represents a very strong association between *y* and *x*, whereas an error ratio of 0.8 represents a weak association.

As Table 75 indicates, the error ratio is the principle determinant of the sample size required to satisfy the 90/10 criteria for estimating *y*. If the error ratio is small, then the required sample is correspondingly small.

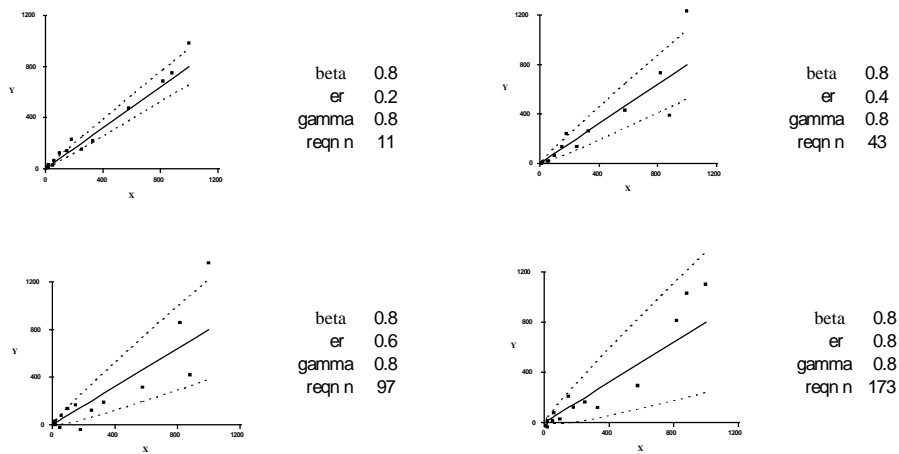


Table 75: Examples of MBSS Ratio Models

6. APPENDIX B: THEORETICAL FOUNDATION OF SAVINGS ESTIMATION

MBSS™ methodology was used where feasible to extrapolate the results to the target population. In the situations where we could not utilize MBSS methodology, we made use of traditional simple random sampling (SRS) techniques. MBSS has been used for all of California's IOUs, NEES, Northeast Utilities, Consolidated Edison, The New York Power Authority, Wisconsin Electric, Sierra Pacific Power Company, and Washington Power and Light among others. MBSS was used in the end-use metering component of the 1992 evaluation of PG&E's CIA program, the 1994, 1996, and 1998 NRNC evaluations for PG&E and Southern California Edison, and the 1998 NRNC Baseline Study for the CBEE. A complete description of MBSS methodology is available if further discussion of the methodology is required.²⁶

The following sections will describe in more detail three topics:

- Case weights
- Balanced stratification to calculate case weights
- Stratified ratio estimation using case weights.

6.1 Case Weights

6.1.1 Theoretical Foundation

Given observations of a variable y in a stratified sample, estimate the population total Y .

Note that the population total of y is the sum across the H strata of the subtotals of y in each stratum. Moreover each subtotal can be written as the number of cases in the stratum times the mean of y in the stratum. This gives the equation:

$$Y = \sum_{h=1}^H N_h \mu_h$$

Motivated by the preceding equation, we estimate the population mean in each stratum using the corresponding sample mean. This gives the conventional form of the stratified-sampling estimator, denoted \hat{Y} , of the population total Y :

²⁶ *Methods and Tools of Load Research, The MBSS System, Version V*. Roger L. Wright, RLW Analytics, Inc. Sonoma CA, 1996.

$$\hat{Y} = \sum_{h=1}^H N_h \bar{y}_h$$

With a little algebra, the right-hand side of this equation can be rewritten in a different form:

$$\begin{aligned} \hat{Y} &= \sum_{h=1}^H N_h \bar{y}_h \\ &= \sum_{h=1}^H N_h \left(\frac{1}{n_h} \sum_{k \in s_h} y_k \right) \\ &= \sum_{k=1}^n \left(\frac{N_h}{n_h} \right) y_k \end{aligned}$$

Motivated by the last expression, we define the **case weight** of each unit in the sample to be $w_k = \frac{N_h}{n_h}$. Then the conventional estimate of the population total can be written as a simple weighted sum of the sample observations:

$$\hat{Y} = \sum_{k=1}^n w_k y_k$$

The case weight w_k can be thought of as the number of units in the population represented by unit k in the sample. The conventional sample estimate of the population total can be obtained by calculating the weighted sum of the values observed in the sample.

6.1.2 Calculating the Case Weights

Balanced post-stratification was used to calculate the case weights associated with the final participant sample. In this approach, the sample projects are sorted by the stratification variable, annual energy savings, and then divided equally among the strata. Then the first stratum cutpoint is determined midway between the values of the stratification variable for the last sample case in the first stratum and the first sample case in the second stratum. The remaining strata cutpoints are determined in a similar fashion. Then the population sizes are tabulated within each stratum. Finally the case weights are calculated in the usual way.

6.2 Stratified Ratio Estimation

Ratio estimation is used to estimate the population total Y of the target variable y taking advantage of the known population total X of a suitable explanatory variable x . The ratio estimate of the population total is denoted \hat{Y}_{ra} to distinguish it from the ordinary stratified sampling estimate of the population total, which is denoted as \hat{Y} .

Motivated by the identity $Y = BX$, we estimate the population total Y by first estimating the population ratio B using the sample ratio $b = \bar{y}/\bar{x}$, and then estimating the population total as the product of the sample ratio and the known population total X . Here the sample means are calculated using the appropriate case weights. This procedure can be summarized as follows:

$$\begin{aligned}\hat{Y}_{ra} &= bX \quad \text{where} \\ b &= \frac{\bar{y}}{\bar{x}} \\ \bar{y} &= \frac{1}{\hat{N}} \sum_{k=1}^n w_k y_k \\ \bar{x} &= \frac{1}{\hat{N}} \sum_{k=1}^n w_k x_k \\ \hat{N} &= \sum_{k=1}^n w_k\end{aligned}$$

The conventional 90 percent confidence interval for the ratio estimate of the population total is usually written as

$$\begin{aligned}\hat{Y}_{ra} &\pm 1.645 \sqrt{V(\hat{Y}_{ra})} \quad \text{where} \\ V(\hat{Y}_{ra}) &= \sum_{h=1}^H N_h^2 \left(1 - \frac{n_h}{N_h}\right) \frac{s_h^2(e)}{n_h} \\ s_h^2(e) &= \frac{1}{n_h - 1} \sum_{k \in S_h} (e_k - \bar{e}_h)^2 \\ e_k &= y_k - b x_k\end{aligned}$$

We can calculate the relative precision of the estimate \hat{Y}_{ra} using the equation

$$rp = \frac{1.645 \sqrt{V(\hat{Y}_{ra})}}{\hat{Y}_{ra}}$$

MBSS theory has led to an alternative procedure to calculate confidence intervals for ratio estimation, called model-based domains estimation. This method yields the same estimate as the conventional approach described above, but gives slightly different error bounds. This approach has many advantages, especially for small samples, and has been used throughout this study.

Under model-based domains estimation, the ratio estimator of the population total is calculated as usual. However, the variance of the ratio estimator is estimated from the case weights using the equation

$$V(\hat{Y}_{ra}) = \sum_{k=1}^n w_k (w_k - 1) e_k^2$$

Here w_k is the case weight discussed above and e_k is the sample residual $e_k = y_k - b x_k$. Then, as usual, the confidence interval is calculated as

$$\hat{Y}_{ra} \pm 1.645 \sqrt{V(\hat{Y}_{ra})}$$

and the achieved relative precision is calculated as

$$rp = \frac{1.645 \sqrt{V(\hat{Y}_{ra})}}{\hat{Y}_{ra}}$$

The model-based domains estimation approach is often much easier to calculate than the conventional approach since it is not necessary to group the sample into strata. In large samples, there is generally not much difference between the case-weight approach and the conventional approach. In small samples the case-weight approach seems to perform better. For consistency, we have come to use model-based domains estimation in most work.

This methodology generally gives error bounds similar to the conventional approach. Equally, the model-based domains estimation approach can be derived from the conventional approach by making the substitutions:

$$\begin{aligned} \bar{e}_h &\approx 0 \\ s_h^2(e) &\approx \frac{1}{n_h} \sum_{k \in s_h} e_k^2 \end{aligned}$$

In the first of these substitutions, we are assuming that the within-stratum mean of the residuals is close to zero in each stratum. In the second substitution, we have replaced the within-stratum variance of the sample residual e , calculated with $n_h - 1$ degrees of freedom, with the mean of the squared residuals, calculated with n_h degrees of freedom.

Model-based domains estimation is appropriate as long as the expected value of the residuals can be assumed to be close to zero. This assumption is checked by examining the scatter plot of y versus x . It is important to note that the assumption affects only the error bound, not the estimate itself. \hat{Y}_{ra} will be essentially unbiased as long as the case weights are accurate.

7. APPENDIX C: DECISION MAKER SURVEY INSTRUMENTS

This section provides the decision-maker survey instruments used for the program evaluation.

7.1 Single Family Shadescreens (EEM 1)

Introduction

Hello, may I speak with **Contact Name**

Hello, my name is <<interviewer>>, I am calling on behalf of the Davis Energy Efficiency Program, or DEEP, regarding their Single Family Shadescreen Rebate program. We are conducting an evaluation study of the program on their behalf. We received your name and contact information from DEEP's program records in order to conduct the study. Your responses will be kept confidential and will only be reported in aggregate in our evaluation report.

Q1. I have a few brief questions that will take only a couple of minutes to complete, may I ask you these questions now?

1. Yes
2. No Call back date and time: _____

Q2. Our information shows that you received a rebate for installing shadescreens. Is this correct?

1. Yes
 2. No → Thank and Terminate
98. DK → Is there someone else in your home who would know?
Record Name _____
99. Refused → Thank and Terminate

Q3. Our records show that your home is located at **Address** in Davis, is this the correct address?

1. Yes
 2. No, ask them for correction (enter here _____)
99. DK/Refused

Q4. We need to understand where the shadescreens were installed. Please indicate which window orientations received shadescreens, the number of windows per side, and if possible, the square footage of shadescreens installed by orientation.

1. North - _____ windows _____ sf
2. South - _____ windows _____ sf
3. East - _____ windows _____ sf
4. West - _____ windows _____ sf

Q5. How important was the DEEP information about shadescreen benefits

1. Very unimportant
2. Somewhat unimportant
3. Neither important nor unimportant
4. Somewhat important
5. Very important

Q6. How important was the DEEP rebate in allowing you to install the shadescreens? Would you say...

1. Very unimportant
2. Somewhat unimportant
3. Neither important nor unimportant
4. Somewhat important
5. Very important

Q7. How important was the total cost in your decision to go ahead with installation of the shadescreens?

1. Very unimportant
2. Somewhat unimportant
3. Neither important nor unimportant
4. Somewhat important
5. Very important

Q8. Prior to your involvement with the program, did you have plans to install the shadescreens?

1. Yes
2. Maybe
3. No (Skip to Q10)
99. Don't know/ Refused

If Yes, what plans already existed? _____

Q9. When, (relative to actual installation) would that have occurred?

- 1. Same time or sooner
- 2. Within 6 months
- 3. 1 year later
- 4. 2 years later
- 5. More than 2 years
- 6. Never
- 99. Don't know / Refused

Q10. Before participating in DEEP's Single Family Shadescreen Program, were you aware of the use of shadescreens as an energy efficiency measure?

- 1. Yes
- 2. No
- 99. Don't know / Refused

If Yes, please describe the nature of that prior knowledge? _____

Q11. Since participating in DEEP's Single Family Shadescreen Program, have you installed any additional shadescreens without a rebate?

- 1. Yes
- 2. No
- 99. Don't know / Refused

If Yes, how many shadescreens have been installed? _____

Satisfaction/Process Questions

Q12. How did you first become aware of DEEP's Single Family Shadescreen program?

- 1. Theater Ad
- 2. Direct Mail
- 3. Farmers Market
- 4. Energy Center
- 5. Radio Ad
- 6. DEEP Staff
- 7. Newspaper Ad
- 8. Friend/colleague
- 9. DEEP Web site
- 10. Other: _____
- 98. DK/Refused

Q13. How would you rate your satisfaction with DEEP's Single Family Shadescreen program?

- 1. Very unsatisfied, why?
- 2. Not Satisfied, why?
- 3. Neither satisfied nor unsatisfied
- 4. Satisfied
- 5. Very Satisfied

Why:

Q14. How would you rate your satisfaction with the contractor, if not self-installed, that completed the installation of your shadescreens?

- 1. Very unsatisfied, why?
- 2. Not Satisfied, why?
- 3. Neither satisfied nor unsatisfied
- 4. Satisfied
- 5. Very Satisfied

Why:

Q15. Did you have direct contact with a DEEP staff member?

- 1. Yes
- 2. No (Skip to Q17)
- 99. Don't know / Refused

Q16. How satisfied were you with the information and service provided by a DEEP staff member? Would you say you were . . .

- 1. Very unsatisfied, why?
- 2. Not Satisfied, why?
- 3. Neither satisfied nor unsatisfied
- 4. Satisfied
- 5. Very Satisfied

Why:

Q17. What recommendations would you have to improve this program for future program participants like yourself?

7.2 Single Family Duct Repair (EEM 3)

Introduction

Hello, may I speak with **Contact Name**.

Hello, my name is <<interviewer>>, I am calling on behalf of the Davis Energy Efficiency Program, or DEEP, regarding their Single Family Duct Repair Service program. We are conducting an evaluation of the program on their behalf. We received your name and contact information from DEEP's program records in order to conduct the study. Your responses will be kept confidential and will only be reported in aggregate in our evaluation report.

Q18. I have a few brief questions that will take only a few minutes to complete, may I ask you these questions now?

- 1. Yes
- 2. No Call back date and time: _____

Q19. Our information shows that you recently had duct repair service at your home on behalf of DEEP, is this correct?

- 1. Yes

2. No → Thank and Terminate
100. DK → Is there someone else at your location or company who would know?

Record Name _____

101. Refused → Thank and Terminate

Q20. Our records show that your home is located at <<Address>> in Davis, is this the correct address?

3. Yes
4. No → *ask for correction (enter here _____)*
100. DK/Refused

Q21. Prior to your involvement with the program, did you have plans to repair your duct system?

4. Yes
5. Maybe
6. No (Skip to Q6)
100. Don't know/ Refused

If Yes, what plans already existed? _____

Q22. When, (relative to actual service) would you have had the system repaired if you hadn't used DEEP rebate?

7. Same time or sooner
8. Within 6 months
9. 1 year later
10. 2 years later
11. More than 2 years
12. Never
100. Don't know / Refused

Q23. How important was the DEEP rebate in allowing you to repair your duct systems? Would you say...

5. Very unimportant
6. Somewhat unimportant
7. Neither important nor unimportant
8. Somewhat important
9. Very important

Q24. How important was the total cost of the duct repair in your decision to go ahead?

1. Very unimportant
2. Somewhat unimportant
3. Neither important nor unimportant
4. Somewhat important
5. Very important

Q25. Before participating in DEEP's Single Family Duct Repair Program, have you previously had your duct system serviced or repaired?

1. Yes
2. No
99. Don't know / Refused

Q26. Was the duct service for duct cleaning or duct leakage repair.

1. Duct cleaning
2. Duct leakage repair
3. Duct cleaning and leakage repair
4. Other _____
99. Don't know / Refused

Q27. Did the duct service involve the use of a duct pressure testing instrument

1. Yes
2. No
99. Don't know / Refused

Satisfaction/Process Questions

Q28. How did you first become aware of DEEP's Single Family Duct Repair program?

11. Davis Energy Center
12. Direct Mail
13. Farmers Market or other event
14. Radio Ad
15. DEEP staff
16. Newspaper Ad
17. Friend/colleague
18. DEEP Web site
19. Other: _____
99. DK/Refused

Q29. How would you rate your satisfaction with DEEP's Single Family Duct Repair program?

1. Very unsatisfied, why?
2. Not satisfied, why?
3. Neither satisfied nor unsatisfied
4. Satisfied
5. Very satisfied

Why:

Q30. How would you rate your satisfaction with the contractor that repaired your duct system?

1. Very unsatisfied, why?
2. Not satisfied, why?
3. Neither satisfied nor unsatisfied
4. Satisfied
5. Very Satisfied

Why:

Q31. Did you have direct contact with a DEEP staff member?

1. Yes
2. No (Skip to Q16)
99. Don't know / Refused

Q32. How satisfied were you with the service provided by the DEEP staff member? Would you say you were . . .

1. Extremely dissatisfied
2. Somewhat dissatisfied
3. Neither satisfied nor dissatisfied
4. Somewhat satisfied
5. Very satisfied
99. DK/Refused

If dissatisfied, Why?

Q33. In comparison to your expectation of energy cost savings on you utility bill, would you say that you are experiencing more, the same or less cost savings?

1. Significantly less
2. Slightly less
3. The same
4. Slightly more
5. Significantly more
99. Don't know / Refused

Q34. In comparison to your expectation of improved comfort would you say that you are experiencing more, the same or less comfort than before?

1. Significantly less
2. Slightly less
3. The same
4. Slightly more
5. Significantly more
99. Don't know / Refused

Q35. What recommendations would you have to improve this program for future program participants like yourself?

7.3 Multifamily Duct Repair (EEM 4)

Introduction

Hello, may I speak with **Contact Name**.

Hello, my name is <<interviewer>>, I am calling on behalf of the Davis Energy Efficiency Program, or DEEP, regarding their Multifamily Duct Repair Service program. We are conducting an evaluation study of the program on their behalf. We received your name and contact information from DEEP's program records in order to conduct the study.

Q1. I have a few brief questions that will take only a few minutes to complete, may I ask you these questions now?

1. Yes
2. No Call back date and time: _____

Q2. Our information shows that you recently had duct repair service at the <<Site Name>> on behalf of DEEP, is this correct?

1. Yes
2. No → Thank and Terminate
98. DK → Is there someone else at your location or company who would know?
Record Name _____
99. Refused → Thank and Terminate

Q3. Our records show that <<Site Name>> is located at <<Address>> in Davis, is this the correct address?

1. Yes
2. No, ask for correction (enter here _____)
99. DK/Refused

Q4. Prior to your involvement with the program, did you have plans to repair the duct systems at this address?

1. Yes
 2. Maybe
 3. No (Skip to Q6)
 99. Don't know/ Refused
- If Yes**, what plans already existed? _____
-

Q5. When, (relative to actual service) would the service have occurred?

1. Same time or sooner
2. Within 6 months
3. 1 year later
4. 2 years later
5. More than 2 years
6. Never
99. Don't know / Refused

Q6. How important was the incentive in allowing you to repair your duct systems? Would you say...

1. Very unimportant
2. Somewhat unimportant
3. Neither important nor unimportant
4. Somewhat important
5. Very important

Q7. How important was the total cost to you in your decision to go ahead with the duct repair?

1. Very unimportant
2. Somewhat unimportant
3. Neither important nor unimportant
4. Somewhat important
5. Very important

Q8. How important is the comfort in the units to you?

1. Very unimportant
2. Somewhat unimportant
3. Neither important nor unimportant
4. Somewhat important
5. Very important

Q9. Before participating in DEEP's Multifamily Duct Repair Program, have you previously serviced the duct systems at this address?

1. Yes
2. No
99. Don't know / Refused

If Yes, please describe the nature of that prior experience *(if cleaning of ducts, change answer to no)* _____

Q10. Since participating in DEEP's Multifamily Duct Repair Program, have you serviced your duct systems outside of program's assistance?

1. Yes
2. No
99. Don't know / Refused

If Yes, what equipment has been repaired? _____

Satisfaction/Process Questions

Q11. How did you first become aware of DEEP's Multifamily Duct Repair program?

- 1. City of Davis Mailing
- 2. Movie Theater Ad
- 3. Direct Mail
- 4. Radio Ad
- 5. DEEP staff phone call
- 6. Newspaper Ad
- 7. Friend/colleague
- 8. DEEP Web site
- 9. Other: _____
- 100. DK/Refused

Q12. How would you rate your satisfaction with DEEP's Multifamily Duct Repair program?

- 1. Very unsatisfied, why?
- 2. Not satisfied, why?
- 3. Neither satisfied nor unsatisfied
- 4. Satisfied
- 5. Very satisfied

Why:

Q13. How would you rate your satisfaction with the contractor that repaired your duct system?

- 1. Very unsatisfied, why?
- 2. Not satisfied, why?
- 3. Neither satisfied nor unsatisfied
- 4. Satisfied
- 5. Very Satisfied

Why:

Q14. Did you have direct contact with a DEEP staff member?

1. Yes
2. No (Skip to Q16)
99. Don't know / Refused

Q15. How satisfied were you with the service provided by the DEEP staff member? Would you say you were . . .

1. Extremely dissatisfied
2. Somewhat dissatisfied
3. Neither satisfied nor dissatisfied
4. Somewhat satisfied
5. Very satisfied
99. DK/Refused

If dissatisfied, Why?

Q16. Does your company pay for the energy (gas and/or electricity) utility bills or do the tenants pay them

1. Tenants (Skip to Q18)
2. Owner (Skip to Q17)
99. Don't know / Refused

Q17. If owner, In comparison to your expectation of energy cost savings, would you say that you are experiencing more, the same or less cost savings?

1. Significantly less
2. Slightly less
3. The same
4. Slightly more
5. Significantly more
99. Don't know / Refused

Q18. How important were the energy savings for the tenant to you?

6. Very unimportant
7. Somewhat unimportant
8. Neither important nor unimportant
9. Somewhat important
10. Very important

Q19. What recommendations would you have to improve this program for future program participants like yourself?

7.4 Compact Fluorescent Lamp Commercial (EEM 6)

Introduction/Background

I would like to ask you some questions regarding your recent lighting retrofit.

Q1. Are you the best person to be speaking with regarding the DEEP Davis CFL program?

- | | |
|---|--------------------------------------------------------------------------|
| 1 | Yes |
| 2 | No / [Meet with new person] |
| 3 | No / Not available [<i>get phone number for other person</i>] |
| 4 | No / No other person / Don't know / Refused
[<i>skip to thanks</i>] |

Q2. Which method did you receive the compact fluorescent bulbs?

- | | |
|---|-------------------------------------------------------------------------|
| 1 | As a give-away from a DEEP staff member |
| 2 | As part of a larger lighting retrofit project completed by a contractor |
| 3 | Other _____ |
| 4 | Don't Know |

Q3. How did you first learn of DEEP's Commercial CFL Program? (ONE RESPONSE ONLY)

- | | |
|----|--------------------------------------------------------|
| 1 | Contractor |
| 2 | DEEP staff |
| 3 | Friend / Business colleague / Professional association |
| 4 | DEEP marketing / advertising |
| 5 | Other (specify) _____ |
| 6 | Have not heard of it |
| 99 | Don't know / Refused |

Free-Rider Questions

Q4. Do you have plans to buy compact fluorescent bulbs before participating in the program?

- | | |
|----|----------------------|
| 1 | Yes |
| 2 | No |
| 99 | Don't know / Refused |

Q5. When, (relative to actual installation) would the replacement have occurred?

- | | |
|----|----------------------|
| 1 | Same time or sooner |
| 2 | Within 6 months |
| 3 | 1 year later |
| 4 | 2 years later |
| 5 | More than 2 years |
| 6 | Never |
| 99 | Don't know / Refused |

Spillover Questions

Q6. Since participating in DEEP's Davis Lights/Customized Commercial Program, have you installed any additional compact fluorescent bulbs at your own cost?

- | | |
|----|----------------------|
| 1 | Yes |
| 2 | No (Skip to Q12) |
| 99 | Don't know / Refused |

If Yes, what equipment has been installed?

Satisfaction Questions

Q7. Could you rate your satisfaction with the DEEP CFL program? Would you say...

- | | |
|----|------------------------------------|
| 1 | Very dissatisfied (Why?) |
| 2 | Dissatisfied (Why?) |
| 3 | Neither satisfied nor dissatisfied |
| 4 | Satisfied |
| 5 | Very Satisfied |
| 99 | Don't know / Refused |

If unimportant why?

Q8. Could you rate your satisfaction with the performance of the compact fluorescent bulbs? Would you say...

- | | |
|-----|------------------------------------|
| 6 | Very dissatisfied (Why?) |
| 7 | Dissatisfied (Why?) |
| 8 | Neither satisfied nor dissatisfied |
| 9 | Satisfied |
| 10 | Very Satisfied |
| 100 | Don't know / Refused |

If unimportant why?

Q9. Did you have direct contact with a DEEP staff member?

- | | |
|-----|-------------------------|
| 1 | Yes |
| 2 | No (Skip to Q12) |
| 100 | Don't know / Refused |

Q10. How satisfied were you with the service provided by the DEEP staff member? Would you say you were . . .

- | | |
|----|------------------------------------|
| 1 | Extremely dissatisfied, why? |
| 2 | Somewhat dissatisfied, why? |
| 3 | Neither satisfied nor dissatisfied |
| 4 | Somewhat satisfied |
| 5 | Very satisfied |
| 99 | Don't Know/Refused |

Q11. In comparison to your expectation of energy cost savings, would you say that you are experiencing more, the same or less cost savings?

- | | |
|----|----------------------|
| 1 | Significantly less |
| 2 | Slightly less |
| 3 | The same |
| 4 | Slightly more |
| 5 | Significantly more |
| 99 | Don't know / Refused |

Q12. Do you have any other comments?

Thank you for taking the time to complete this questionnaire. Your responses are very important and will be used to assist DEEP in evaluating its Commercial Programs.

7.5 Compact Fluorescent Lamp Residential (EEM 7)

Introduction

Hello, may I speak with <<respondent>>.

Hello, my name is <<interviewer>>, I am calling on behalf of the Davis Energy Efficiency Program, or DEEP, regarding their Compact Fluorescent Lamp Give-Away program. We are conducting an evaluation study of the program on their behalf. We received your name and contact information from DEEP's program records in order to conduct the study. Your responses will be kept confidential and will only be reported in aggregate in our evaluation report.

Q1. I have a few brief questions that will take only a couple of minutes to complete, may I ask you these questions now?

1. Yes
2. No → Call back date and time: _____

Q2. Our records show that your home is located at <<address>>, is this the correct address?

1. Yes
 2. No → Enter Corrected Address here
(_____)
98. DK/Refused

Q3. Our information shows that you received free compact fluorescent bulbs from DEEP, is this correct?

1. Yes
2. No → Thank and Terminate
98. DK → Is there someone else in your home who would know?
Record Name _____
99. Refused → Thank and Terminate

Q4. Have you installed all 3 compact fluorescent bulbs in your home?

1. 1 bulb
2. 2 bulbs
3. 3 bulbs
4. None, Why → Go to Q9
98. DK/Refused

Why? _____

Q5. In which rooms have you installed them in? (*Do not prompt*)

<u>Room</u>	<u>Number of Fixtures</u>
Bedroom	
Bathroom/Laundry	
Kitchen	
Family Room/Dining Room	
Hallway	
Closet	
Other _____	

Q6. Could you estimate how many hours the fixtures with the compact fluorescent bulbs are used on a typical *weekday*?

1st fixture _____
 2nd fixture _____
 3rd fixture _____

Q7. Could you estimate how many hours the fixtures with the compact fluorescent bulbs are used on a typical *weekend day*?

1st fixture _____
 2nd fixture _____
 3rd fixture _____

Q8. Could you rate your satisfaction with the performance of the compact fluorescent bulbs you have installed in your house? If unsatisfied, why?

1. Very Dissatisfied, why?
2. Not Satisfied, why?
3. Neither satisfied nor dissatisfied
4. Satisfied
5. Very Satisfied

Why? _____

Q9. Did you have plans to buy compact fluorescent bulbs before you were given the bulbs from DEEP?

1. Yes
2. Maybe
3. No
99. Don't know/ Refused

If Yes, what plans already existed? _____

Q10. Before participating in DEEP's Compact Fluorescent Give-Away Program, had you used compact fluorescent bulbs?

3. Yes
4. No (Skip to Q12)
100. Don't know / Refused

If Yes, please describe the nature of that prior experience? _____

Q11. Are the non-DEEP bulbs still in use?

1. Yes
2. No
99. Don't know / Refused

Q12. Since participating in DEEP's Compact Fluorescent Give-Away Program Program, have you installed any additional compact fluorescent bulbs at your own cost?

3. Yes
4. No
100. Don't know / Refused

Satisfaction/Process Questions

Q13. How did you first become aware of DEEP's Compact Fluorescent Give-Away program?

1. Community event
2. Farmers Market
3. Energy Center
4. Movie Ad
5. Radio Ad
6. DEEP staff/office
7. Newspaper Ad
8. Friend/colleague
9. DEEP Web site
10. Other: _____

DK/Refused

Q14. How would you rate your satisfaction with DEEP's Compact Fluorescent Give-Away program?

1. Very unsatisfied, why?
2. Not Satisfied, why?
3. Neither satisfied nor unsatisfied
4. Satisfied
5. Very Satisfied

Why? _____

Q15. Do you have any recommendations to improve this program?

7.6 Single Family Window - Mounted Evaporative Cooler (EEM 8)

Introduction

Hello, may I speak with <<respondent>>.

Hello, my name is <<interviewer>>, I am here today in behalf of the Davis Energy Efficiency Program, or DEEP, about their Evaporative Cooler program. We are doing a study of the program and need your input on its effectiveness. Your responses will be kept confidential and will be combined with everyone else's in our report so no one can be identified.

Q1. Our information shows that DEEP installed an evaporative cooler in your home, is this correct?

3. Yes
4. No → Thank and Terminate

98. DK → Is there someone else in your home who would know?

Record Name _____

99. Refused → Thank and Terminate

Q2. Do you rent or own your residence?

1. Rent property and mobile home
 2. Rent property and own mobile home
 3. Own property and mobile home
99. DK/Refused

Q3. Did you previously use an air conditioner or evaporative cooler or both at this address?

1. Yes, I used an air conditioner
 2. Yes, I used an evaporative cooler
 3. Yes, I used both an air conditioner and an evaporative cooler
 4. No → Go to question 9
98. DK/Refused

Q4. How often did you use previously use the unit(s) in the summer time?
Would you say it is used..... (prompt with - rarely, occasionally, frequently, every day etc – if needed)

Q5. Were they/Was it removed when the new DEEP unit was installed?

1. Yes → Go to question 9
 2. No
98. DK/Refused

Q6. How has your usage of the old unit changed? Would you say it is used.....
(prompt with - rarely, occasionally, frequently, every day etc – if needed)

Q7. What is the usage of the new DEEP unit? Would you say it is used.....
(prompt with - rarely, occasionally, frequently, every day etc – if needed)

Q8. What were the main reasons you recently decided to install a new evaporative cooler?

Q9. Are you using your new evaporative cooler to help ventilate your home?

1. Yes
2. No
99. DK/Refused

Q10. Had the DEEP program *not been* available to you, which of the following would you have most likely done?

1. Purchased a window air conditioning unit
2. Purchased a room fan
3. Fixed the existing evaporative cooler
4. Would have purchased the same type of evaporative cooler
5. Would have purchased an evaporative cooler, but a less expensive less efficient unit
6. Would not have purchased anything(**skip to Q12**)
7. Other:_____
98. DK/Refused

Q11. At what time would you have purchased it?

1. Same time or sooner
2. Several months later
3. One year later
4. More than a year later
98. DK/Refused

Satisfaction/Process Questions

Q12. How did you first become aware of DEEP's Evaporative Cooler program?

- 1. DEEP staff
- 2. Friend/colleague
- 3. Other: _____
- 98. DK/Refused

Q13. How would you rate your satisfaction with the DEEP staff? If dissatisfied, why?

- 1. Very unsatisfied, why?
- 2. Not Satisfied , why?
- 3. Neither satisfied nor unsatisfied
- 4. Satisfied
- 5. Very Satisfied
- 99. DK/Refused

Why:

Q14. How would you rate your satisfaction with DEEP's Evaporative Cooler program?

- 1. Very unsatisfied, why?
- 2. Not Satisfied , why?
- 3. Neither satisfied nor unsatisfied
- 4. Satisfied
- 5. Very Satisfied

Why:

Q15. Has participating in DEEP's Evaporative Cooler program provided more comfort to your household. Please explain.

Q16. How would you rate your satisfaction with the contractor that completed the installation of your evaporative cooler?

6. Very unsatisfied, why?
7. Not Satisfied, why?
8. Neither satisfied nor unsatisfied
9. Satisfied
10. Very Satisfied

Why:

Q17. Are you responsible for the electric bills?

1. Yes
2. No (Skip to Q21)
98. DK/Refused

Q18. Have you noticed any change in the amount of money you spend on your monthly summertime electric bill since the installation of the evaporative cooler?

1. Yes, I am paying less
2. Yes, I am paying more
3. No, I am paying the same
99. DK/Refused

Q19. What recommendations would you have to improve this program for future program participants like yourself?

7.7 Small Commercial Exit Sign (EEM 5), Davis Lights (EEM 9a), and Customized Commercial Projects (EEM 9b)

Introduction/Background

[The site surveyor will meet with the customer (business owner who signed the Contractor agreement and is listed in the database)]

I would like to ask you some questions regarding your recent lighting retrofit.

Q1. Are you the best person to be speaking with regarding the DEEP Davis Lights/Customized Commercial program?

- | | |
|---|--------------------------------------------------------------------------|
| 5 | Yes |
| 6 | No / [Meet with new person] |
| 7 | No / Not available [<i>get phone number for other person</i>] |
| 8 | No / No other person / Don't know / Refused
[<i>skip to thanks</i>] |

Q2. What was the motivation for changing your lighting system?

Q3. How old was your lighting system prior to the replacement? _____ years

Q4. How did you first learn of DEEP's Davis Lights/Customized Commercial Program?
(ONE RESPONSE ONLY)

- | | |
|-----|--------------------------------------------------------|
| 7 | Contractor |
| 8 | DEEP staff |
| 9 | Friend / Business colleague / Professional association |
| 10 | DEEP marketing / advertising |
| 11 | Other (specify) _____ |
| 12 | Have not heard of it |
| 100 | Don't know / Refused |

Q5. How did you first hear about the energy efficient lighting technologies that were installed? (ONE RESPONSE ONLY)

- | | |
|----|--------------------------------------------------------|
| 1 | Contractor |
| 2 | DEEP representative |
| 3 | Friend / Business colleague / Professional association |
| 4 | DEEP marketing / advertising |
| 5 | Other (specify) _____ |
| 99 | Don't know / Refused |

Free-Rider Questions

Q6. How important was the overall cost in your decision to go ahead with the lighting retrofit?

- | | |
|----|----------------------------------|
| 1 | Very Unimportant (Why?) |
| 2 | Unimportant (Why?) |
| 3 | Neither important or unimportant |
| 4 | Important |
| 5 | Very Important |
| 99 | DK/Refused |

If unimportant why?

Q7. How important was the DEEP incentive in allowing you to install the energy efficient lighting? Would you say...

- | | |
|----|----------------------------------|
| 1 | Very Unimportant (Why?) |
| 2 | Unimportant (Why?) |
| 3 | Neither important or unimportant |
| 4 | Important |
| 5 | Very Important |
| 99 | DK/Refused |

If unimportant why?

Q8. Do you think you would have installed the energy efficient lighting system were it not for the DEEP Program?

- | | |
|----|----------------------|
| 1 | Yes |
| 2 | No |
| 99 | Don't know / Refused |

Q9. When, (relative to actual installation) would the replacement have occurred?

- | | |
|---|---------------------|
| 1 | Same time or sooner |
| 2 | Within 6 months |
| 3 | 1 year later |
| 4 | 2 years later |
| 5 | More than 2 years |

6	Never
99	Don't know / Refused

Spillover Questions

Q10. Since participating in DEEP's Program, have you installed any additional energy efficient lighting equipment without a rebate?

1	No (Skip to Q12)
2	Yes
100	Don't know / Refused

If Yes, what equipment has been installed?

Q11. Did participation in the Program influence your decision to install the energy efficient equipment? If not, what prompted you to install them?

1	No
2	Yes
99	Don't know / Refused

If No, what prompted you to install them?

Satisfaction Questions

Q12. Using the following codes, record customer satisfaction to the following questions.

1	Extremely dissatisfied
2	Somewhat dissatisfied
3	Neither satisfied nor dissatisfied(Skip to Q14)
4	Somewhat satisfied(Skip to Q14)
5	Very satisfied (Skip to Q14)

Q11 How satisfied are you with:	1*	2*	3	4	5	DK/NR
a) Contractor						
b) DEEP program process						
c) Resulting lighting system						

Q13. If dissatisfied, Why?

a) Contractor _____

b) DEEP program process _____

c) Resulting lighting system _____

Q14. Did you have direct contact with a DEEP staff member?

- 1 Yes
- 2 No (**Skip to Q16**)
- 100 Don't know / Refused

Q15. How satisfied were you with the service provided by the DEEP staff member?
 Would you say you were . . .

- 1 Extremely dissatisfied, why?
- 2 Somewhat dissatisfied, why?
- 3 Neither satisfied nor dissatisfied
- 4 Somewhat satisfied
- 5 Very satisfied
- 100 Don't Know/Refused

If dissatisfied, Why? _____

Q22. In comparison to your expectation of energy cost savings, would you say that you are experiencing more, the same or less cost savings?

- 1 Significantly less

2	Slightly less
3	The same
4	Slightly more
5	Significantly more
100	Don't know / Refused

Q23. Do you have any other comments?

Thank you for taking the time to complete this questionnaire. Your responses are very important and will be used to assist DEEP in evaluating its Commercial Programs.

7.8 City School Partnership (EEM 9c)

Introduction/Background

[The site surveyor will meet with the customer contact (school district personnel who signed the Contractor agreement and is listed in the database, or the customer designated site contact)]

I would like to ask you some questions regarding your recent participation in the DEEP City-School Partnership program.

Q1. Are you the best person to be speaking with regarding the DEEP's City-School Partnership program?

1	Yes
2	No / [Meet with new person]
3	No / Not available [<i>get phone number for other person</i>]
4	No / No other person / Don't know / Refused [<i>skip to thanks</i>]

Q2. What was the motivation for participating in the program?

Q3. How did you first learn of DEEP's City-School Partnership program? (ONE RESPONSE ONLY)

1	Contractor
2	DEEP staff
3	Friend / Business colleague / Professional association

- 4 DEEP marketing / advertising
- 5 Other (specify)_____
- 6 Have not heard of it
- 99 Don't know / Refused

Q4.How did you first hear about the energy efficient technologies that were installed through the program? (ONE RESPONSE ONLY)

- 1 Contractor
- 2 DEEP representative
- 3 Friend / Business colleague / Professional association
- 4 DEEP marketing / advertising
- 5 Other (specify)_____
- 99 Don't know / Refused

Free-Rider Questions

Q5. How important was the overall cost in your decision to go ahead with the cool roof installations?

- | | |
|----|----------------------------------|
| 1 | Very Unimportant (Why?) |
| 2 | Unimportant (Why?) |
| 3 | Very Important |
| 4 | Neither important or unimportant |
| 5 | Important |
| 99 | DK/Refused |

If unimportant why?

Q6. How important was the DEEP incentive in allowing you to install the cool roof installation? Would you say...

- | | |
|----|----------------------------------|
| 1 | Very unimportant (Why?) |
| 2 | Unimportant (Why?) |
| 3 | Neither important or unimportant |
| 4 | Important |
| 5 | Very Important |
| 99 | Don't know / Refused |

If unimportant why?

Q7. Do you think you would have installed the cool roof were it not for the DEEP Program?

- | | |
|----|----------------------|
| 1 | Yes |
| 2 | No |
| 99 | Don't know / Refused |

Q8. When, (relative to actual installation) would the installation have occurred?

- | | |
|---|---------------------|
| 1 | Same time or sooner |
| 2 | Within 6 months |
| 3 | 1 year later |
| 4 | 2 years later |

5	More than 2 years
6	Never
99	Don't know / Refused

Spillover Questions

Q9. Since participating in DEEP's City-School Partnership program, have you installed any other energy efficiency measures without a rebate?

1	Yes
2	No (Skip to Q12)
99	Don't know / Refused

If Yes, what equipment has been installed?

Q10. Did participation in the Program influence your decision to install the energy efficient equipment? If not, what prompted you to install them?

1	Yes
2	No
99	Don't know / Refused

If No, what prompted you to install them?

Satisfaction Questions

Q11. Using the following codes, record customer satisfaction to the following questions.

1	Extremely dissatisfied
2	Somewhat dissatisfied
3	Neither satisfied nor dissatisfied (Skip to Q14)
4	Somewhat satisfied (Skip to Q14)
5	Very satisfied (Skip to Q14)

Q11 How satisfied are you with:	1*	2*	3	4	5	DK/NR
a) Contractor						
b) DEEP program process						
c) Resulting roof						
d) Resulting lighting system						

Q12. If dissatisfied, Why?

a) Contractor _____

b) DEEP program process _____

c) Resulting roof _____

d) Resulting lighting system _____

Q13. Did you have direct contact with a DEEP staff member?

- 1 Yes
- 2 No (**Skip to Q16**)
- 99 Don't know / Refused

Q14. How satisfied were you with the service provided by the DEEP staff member?
 Would you say you were . . .

- 1 Extremely dissatisfied, why?
- 2 Somewhat dissatisfied, why?
- 3 Neither satisfied nor dissatisfied
- 4 Somewhat satisfied
- 5 Very satisfied
- 99 Don't Know/Refused

If dissatisfied, Why? _____

Q24. In comparison to your expectation of energy cost savings, would you say that you are experiencing more, the same or less cost savings?

- | | |
|----|----------------------|
| 1 | Significantly less |
| 2 | Slightly less |
| 3 | The same |
| 4 | Slightly more |
| 5 | Significantly more |
| 99 | Don't know / Refused |

Q25. Do you have any other comments?

Thank you for taking the time to complete this questionnaire. Your responses are very important and will be used to assist DEEP in evaluating its Commercial Programs.

7.9 Multifamily Swimming Pool Retrofit Project (EEM 10)

Introduction

Hello, may I speak with _____.

Hello, my name is _____. I am calling on behalf of the Davis Energy Efficiency Program, or DEEP, regarding their Multifamily Swimming Pool Retrofit program. We are conducting an evaluation study of the program on their behalf. We received your name and contact information from DEEP's program records in order to conduct the study.

Q1. I have a few brief questions that will take only a few minutes to complete, may I ask you these questions now?

1. Yes
2. No Call back date and time: _____

Q2. Our information shows that you recently installed pool pumps at the Site Name on behalf of DEEP, is this correct?

1. Yes
 2. No → Thank and Terminate
98. DK → Is there someone else at your location or company who would know?

Record Name _____

99. Refused → Thank and Terminate

Q3. Our records show that Site Name is located at Address in Davis, is this the correct address?

1. Yes
2. No, ask for correction (enter here _____)
99. DK/Refused

Q4. What types of pumps were installed prior to the new DEEP-rebated models? _____

Q5. Where were the two pool pumps installed? Both at the same pool?

Q6. Are the pool pumps single speed or double speed?

Q7. What is the daily schedule for each pool pump?

Q8. Prior to your involvement with the program, did you have plans to install pool pumps at this address?

1. Yes
2. Maybe
3. No (Skip to Q10)
1. Don't know/ Refused

If Yes, what plans already existed? _____

Q9. When, (relative to actual installation) would the installation have occurred?

1. Same time or sooner
2. Within 6 months
3. 1 year later
4. 2 years later
5. More than 2 years
6. Never
99. Don't know / Refused

Q10. How important was the incentive in allowing you to install pool pumps?
Would you say...

1. Very unimportant
2. Somewhat unimportant
3. Neither important nor unimportant
4. Somewhat important
5. Very important

Satisfaction/Process Questions

Q11. How did you first become aware of DEEP's Multifamily Swimming Pool Retrofit program?

1. City of Davis Mailing
2. DEEP Marketing
3. DEEP staff phone call
4. Friend/colleague
5. DEEP Web site
6. Other: _____
98. DK/Refused

Q12. How would you rate your satisfaction with DEEP's Multifamily Swimming Pool Retrofit program?

1. Very unsatisfied, why?
2. Not satisfied, why?
3. Neither satisfied nor unsatisfied
4. Satisfied
5. Very satisfied

Why:

Q13. How would you rate your satisfaction with the contractor that installed your pool pumps?

1. Very unsatisfied, why?
2. Not satisfied, why?
3. Neither satisfied nor unsatisfied
4. Satisfied
5. Very Satisfied

Why:

Q14. Did you have direct contact with a DEEP staff member?

3. Yes
4. No (Skip to Q18)
100. Don't know / Refused

Q15. How satisfied were you with the service provided by the DEEP staff member? Would you say you were . . .

1. Extremely dissatisfied
2. Somewhat dissatisfied
3. Neither satisfied nor dissatisfied
4. Somewhat satisfied
5. Very satisfied
100. DK/Refused

If dissatisfied, Why?

Q16. If owner, In comparison to your expectation of energy cost savings, would you say that you are experiencing more, the same or less cost savings?

1. Significantly less
2. Slightly less
3. The same
4. Slightly more
5. Significantly more
99. Don't know / Refused

Q17. What recommendations would you have to improve this program for future program participants like yourself?

7.10 Multifamily Laundry Retrofit Project (EEM 13)

Introduction

Hello, may I speak with **Site Contact**

Hello, my name is <<interviewer>>, I am calling on behalf of the Davis Energy Efficiency Program, or DEEP, regarding their Multifamily Laundry Retrofit program. We are conducting an evaluation study of the program on their behalf. We received your name and contact information from DEEP's program records in order to conduct the study.

Q1. I have a few brief questions that will take only a few minutes to complete, may I ask you these questions now?

1. Yes
2. No Call back date and time: _____

Q2. Our information shows that you recently installed new energy and water efficient clothes washers at the **Site Name**, is this correct?

1. Yes
2. No → Thank and Terminate
98. DK → Is there someone else who would know?
Record Name _____
99. Refused → Thank and Terminate

Q3. Did you receive a DEEP rebate for your clothes washers?

1. Yes
2. No → Thank and Terminate
98. DK → Is there someone else in your home who would know?
Record Name _____
99. Refused → Thank and Terminate

Q4. How many clothes washers were rebated as part of the DEEP program?

Q5. Our records show that **Site Name** is located at **Address** in Davis, is this the correct address?

1. Yes
2. No, *ask them for correction (enter here _____)*
99. DK/Refused

Q6. Prior to your involvement with the program, did you have plans to replace your existing clothes washers?

1. Yes
 2. Maybe
 3. No (Skip to Q8)
 99. Don't know/ Refused
- If Yes**, what plans already existed? _____

Q7. When, (relative to actual installation) would the replacement have occurred?

1. Same time or sooner
2. Within 6 months
3. 1 year later
4. 2 years later
5. More than 2 years
6. Never
100. Don't know / Refused

Q8. How important was the DEEP incentive in allowing you to install the clothes washers at this time? Would you say...

1. Very unimportant
2. Somewhat unimportant
3. Neither important nor unimportant
4. Somewhat important
5. Very important

Q9. How important was the total cost in your decision to purchase these clothes washers?

1. Very unimportant
2. Somewhat unimportant
3. Neither important nor unimportant
4. Somewhat important
5. Very important

Q10. Do you think you would have installed energy and water efficient clothes washers were it not for the DEEP's Multifamily Laundry Retrofit Program?

1. Yes
2. No
99. Don't know / Refused

Q11. Before participating in DEEP's Multifamily Laundry Retrofit Program, did you have any prior experience with the type of ENERGYSTAR and water efficient clothes washers that were installed as part of the Program?

1. Yes
2. No
99. Don't know / Refused

If Yes, please describe the nature of that prior experience? _____

Q12. Since participating in DEEP's Multifamily Laundry Retrofit Program, have you installed or do you plan to install any additional clothes washers without a rebate?

1. Yes
2. No
99. Don't know / Refused

If Yes, what equipment has been or will be installed? _____

Satisfaction/Process Questions

Q13. How did you first become aware of DEEP's Multifamily Laundry Retrofit program?

1. Direct mail form DEEP
2. Radio Ad
3. DEEP staff
4. Newspaper Ad
5. Friend/colleague
6. DEEP Web site
7. Other: _____
98. DK/Refused

Q14. How would you rate your satisfaction with DEEP's Multifamily Laundry Retrofit program?

1. Very unsatisfied
2. Not Satisfied
3. Neither satisfied nor unsatisfied
4. Satisfied
5. Very Satisfied

Q15. How would you rate your satisfaction with the installation of your clothes washers?

1. Very unsatisfied, why?
2. Not Satisfied, why?
3. Neither satisfied nor unsatisfied
4. Satisfied
5. Very Satisfied

Why:

Q16. Did you have direct contact with a DEEP staff member?

1. Yes
2. No (Skip to Q18)
99. Don't know / Refused

Q17. How satisfied were you with the information and service provided by the DEEP staff member? Would you say you were . . .

1. Very unsatisfied
 2. Somewhat unsatisfied
 3. Neither satisfied nor dissatisfied
 4. Somewhat satisfied
 5. Extremely satisfied
 98. DK/Refused
- If dissatisfied, Why?
-

Q18. Did you anticipate cost savings on your laundry room water bills from the new units?

1. Yes
2. No
99. Don't know / Refused

Q19. Does your company pay for the energy utility bills for the laundry room or do the tenants pay them

1. Yes
2. No (Skip to Q20)
99. Don't know / Refused

Q20. Did you anticipate cost savings on your laundry room energy bills from the new units?

1. Yes
2. No (Skip to Q22)
99. Don't know / Refused

Q21. In comparison to your expectation of energy and water cost savings, would you say that you are experiencing more, the same or less cost savings?

1. Significantly less
2. Slightly less
3. The same
4. Slightly more
5. Significantly more
99. Don't know / Refused

Q22. What recommendations would you have to improve this program for future program participants like yourself?

7.11 Torchiere Swap (EEM 14)

Introduction

Hello, may I speak with <<respondent>>.

Hello, my name is <<interviewer>>, I am calling on behalf of the Davis Energy Efficiency Program, or DEEP, regarding their Torchiere Swap program. We are conducting an evaluation study of the program on their behalf. We received your name and contact information from DEEP's program records in order to conduct the study.

Q1. I have a few brief questions that will take only a few minutes to complete, may I ask you these questions now?

1. Yes
2. No Call back date and time:_____

Q2. Our information shows that you exchanged your inefficient halogen torchiere lamp with a more efficient fluorescent one from DEEP, is this correct?

1. Yes
2. No → Thank and Terminate
99. DK → Is there someone else in your home who would know?
Record Name_____
100. Refused → Thank and Terminate

Q3. Our records show that your home is located at <<address>>, is this the correct address?

1. Yes
2. No

99. DK/Refused
If no ask for correction (enter here _____)

Q4. Have you used the new fluorescent torchiere lamp in your home?

1. Yes
2. No
99. DK/Refused

Q5. In which room do you use it in?

1. Bedroom
2. Bathroom/Laundry
3. Kitchen
4. Family Room/Dining Room
5. Hallway
6. Closet
7. Other _____
99. DK/Refused

Q6. Could you estimate how many hours the torchiere is turned on a typical *weekday*? _____

Q7. Could you estimate how many hours the torchiere is turned on a typical *weekend day*? _____

Q8. Did you have plans to replace your inefficient torchiere lamp with a more efficient one before you heard of the DEEP program?

1. Yes
2. Maybe
3. No (Skip to Q9)
99. Don't know/ Refused

If Yes, what plans already existed? _____

Q9. Could you rate your satisfaction with the performance of the new torchiere lamp you have installed in your house? If unsatisfied, why?

1. Very Dissatisfied, why?
2. Not Satisfied, why?
3. Neither satisfied nor dissatisfied
4. Satisfied
5. Very Satisfied

Why?

Q10. When, (relative to actual installation) would that have occurred?

1. Same time or sooner
2. Within 6 months
3. 1 year later
4. 2 years later
5. More than 2 years
6. Never
99. Don't know / Refused

Q11. Before participating in DEEP's Torchiera Swap, did you have any prior experience with compact fluorescent torchiere lamps?

1. Yes
2. No
99. Don't know / Refused

If Yes, please describe the nature of that prior experience? _____

Q12. Since participating in DEEP's Torchiera Swap Program, have you installed any additional compact fluorescent torchiere lamps at your own cost?

1. Yes
2. No
99. Don't know / Refused

Satisfaction/Process Questions

Q13. How did you first become aware of DEEP's Torchiera Swap program?

1. Direct mail
2. Farmers Market
3. Energy Center
4. Radio Ad
5. TV Ad
6. Newspaper Ad
7. Friend/colleague
8. DEEP Web site
9. Other:_____

99. DK/Refused

Q14. How would you rate your satisfaction with DEEP's Torchiere Swap Program?

10. Very dissatisfied, why?
11. Not satisfied , why?
12. Neither satisfied nor dissatisfied
13. Satisfied
14. Very Satisfied

Why? _____

Q15. What recommendations would you have to improve this program for future program participants like yourself?

7.12 Single Family HVAC Charge and Airflow (EEM 15) and Multifamily Charge and Airflow (EEM 16)

Introduction

Hello, may I speak with **Contact Name**.

Hello, my name is <<interviewer>>, I am calling on behalf of the Davis Energy Efficiency Program, or DEEP, regarding their Single Family AC Tune-up program.. We are conducting an evaluation study of the program on their behalf. We received your name and contact information from DEEP's program records in order to conduct the study.

Q1. I have a few brief questions that will take only a couple of minutes to complete, may I ask you these questions now?

1. Yes
2. No Call back date and time: _____

Q2. Our information shows that last summer you had air conditioner service at your home as part of the DEEP's AC Tune-up program, is this correct?

1. Yes
2. No → Thank and Terminate

98. DK → Is there someone else at your location or company who would know?

Record Name _____

99. Refused → Thank and Terminate

Q3. Our records show that your home is located at <<Address>> in Davis, is this the correct address?

1. Yes
2. No, *ask them for correction (enter here _____)*
99. DK/Refused

Q4. Prior to your involvement with the program, did you have plans to service your air conditioner? Did this include plans to have the refrigerant charge and system air flow adjusted?

1. Yes
2. Maybe
3. No (Skip to Q6)
99. Don't know/ Refused

If Yes, what plans already existed? _____

Q5. When, (relative to the DEEP AC Tune-up service) would the service have occurred?

1. Same time or sooner
2. Within 6 months
3. 1 year later
4. 2 years later
5. More than 2 years
6. Never
99. Don't know / Refused

Q6. How important was the total cost in your decision to go ahead with the air conditioner service?

1. Very unimportant
2. Somewhat unimportant
3. Neither important nor unimportant
4. Somewhat important
5. Very important

Q7. Since participating in the DEEP AC Tune-up Program, do you plan to complete this type of AC service in the future?

1. 1 year later or sooner
2. 2 years later
3. More than 2 years
4. Never
99. Don't know / Refused

Q8. Did you previously have your AC serviced prior to participating in DEEP's Program? What kind of service? Annual fixed fee maintenance, emergency repair, replacement of major components, etc.?

1. Yes
2. No
99. Don't know / Refused

If Yes, how did it compare to this one, was it any different or more expensive?

Satisfaction/Process Questions

Q9. How did you first become aware of DEEP's Single Family HVAC Charge and Air-flow program?

1. Direct Mail
2. Theater Ad
3. Energy Center
4. Farmers Market or other event
5. Radio Ad
6. DEEP staff
7. Newspaper Ad
8. Friend/colleague
9. DEEP Web site
10. Other: _____
98. DK/Refused

Q10. How would you rate your satisfaction with DEEP's Single Family HVAC Charge and Air-flow program?

- 1. Very unsatisfied, why?
- 2. Not satisfied, why?
- 3. Neither satisfied nor unsatisfied
- 4. Satisfied
- 5. Very satisfied

Why:

Q11. How would you rate your satisfaction with the contractor that serviced your air conditioner?

- 1. Very unsatisfied, why?
- 2. Not satisfied, why?
- 3. Neither satisfied nor unsatisfied
- 4. Satisfied
- 5. Very Satisfied

Why:

Q12. Did you have direct contact with a DEEP staff member?

- 1. Yes
- 2. No (Skip to Q13)
- 99. Don't know / Refused

Q13. How satisfied were you with the service provided by the DEEP staff member? Would you say you were . . .

- 1. Extremely dissatisfied
- 2. Somewhat dissatisfied
- 3. Neither satisfied nor dissatisfied
- 4. Somewhat satisfied
- 5. Very satisfied
- 98. DK/Refused

If dissatisfied, Why?

Q14. What recommendations would you have to improve this program for future program participants like yourself?
