Evaluation, Measurement and Verification Study of the

San Diego Gas & Electric Company's 2004-2005 LOCAL NONRESIDENTIAL RETROFIT CUSTOMER ENERGY SAVINGS BID PROGRAM – PROCUREMENT Volume 1 of 2

Final Report

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Prepared for

The California Public Utilities Commission

Prepared by

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Table of Contents

Table of Contents

List of Tables:

Table of Contents

List of Figures:

1. Executive Summary

This is the executive summary of the San Diego Gas & Electric Company's 2004-2005 Local Nonresidential Retrofit Customer Energy Savings Bid Program – Procurement (Project ID No. 1320-04) Program Evaluation, Measurement and Verification (EM&V) Study. This study was conducted at the request of the California Public Utilities Commission. The study was managed by San Diego Gas & Electric Company. It was funded through the public goods charge (PGC) for energy efficiency and is available for download at www.calmac.org.

1.1 Program Overview

The Customer Energy Savings Bid (CESB) program provides incentives for energy-efficient retrofits or replacements of existing equipment at SDG&E customer sites. A project, also known as a contract, must save at least 500,000 kWh per year for electric projects or 25,000 therms per year for gas projects. The program allows aggregation of small projects to meet the energy savings criteria, thus a project may comprise a single site, or may be aggregated from multiple sites belonging to multiple customers, and may include a variety of measures. The aggregation option allows small customers, as well as large customers, to participate in the program. Typically, only large customers have energy efficiency opportunities large enough to self-sponsor a project, however, small customers may participate through a type of project sponsor known as energy efficiency service providers (EESP).

Any energy saving retrofit project involving the permanent replacement of existing, fully-operational equipment that had a high potential for energy savings and peak demand reduction was eligible for the CESB program. The financial incentives for the CESB projects were based on verified annual energy savings and peak demand reduction. To qualify for an incentive payment, the estimated annual savings must have been verified and approved by SDG&E. This may have been achieved through an approved M&V study conducted by the project sponsor or by SDG&E's M&V subcontractor. Originally, projects must be installed by December 15, 2005, however, due to long lead times for some projects this deadline was extended to December 31, 2006.

1.2 Evaluation Objectives

This study assessed the performance of the CESB program in terms of accomplishment of program goals and the effectiveness of the program. Key evaluation objectives included:

- Measurement and verification of energy and peak demand savings through engineering based, project-specific measurement and verification (M&V)
- Process evaluation to assess overall performance and customer satisfaction

1.3 Impact Evaluation

Engineering-based analyses were used to estimate verified savings on a project-by-project basis. The program required measurement and verification of all projects. The program offered participants the option of using a third party contractor to conduct the M&V at no cost to the participant. Over three-quarters of the participants elected to use this option. The M&V was rigorous and performed for each project. These M&V analyses were the bases for the impact evaluation.

The program reported and *ex post* load impacts are shown in Table 1-1.

Table 1-1
Savings Goal and Verified Savings

	Goals	Reported	*Ex Post* Load Impacts	Realization Rate	% of Goal
Gross kWh		150,576,832	94,413,445	62.7%	
Gross kW		26,587	16,186	60.9%	
Gross therms		336,324	103,959	30.9%	
Net-To-Gross	0.80	0.80	0.64		
Net kWh	108,800,000	120,461,466	60,424,605	50.2%	56%
Net kW	17,600	21,270	10,359	48.7%	59%
Net therms	320,000	269,059	66,534	24.7%	21%

The low realization rate is largely due to the following factors:

- Projects that were reported but were not installed or completed. These projects accounted for 16% (over 23 million kWh).

- Aggregation projects targeted at multiple customers that were not fully subscribed, i.e., the projects did not obtain enough customers to fully consume the incentives that were in the project participation agreement with CESB.

- The reporting of savings based on contracted amounts, rather than invoiced amounts from the project sponsors is the principal reason for the two areas of discrepancy

identified above. If the invoiced amounts were reported, rather than contracted, the realization rates would have been significantly higher.

- The *ex post* net-to-gross ratio of 0.64 is lower than the *ex ante* value of 0.80 further widening the gap between reported and *ex post* net impacts.

1.4 Process Evaluation

The major reason customer chose to installation energy efficient equipment was to reduce energy costs as shown in Table 1-2.

Table 1-2
Reason for Decision to Pursue Installation

Reason	Percent
Reduce Energy Costs	64%
Replace Older Equipment	14%
Improve Measure Performance	8%
Payback/ROI	6%
Acquire Rebate	6%
Protect Environment	3%
Total (multiple responses permitted)	*36*

Customers learned of the program through third parties, such as, energy efficiency service providers that were participating in CESB as an aggregator and were marketing the program or from an SDG&E account executive or program literature provided to them as shown in Table 1-3.

Table 1-3
How Customers Learned about the Program

Source	Percent
EESP Project Sponsor	42%
SDG&E Account Exec or Program Literature	38%
Consulting Engineer	4%
Self-knowledge	4%
Business colleague/Professional Association/Tradeshow	4%
Other Word-of-Mouth	4%
Don't Know	4%
Total	*25*

A third party was influential in helping the customer decide to install energy efficient equipment for a vast majority of projects as shown in Table 1-4.

Table 1-4
How Customer Decided to Install Energy-Efficiency Equipment

Process Which Led To Installation	EESP-sponsored	Self-sponsored	Percent
Own idea, pursued on our own	11%	0%	7%
Third party's idea, pursued on our own	37%	38%	37%
Own idea, convinced by third party	42%	13%	33%
Third party's idea, convinced by third party	11%	50%	22%
Total	*19*	*8*	*27*

Table 1-5 and Table 1-6 show what program features were best-liked and most disliked, respectively. Saving money/energy was the most liked feature of the program, followed by the smooth process. The smooth process was likely due to the EESP performing a "turnkey" installation for the customers on aggregation projects. Almost half had no dislikes of the program, while marketing and process issues such as paperwork and coordination with various parties were the most disliked features.

Table 1-5
Best-Liked Features of CESB

Most-Liked Features of CESB	Percent
Saved money/energy	62%
Smooth process	19%
Non-energy benefits of equipment	19%
Total (multiple responses permitted)	*21*

Table 1-6
Most Disliked Features of CESB

Most-Disliked Features of CESB	Percent
Nothing	48%
Marketing	19%
Process Issues	14%
Equipment Installed	10%
Program Structure	5%
Vendor Issues	5%
Total (multiple responses permitted)	*21*

2. Introduction

The Customer Energy Savings Bid ("CESB") program, funded as part of SDG&E's procurement forecast plan[1], was a multi-year program that offered nonresidential electric customers the opportunity to submit proposals to implement projects that would produce energy savings and peak demand reduction in the San Diego Gas and Electric Company service territory. Customers were encouraged to develop and submit innovative and unique strategies that would yield peak demand reductions and energy savings. The primary target group for this program was nonresidential customers that may have had requirements that hindered their participation in other existing SDG&E energy efficiency programs. Hard-to-reach nonresidential customers, as defined in the CPUC's *Energy Efficiency Policy Manual, Version 2,* were encouraged to participate.

This report describes the results of San Diego Gas & Electric Company's 2004-2005 Local Nonresidential Retrofit Customer Energy Savings Bid Program – Procurement (Project ID No. 1320-04) Program Evaluation, Measurement and Verification (EM&V) Study.

This study was conducted at the request of the California Public Utilities Commission. The study was managed by San Diego Gas & Electric Company. It was funded through the public goods charge (PGC) for energy efficiency and is available for download at www.calmac.org.

[1] As ordered in D.02-10-062 "*Final Decision on Procurement OIR*" and filed on April 15, 2003. D.03-08-067 further ordered the IOUs to submit procurement funded program proposals in its "*Instructions for the Submission of Requests for Extension and Submission of New Program Proposals and Plans*".

3. Program Overview

The CESB program provides incentives for energy-efficient retrofits or replacements of existing equipment at SDG&E customer sites. A project, also known as a contract, must save at least 500,000 kWh per year for electric projects or 25,000 therms per year for gas projects. The program allows aggregation of small projects to meet the energy savings criteria, thus a project may comprise a single site, or may be aggregated from multiple sites belonging to multiple customers, and may include a variety of measures. The aggregation option allows small customers, as well as large customers, to participate in the program. Typically, only large customers have energy efficiency opportunities large enough to self-sponsor a project, however, small customers may participate through a type of project sponsor known as energy efficiency service providers (EESP).

As compared to other energy efficiency programs, the CESB program is designed to be flexible and adaptable:

- The project sponsor proposes a project and desired incentives.
- Incentives may cover up to 100% of the project's measure costs, up to certain limits ($/kWh saved or $/therm saved) that vary by measure type.
- The incentive actually paid is based on verified savings which is determined through a mandatory measurement and verification (M&V).
- SDG&E offered participants the option of performing the M&V themselves or having SDG&E's M&V contractor perform the verification.

Aggregation was allowed where a project sponsor may install program-related equipment at a number of sites of various SDG&E customers. The 500,000 kWh per year or 25,000 therms per year threshold requirement may be met by taking the sum savings from the aggregated customer sites.

3.1.1 Program Objectives

The overall goal of the CESB Program is to reduce energy usage by bridging the gap between the maximum expenditure the customer's internal investment criteria and the required level of

investment to achieve cost-effective efficiency gains. This program is designed to meet the following objectives:

- Provide net kWh savings of 108,800,000 kWh, decrease peak kW demand by 17,600 kW, and provide 320,000 therms in first year savings;
- Reduce the cost barriers of investing in energy-efficient equipment and systems by shortening the payback period for the customer;
- Support local governmental agencies considering energy efficiency retrofit projects for their facilities;
- Provide energy efficiency support to customers with customized needs, e.g., use of more innovative, process-specific technologies, or complex projects requiring staged efficiency improvements.

3.1.2 Program Rationale

As a nonresidential energy-efficiency program, the CESB Program was designed to maximize energy savings and peak load reductions from nonresidential customers. The program approach was designed to encourage customers to invest in the early-replacement of older, less-efficient equipment with new high efficiency equipment.

This program was designed to address market barriers due to:

1. Budgetary planning horizons (e.g., fiscal year planning versus calendar year planning) that differ from CPUC program funding cycles, and
2. Longer planning horizons that do not coincide with program funding period.

This program was based on SDG&E's highly successful 2001 Peak Load Reduction Bid program. The 2001 program achieved outstanding results, annual energy savings of 9,604,000 kWh and peak demand reduction of 1,600 kW.

Although the program is similar to the Standard Performance Contract (SPC), the baseline for calculating savings is different. The baseline for the SPC program is Title 24/Title 20 standards, whereas the baseline for CESB is the efficiency of the existing equipment.

3.1.3 Market Segments Targeted

Eligible market segments included all nonresidential customers. Initial outreach efforts emphasized governmental and institutional customers whose investment planning and approval processes did not allow them to easily participate within existing Public Goods Charge (PGC)-funded programs. The program allowed aggregation of smaller nonresidential customers (e.g., chain customers or strip mall businesses) into projects where the aggregate savings enables the project to meet the required savings threshold.

3.1.4 Measures Targeted

Any energy saving retrofit project involving the permanent replacement of existing, fully-operational equipment that had a high potential for energy savings and peak demand reduction was eligible for the CESB program. The financial incentives for the CESB projects were based on verified annual energy savings and peak demand reduction. To qualify for an incentive payment, the estimated annual savings must have been verified and approved by SDG&E. This may have been achieved through an approved M&V study conducted by the project sponsor or by SDG&E's M&V subcontractor. Originally, projects must be installed by December 15, 2005, however, due to long lead times for some projects this deadline was extended to December 31, 2006.

Projects comprised:

- Retrofit of local government facilities
- Large customer retrofit projects
- Aggregated customer retrofit projects

Many different types of equipment were eligible for projects under the CESB program. Some examples of eligible, specialized projects included, but were not limited to:

- Energy-efficient chiller and HVAC applications
- Early retirement of older packaged HVAC systems
- Refrigeration system upgrades
- Air compressor system improvements
- Hi-bay HID to advanced fluorescent lighting conversions

Projects that were not eligible for the CESB program include:

- New construction
- Fuel substitution
- O&M changes
- Distributed generation

3.1.5 Required Measurement and Verification

The CESB program bases incentive payments on verified savings as documented through accepted measurement and verification (M&V) analyses and reports. The M&V requirement was a barrier to entry for many projects during early program introduction. SDG&E modified its program design and offered participants the option of performing the M&V themselves or to use SDG&E's third party M&V contractor (KEMA Inc.) at no cost to the participant. This option proved to be a facilitating option as over three out of four projects chose this approach to completing the M&V requirement as shown in Table 3-1.

Table 3-1
M&V Provider

	No. Projects	Percent	% of kWh Savings	% of kW Savings	% of Therm Savings
Self M&V	**8**	**22%**	**10%**	**9%**	**55%**
SDG&E M&V Contractor	**29**	**78%**	**90%**	**91%**	**45%**
Total	**37**	**100%**	**100%**	**100%**	**100%**

3.1.6 Aggregation Allowed

A project must meet minimum energy saving thresholds of 500,000 kWh per year or 25,000 therms per year. The CESB program allows aggregation where the project sponsor may install energy efficient equipment at a number of small sites and aggregate the savings to meet the minimum program thresholds. Almost 60% of all projects were aggregation projects as shown in Table 3-2.

Table 3-2
Aggregation of Sites

	No. Projects	Percent	% of kWh Savings	% of kW Savings	% of Therm Savings
Single Site	15	41%	16%	13%	51%
Aggregation	22	59%	84%	87%	49%
Total	37		100%	100%	100%

4. Impact Evaluation

This section describes the general approach used to estimate the load impacts of the CESB. CESB required M&V for each project. This impact evaluation is a compilation of the individual measurement and verifications done for each project. Individual M&V reports for each project are included in the Appendix B. These reports contain specifics of the M&V performed for each project. Some projects were implemented at one site, while others were aggregates with many sites. As can be seen in Table 4-1 there were the following categories of projects:

- **Single site.** Measure was installed at a single location.
- **Aggregate – single customer.** Similar measures were installed at multiple locations of a single customer.
- **Aggregate – multiple customers.** Similar measures were installed at sites of multiple customers. These projects were similar to programs with marketing/sales efforts by the energy service providers (project sponsor).

Table 4-1
Project and Customer Type

		No. Projects	Single Customer	Multiple Customers
Projects Completed	**Single Site**	15	14	1
	Aggregation of Sites	22	11	11
	Total Completed	37	25	12
Projects Not Completed		5	2	3
Total Projects		42	27	15

The choice of a specific evaluation approach for each project was based in part on the type of project and customer type, as well as the measure.

4.1 Methodology

KEMA Inc. conducted the impact evaluation of the CESB program using engineering approaches on a project-specific basis, incorporating M&V analyses where acceptable. By

understanding the principal parameters that drive the savings resulting from the measure's load impact equation and designing measurement schemes that target the key parameters, we were able to provide a much deeper understanding of why evaluation results differ from initial expectations.

Elements of the evaluation approach used are:

- **Site-specific planning, data collection, and analysis**, including: review of project files to develop an appropriate evaluation approach; on-site data collection using interviews, metering/monitoring, and collection of other site data such as production records and facility management outputs; analysis of data to develop energy impacts and reasons why results differ from expectations.

- **Gross program savings analysis:** the results of the site analyses were aggregated and implementation rates (verified savings divided by reported savings) were estimated for kWh and therm savings, and kW reduction.
  - The projects were divided into three groups:
    - **Completed projects with M&V:** These projects were subjected to detailed project specific verification. Thirty two projects fell into this group.
    - **Completed projects without M&V:** These projects were completed but were not subjected to M&V. Five projects fell into this group.
    - **Cancelled or projects that were not installed:** These projects were either cancelled or not installed for some reason. The reported savings for these projects were removed from the total reported savings prior to estimating program savings.
  - After removing the reported savings of cancelled projects from the total reported program savings, the realization rates were used to extrapolate the gross *ex post* program savings.

- **Net-to-gross analysis:** determining what would have occurred without the program. The net-to-gross analysis is discussed in Section 5.3.

Following is additional detail on key aspects of the impact evaluation. These include site planning and site reporting, addressing key evaluation issues, monitoring, our basic site analysis approaches by end use, and our net-to-gross analysis approach.

4.1.1.1 Project-Specific Analysis

The project-specific analysis utilized various information sources and the general approaches described below to develop the site-specific evaluation approach. A project-specific M&V report was generated for each project subjected to program-provided M&V. M&V analyses conducted by other parties were reviewed prior their inclusion in the evaluation. Detailed analysis reports for each project may be found in Appendix B.

4.1.1.2 Monitoring

Most projects required some sort of monitoring of equipment operation to gain a sufficient understanding of the pre- and post-retrofit operating schedule, load profile, control strategy, operating conditions and operating control setpoints, or ambient conditions to provide a confident result.

Where available on-site systems, such as energy management control systems, were used to the maximum degree possible to provide operating schedules and monitor equipment operation.

Where load performance data was not readily available from the customer, short-term monitoring of key equipment was done. Monitoring was performed using a variety of equipment including multi-channel data loggers equipped with clamp-on current transformers, temperature, pressure, or other sensors to measure energy consumption, operating parameters, or loading profile of equipment or systems being evaluated at the specific site, as well as light loggers and motor loggers to gather end use runtimes. We also used spot measurements to confirm individual point of operating performance in conjunction with manufacturer's performance curves to predict performance over the remaining operation load profile and operating conditions.

4.2 Impact Evaluation Results

This section provides a summary of the load impact evaluation. More detailed discussion of each the analysis for each site may be found in Appendix B. Table 4-2 shows the program accomplishment compared with the program goals.

Table 4-2
Summary of Savings Goals and *Ex Post* Load Impacts

	Goals	Reported	*Ex Post* Load Impacts	Realization Rate	% of Goal
Gross kWh		150,576,832	94,413,445	62.7%	
Gross kW		26,587	16,186	60.9%	
Gross therms		336,324	103,959	30.9%	
Net-To-Gross	0.80	0.80	0.64		
Net kWh	108,800,000	120,461,466	60,424,605		56%
Net kW	17,600	21,270	10,359		59%
Net therms	320,000	269,059	66,534		21%

4.2.1 Gross Load Impacts

Total reported savings from the Program's Monthly Report Narrative downloaded from the EEGA website dated January 2006 are shown in Table 4-3. The narrative indicated the load impacts would be updated in SDG&E's 2006 AEAP May 1st filing. Updated values for this proceeding were provided by SDG&E and are shown in Table 4-4. The values in Table 4-4 were used as the basis for estimating load impacts for this evaluation.

Table 4-3
Reported Load Impacts
From CESB Monthly Report Narrative for January 2006

	kWh Savings	kW Reduced	Therm Savings
Goal	108,800,000	17,600	320,000
Reported Net Impacts	121,323,216	20,915	260,203
Net-To-Gross	0.80	0.80	0.80
Reported Gross Impacts (Net/NTGR)	151,654,020	26,144	325,254
Source: CESB Monthly Report Narrative for January 2006 downloaded from EEGA			

Table 4-4
Reported Load Impacts
From Updated Worksheet Revised March 7, 2006

	kWh Savings	kW Reduced	Thm Savings
Goal	108,800,000	17,600.0	320,000
Reported Net Impacts	120,461,466	21,269.8	269,059
Net-To-Gross	0.80	0.80	0.80
Reported Gross Impacts (Net/NTGR)	150,576,832	26,587	336,324
Source: Worksheet from SDG&E, Revised March 7, 2007			

Table 4-5 and Table 4-6 show a summary of CESB program projects. Table 4-5 shows project characteristics while Table 4-6 shows the load impacts by project.

Table 4-5 shows there were 42 projects in the program, of which 32 had M&V analyses performed, five (5) projects were completed but not verified through M&V, and five (5) projects were not installed or completed.

Table 4-6 shows the reported load impacts for all projects and the results of the individual M&V analyses for those 32 projects subjected to M&V.

Table 4-5
Project Descriptions

ID No.	M&V Status	IPMVP Option	Project Sponsor Type	Type of Project	Type of Customer	NAICS	Measure Description
04-01-010	Complete	Option A	Self-Sponsor	Aggregate	Single Customer	921190, 921110, 921190, 624110	HVAC (controls: Hartman loop, VFD)
04-01-017	Complete	Option A	EESP	Single Site	Single Customer	928110	Lighting: controls and occ sensors, HVAC: upgrades and controls; VFD's & Control Logic
04-01-018	Complete	Option A	Self-Sponsor	Aggregate	Single Customer	531121	Lighting retrofit
04-01-028	Complete	Option A	Self-Sponsor	Aggregate	Single Customer	531121	Lighting retrofit
04-02-001	Complete	Option A	EESP	Single Site	Single Customer	334111	HVAC (central plant)
04-02-003	Complete	Option A	EESP	Aggregate	Multiple Customers	Various	Lighting retrofit-high bay: HID to T8
04-02-004 & 04-02-024	Complete	Option A	EESP	Aggregate	Single Customer	611112 various govt	Other: Vending Miser
04-02-007	Complete	Option B	EESP	Aggregate	Single Customer	611110	Lighting and HVAC
04-02-008	Complete	Option B	EESP	Single Site	Single Customer	928110	EMS, central plant, compressed air retrofit, chiller,Variable Volume
05-04-001	Complete	Option A	EESP	Aggregate	Single Customer	611112	Lighting, t-stat, HE a/c and h/p, VS control of pool pump
05-04-002	Complete	Option A	Self-Sponsor	Single Site	Single Customer	928110	Lighting (High bay lighting HID to T5)
05-04-003	Complete	Option A	EESP	Aggregate	Multiple Customers	445110	Refrig: ASH control, multiplex compressor, night covers, oversized condenser, Floating head/suction pressure, ECM for evap fans. Lighting: T12-T8.
05-04-004	Complete	Option A	EESP	Aggregate	Multiple Customers	445110	Refrig: ASH control, multiplex compressor, night covers, oversized condenser, Floating head/suction pressure, ECM for evap fans,. Lighting: T12-T8.
05-04-006	Complete	Option A	EESP	Aggregate	Multiple Customers	Various	Lighting retrofit: CFL replacement
05-05-001	Complete	Option A	Self-Sponsor	Aggregate	Single Customer	445110	Refrig: ECM motors on evap fans
05-05-002	Complete	Option A	EESP	Aggregate	Multiple Customers	Various	HVAC: RCA and DTS, Lighting: CFL
05-05-004	Complete	Option A	Self-Sponsor	Single Site	Single Customer	531121	Lighting retrofit
05-05-006	Complete	Option A	Self-Sponsor	Aggregate	Single Customer	444110	Lighting retrofit: HID to T5
05-05-007	Complete	Option A	Self-Sponsor	Single Site	Single Customer	531312	Lighting retrofit
05-05-008	Complete	Option A	EESP	Aggregate	Multiple Customers	445110	Refrig: ASH control, multiplex compressor, night covers, oversized condenser, Floating head/suction pressure, ECM for evap fans,. Lighting: T12-T8.

Table 4-5 (continued)
Project Descriptions

ID No.	M&V Status	IPMVP Option	Project Sponsor Type	Type of Project	Type of Customer	NAICS	Measure Description
05-06-001	Complete	Option A	EESP	Aggregate	Multiple Customers	424490	Lighting, refrigeration, and other
05-06-005	Complete	Option A	Self-Sponsor	Aggregate	Single Customer	453910	Lighting retrofit
05-07-003	Complete	Option A	EESP	Aggregate	Multiple Customers	Various	Lighting retrofit in parking garage: HID to T8
05-07-004	Complete	Option A	Self-Sponsor	Single Site	Single Customer	325412	VFD CHW pump, condensing water pump, cooling tower spray pump, upgraded controls fo AH 1-4, 8,9 based on airflow
05-07-006	Complete	Option B	Self-Sponsor	Single Site	Single Customer	561920	3 new chillers w/ VFD, over-sized heat exchangers;; VFD on CHW pumps, condensing water pumps and cooling tower fans
05-07-007	Complete	Option A	Self-Sponsor	Aggregate	Single Customer	448120	Lighting retrofit
05-08-001	Complete	Option A	EESP	Aggregate	Multiple Customers	Various	Lighting (8-ft T12 to 2L4-ft T8)
05-08-002	Complete	Option A	EESP	Single Site	Multiple Customers	445110	Refrig: Cooler control system for evaporator fans, door heaters, scheduling. ECM motors, Remote Site Manager.
05-08-004	Complete	Option A	EESP	Aggregate	Multiple Customers	445110	Strip curtains on commercial refrigeration coolers
05-08-005	Complete	Option A	Self-Sponsor	Single Site	Single Customer	541511	Lighting control EMS and Lighting fixture retrofit
05-08-007	Complete	Option A	Self-Sponsor	Single Site	Single Customer	721110	HVAC: repl 2 chillers w/ vfd, vfd, to CHW pumps. T-stats
05-08-010	Complete	Option A	EESP	Aggregate	Multiple Customers	Various	Parking garage lighting HID to T8
04-02-002	No M&V		EESP	Aggregate	Single Customer	926150	Lighting and HVAC
04-03-002	No M&V		EESP	Single Site	Single Customer	611310	Lighting, HVAC controls, fans, VFDs (inlet vane to VFD)
05-06-004	No M&V		Self-Sponsor	Single Site	Single Customer	721110	HVAC: Hartman loop, VAV AH
05-07-002	No M&V		Self-Sponsor	Single Site	Single Customer	312111	New condenser, floating head/suction pressure, improved system balance.
05-08-008	No M&V		Self-Sponsor	Single Site	Single Customer	312111	Compressed air system upgrade: variable speed air compressor, reduce artificial demand, stop idle eqmt
04-03-001	Not Installed		Self-Sponsor	Aggregate	Single Customer	447110	Lighting retrofit: high bay
05-04-005	Not Installed		Self-Sponsor	Aggregate	Multiple Customers	621491	HVAC: VFD on all pumps, cooling tower fands, chilers. Convert to primary-only, variable flow systesm. Hartman loop.
05-05-009	Not Installed		Self-Sponsor	Aggregate	Multiple Customers	622110	HVAC: chiller, heat recovery, economizers, vfd. Lighting retrofit.
05-07-005	Not Installed		EESP	Aggregate	Multiple Customers	Various	Lighting retrofit: high bay
05-08-009	Not Installed		Self-Sponsor	Single Site	Single Customer	452910	Lighting retrofit: high bay

Table 4-6
Load Impacts By Project

					Reported Gross Impacts			Invoiced			*Ex Post* Gross Impacts			
ID No.	M&V Status	Measure Description	Type of Project	*Ex Ante* NTGR	kWh Savi.	kW Red.	Therm Sav.	kWh Sav.	kW Red.	Therm Sav.	*Ex Post* NTGR	kWh Sav.s	kW Red.	Therm Sav.
04-01-010	Complete	HVAC (controls: Hartman loop, VFD)	Aggregate	0.80	3,910,000	551.00	0	3,910,000	551.00	0	0.64	2,698,272	551.00	0
04-01-017	Complete	Lighting: controls and occ sensors, HVAC: upgrades and controls; VFD's & Control Logic	Single Site	0.80	2,533,439	457.50	124,600	2,079,184	177.00	58,627	0.64	2,703,311	0.00	54,101
04-01-018	Complete	Lighting retrofit	Aggregate	0.80	1,940,815	354.00	0	1,940,815	353.66		0.64	1,347,742	330.23	0
04-01-028	Complete	Lighting retrofit	Aggregate	0.80	3,734,730	796.27	0	3,733,314	795.88		0.64	3,724,806	793.65	
04-02-001	Complete	HVAC (central plant)	Single Site	0.80	1,433,921	313.10	0	1,325,734	48.30	0	0.64	1,433,921	128.00	0
04-02-003	Complete	Lighting retrofit-high bay: HID to T8	Aggregate	0.80	14,000,000	3,904.00	0	10,848,717	1,855.55	0	0.64	10,311,216	1,800.88	0
04-02-004 & 04-02-024	Complete	Other: Vending Miser	Aggregate	0.80	500,850	0.00	0	585,120	0.00	0	0.64	502,440	0.00	
04-02-007	Complete	Lighting and HVAC	Aggregate	0.80	879,239	315.20	0	543,344	250.65	0	0.64	543,344	260.65	0
04-02-008	Complete	EMS, central plant, compressed air retrofit, chiller,Variable Volume	Single Site	0.80	943,295	0.00	0	2,199,356	250.70	0	0.64	2,199,356	250.70	0
05-04-001	Complete	Lighting, t-stat, HE a/c and h/p, VS control of pool pump	Aggregate	0.80	2,316,333	270.80	37,478	2,139,228	286.57	16,340	0.64	2,035,646	286.60	16,340
05-04-002	Complete	Lighting (High bay lighting HID to T5)	Single Site	0.80	2,256,789	361.10	0	829,541	343.80		0.64	686,322	157.70	
05-04-003	Complete	Refrig: ASH control, multiplex compressor, night covers, oversized condenser, Floating head/suction pressure, ECM for evap fans. Lighting: T12-T8.	Aggregate	0.80	5,493,898	444.30	0	5,541,918	744.80		0.64	5,405,659	726.10	
05-04-004	Complete	Refrig: ASH control, multiplex compressor, night covers, oversized condenser, Floating head/suction pressure, ECM for evap fans,. Lighting: T12-T8.	Aggregate	0.80	4,359,607	372.54	0	4,544,209	912.00	0	0.64	4,417,003	894.80	0
05-04-006	Complete	Lighting retrofit: CFL replacement	Aggregate	0.80	8,385,021	3,746.00	0	5,802,645	2,597.63	0	0.64	3,953,529	2,452.80	0
05-05-001	Complete	Refrig: ECM motors on evap fans	Aggregate	0.80	432,394	49.40	0	423,984	48.40	0	0.64	466,032	53.20	0
05-05-002	Complete	HVAC: RCA and DTS, Lighting: CFL	Aggregate	0.80	15,724,420	3,241.20	96,000	15,528,063	3,216.30	19,153	0.64	11,360,053	3,264.82	19,153
05-05-004	Complete	Lighting retrofit	Single Site	0.80	1,415,768	332.50	0	1,415,769	332.54	0	0.64	1,404,809	241.74	0
05-05-006	Complete	Lighting retrofit: HID to T5	Aggregate	0.80	2,578,410	365.90	0	2,113,995	300.03	0	0.64	2,203,838	320.47	0
05-05-007	Complete	Lighting retrofit	Single Site	0.80	1,175,295	259.70	0	1,175,295	259.71	0	0.64	916,012	200.27	0

Table 4-6 (continued)
Load Impacts By Project

					Reported Gross Impacts			Invoiced			*Ex Post* Gross Impacts			
ID No.	M&V Status	Measure Description	Type of Project	*Ex Ante* NTGR	kWh Sav.	kW Red.	Therm Sav.	kWh Sav.	kW Red.	Therm Sav.	*Ex Post* NTGR	kWh Sav.	kW Red.	Therm Sav.
05-05-008	Complete	Refrig: ASH control, multiplex compressor, night covers, oversized condenser, Floating head/suction pressure, ECM for evap fans,. Lighting: T12-T8.	Aggregate	0.80	11,552,276	1,250.00	0	5,396,882	657.64	0	0.64	5,403,427	658.27	0
05-06-001	Complete	Lighting, refrigeration, and other	Aggregate	0.80	1,316,964	37.00	0	618,625	97.00	0	0.64	651,221	92.30	0
05-06-005	Complete	Lighting retrofit	Aggregate	0.80	655,207	88.90	0	655,207	88.90	0	0.64	693,723	88.94	0
05-07-003	Complete	Lighting retrofit in parking garage: HID to T8	Aggregate	0.80	4,535,928	518.00	0	3,945,822	477.09	0	0.64	3,958,530	477.32	0
05-07-004	Complete	VFD CHW pump, condensing water pump, cooling tower spray pump, upgraded controls fo AH 1-4, 8,9 based on airflow	Single Site	0.80	521,908	34.80	0	521,907	34.70	0	0.64	698,480	53.60	0
05-07-006	Complete	3 new chillers w/ VFD, over-sized heat exchangers;; VFD on CHW pumps, condensing water pumps and cooling tower fans	Single Site	0.80	2,887,836	367.20	0	2,887,836	367.20	0	0.64	2,727,810	0.00	
05-07-007	Complete	Lighting retrofit	Aggregate	0.80	853,919	178.80	0	853,919	179.00	0	0.64	1,027,792	177.20	0
05-08-001	Complete	Lighting (8-ft T12 to 2L4-ft T8)	Aggregate	0.80	5,326,080	756.00	0	614,395	85.58	0	0.64	607,738	84.82	0
05-08-002	Complete	Refrig: Cooler control system for evaporator fans, door heaters, scheduling. ECM motors, Remote Site Manager.	Single Site	0.80	1,620,000	136.00	0	73,153	7.28	0	0.64	70,926	6.96	0
05-08-004	Complete	Strip curtains on commercial refrigeration coolers	Aggregate	0.80	10,000,000	1,140.00	0	10,008,335	1,140.70	0	0.64	9,999,684	1,139.70	0
05-08-005	Complete	Lighting control EMS and Lighting fixture retrofit	Single Site	0.80	1,362,806	200.60	0	1362806	200.65	0	0.64	1,557,858	200.61	
05-08-007	Complete	HVAC: repl 2 chillers w/ vfd, vfd, to CHW pumps. T-stats	Single Site	0.80	845,091	34.60	0	845,091	34.60	0	0.64	561,034	59.30	0
05-08-010	Complete	Parking garage lighting HID to T8	Aggregate	0.80	5,355,759	611.40	0	3,672,630	419.25	0	0.64	3,678,061	419.87	0
Subtotal - Project Subjected to Verified Savings					**120,847,998**	**21,487.81**	**258,078**	**98,136,839**	**17,114.11**	**94,120**		**89,949,594**	**16,172.50**	**89,594**
Implementation Rate												**74.4%**	**75.3%**	**34.7%**

Table 4-6 (continued)
Load Impacts By Project

					Reported Gross Impacts			Invoiced			*Ex Post* Gross Impacts			
ID No.	M&V Status	Measure Description	Type of Project	*Ex Ante* NTGR	kWh Savi.	kW Red.	Therm Sav.	kWh Sav.	kW Red.	Therm Sav.	*Ex Post* NTGR	kWh Sav.s	kW Red.	Therm Sav.
04-02-002	No M&V	Lighting and HVAC	Aggregate	0.80	2,374,000	211.00	12,300	1,148,660	48.94	0				
04-03-002	No M&V	Lighting, HVAC controls, fans, VFDs (inlet vane to VFD)	Single Site	0.80	1,814,011	122.50	29,080	1,814,011	122.00	29,080				
05-06-004	No M&V	HVAC: Hartman loop, VAV AH	Single Site	0.80	629,709	97.20	0	629,709	97.20	0				
05-07-002	No M&V	New condenser, floating head/suction pressure, improved system balance.	Single Site	0.80	632,622	142.00	0	577,868	131.00	0				
05-08-008	No M&V	Compressed air system upgrade: variable speed air compressor, reduce artificial demand, stop idle eqmt	Single Site	0.80	572,152	39.00	0	572,152	39.00	0				
Subtotal - Project Completed But Not Subjected to Verification					**6,022,494**	**611.70**	**41,380**	**4,742,400**	**438.14**	**29,080**				
04-03-001	Not Installed	Lighting retrofit: high bay	Aggregate	0.80	657,968	120.50	0							
05-04-005	Not Installed	HVAC: VFD on all pumps, cooling tower fands, chilers. Convert to primary-only, variable flow systesm. Hartman loop.	Aggregate	0.80	2,640,000	301.40	0							
05-05-009	Not Installed	HVAC: chiller, heat recovery, economizers, vfd. Lighting retrofit.	Aggregate	0.80	2,656,435	372.00	36,866							
05-07-005	Not Installed	Lighting retrofit: high bay	Aggregate	0.80	16,390,000	3,639.00	0							
05-08-009	Not Installed	Lighting retrofit: high bay	Single Site	0.80	1,387,212	649.00	0							
Subtotal - Projects Not Installed					**23,731,615**	**5,081.90**	**36,866**							

The verified load impacts were used to estimate the implementation rate as shown in Equation 1. The implementation rate is the fraction of reported savings that was verified.

$$\text{(Eq. 1)}\quad \text{Implementation Rate} = \frac{\sum_i \text{Verified Impacts}_i}{\sum_i \text{Reported Impacts}_i},$$

$$\text{for all projects, i, that were verified through M \& V.}$$

The implementation is the share of reported impacts that were verified for projects that were analyzed through M&V analyses.

As discussed previously there were three groups of projects: (1) projects that were completed and verified; (2) projects that were completed but not verified; and (3) projects that were not installed or completed. Since the projects falling in the third group (not installed or completed) could be clearly identified and there could be no savings from this group, the reported savings for this group were removed from the total reported prior to applying the implementation rate to the reported savings to estimate the *ex post* gross impacts.

Table 4-7 shows the estimate of the gross load impacts. The reported impacts for projects not installed were subtracted from the total reported to yield the reported impacts for completed projects. The reported impacts were multiplied by the implementation rate to estimate the *ex post* gross load impacts.

Table 4-7
Estimate of Gross Load Impacts

Gross Load Impacts				
M&V Group	**Type**	**kWh Savings**	**kW Reduced**	**Therm Savings**
M&V Projects	Reported	120,847,998	21,488	258,078
	Verified	89,949,594	16,173	89,594
	Implementation Rate	74.4%	75.3%	34.7%
Total Reported Gross Impacts		150,576,832	26,587	336,324
Less: Cancelled Projects		23,731,615	5,082	36,866
Total Reported Impacts for Completed Projects		126,845,217	21,505	299,458
Implementation Rate		74.4%	75.3%	34.7%
Ex Post Gross Load Impacts (Implementation Rate x Total Reported for Completed)		94,413,445	16,186	103,959

Table 4-8 shows the verified savings by end use.

Table 4-8
Gross Impact Summary by End Use

		Contracted			Verified		
Measure Type	No. Projects	kWh Savings	kW Reduced	Therm Savings	kWh Savings	kW Reduced	Therm Savings
Compressed Air	1	572,152	39	0	0	0	0
Compressed Air, HVAC	1	943,295	0	0	2,199,356	251	0
HVAC	6	10,228,465	1,398	0	8,119,517	792	0
HVAC, Lighting	5	23,267,442	4,407	287,158	16,642,354	3,812	89,594
Lighting	18	74,385,707	17,093	12,300	36,071,976	7,747	0
Other (Vending Miser)	1	500,850	0	0	502,440	0	0
Refrigeration	3	12,052,394	1,325	0	10,536,642	1,200	0
Refrigeration, Lighting	7	28,651,802	2,919	36,866	15,877,310	2,371	0

4.2.2 Net Load Impacts

Customer and energy efficiency service provider (EESP) surveys were conducted of program participants to gather information on program participation and to estimate the program net-to-gross ratio to calculate net savings.

4.2.2.1 Net-To-Gross Ratio

The estimation of the net-to-gross ratio (NTGR) is described in Section 5.3. Table 4-9 shows the estimated NTGRs estimated in Section 5.3. Net savings were calculated by applying the *Overall Weighted NTGR*, 0.64, to the gross savings estimates.

Table 4-9
Overall CESB Program Net-To-Gross Ratios

Estimate	EESP-Sponsored NTGR	Self-Sponsored NTGR	Overall NTGR
NTGR weighted by measure savings	0.73	0.5	0.64

4.2.2.2 Net Load Impacts

The weighted NTGR in Table 4-9 was applied to the gross load impacts of Table 4-7. The resulting net load impacts are shown in Table 4-10.

Table 4-10
Net Load Impact Summary

	M&V Status	kWh Savings	kW Reduced	Therm Savings
Ex Post	Gross Load Impacts	94,413,445	16,186	103,959
	Net-To-Gross	0.64		
	Net Load Impacts	60,424,605	10,359	66,534
Reported	Net Load Impacts	120,461,466	21,270	269,059
Goal	Net Load Impacts	108,800,000	17,600	320,000
Realization Rate (Net Impacts)		50.2%	48.7%	24.7%
% of Goal		55.5%	58.9%	20.8%

4.2.3 Discussion of Load Impacts

The realization rates shown in Table 4-10 are low compared to other programs. The low realization rates are largely due to the reported load impacts. The impacts reported and shown in Table 4-3 and Table 4-4 were taken from the contracts signed for each project. This led the following:

- Projects that were reported but were not installed or completed. These projects accounted for 16% (over 23 million kWh).

- Aggregation projects targeted at multiple customers that were not fully subscribed, i.e., the projects did not attain the contracted level of participation, thus the load impacts were below the contracted levels

- The reporting of savings based on contracted amounts, rather than invoiced amounts from the project sponsors is the principal reason for the two of the areas of discrepancy identified above. If the invoiced amounts were reported, rather than contracted, the implementation rates would have been higher as shown in Table 4-11. This table shows that the implementation rates go from approximately 75% to well over 90% for gross impacts when comparing verified impacts to contracted or invoiced impacts, respectively.

- The *ex post* net-to-gross ratio of 0.64 is lower than the *ex ante* value of 0.80 further widening the gap between reported and *ex post* net impacts.

Table 4-11
Comparison of Contracted and Invoiced Impacts
(For Projects With M&V Analysis)

				Implementation Rate		
	kWh Savings	kW Reduced	Therm Savings	kWh Savings	kW Reduced	Therm Savings
Contracted	120,847,998	21,487.81	258,078	74.4%	75.3%	34.7%
Invoiced	98,136,839	17,114.11	94,120	91.7%	94.5%	95.2%
Verified	89,949,594	16,172.50	89,594	-	-	-

5. Customer Participant and Project Sponsor Results, CESB 2004-2005

This section presents responses to a set of structured interviews we conducted with a representative sample of customers and energy efficiency service providers (EESPs) participating in the 2004-2005 CESB Program. The primary focus of these interviews was to estimate free-ridership, although some additional information was collected.

- General Characteristics of the 2004-2005 Participant Customer and EESP Samples (5.1)
- Program-Related Decisions (5.2)
- Analysis of First-Year Net Savings Impact (Free-Ridership) (5.3)
- Process-Related Issues (5.4)

5.1 General Characteristics of the 2004-2005 Customer and EESP Samples

This subsection presents characteristics of the sample of 2004-2005 CESB customer participants with whom in-depth interviews were conducted from December 2004 through February 2005 and the sample of EESPs that participated in the program as project sponsors.

As shown in Table 5-1, about half of the ESB projects in 2004-2005 were self-sponsors, with the other half sponsored by an EESP. The EESP projects, however, consisted of a larger number of sites and represented a much larger share of incentives (both *ex ante* and *ex post*) than self-sponsored projects. Note that contracted incentives can differ significantly from paid incentives, so use caution when comparing incentives or shares of incentives.

Table 5-1
Breakdown of Participant Population by Sponsorship Type (2004-05 CESB)

Participant Type	Number of Projects	Number of Sites	Percent of Contracted Incentives	Percent of Incentives Paid
EESP-sponsored	22	647	82%	73%
Self-sponsored	15*	107	18%	27%
Total	*37*	*754*	*100%*	*100%*

*There were 23 contracts for self-sponsoring customers, but incentives were paid for only 15 of those contracts. The remaining projects were either cancelled, otherwise not completed, or did not show verified savings. Only the 15 customers that received payments were considered as targets for the survey.

Table 5-2
Breakdown of Contracted, Measure, and M&V Electricity Savings by Sponsorship Type

Participant Type	Contract kWh Savings	Measure kWh Savings	M&V kWh Savings
EESP-sponsored	97,106,823	48,600,547	26,268,016
Self-sponsored	28,182,884	29,017,746	4,299,923
Total	*125,289,707*	*77,618,293*	*30,567,939*

Table 5-2 shows three metrics of electricity savings for EESP-sponsored and self-sponsored customers: contracted savings, measure savings, and verified electricity savings. These represent savings from three different stages in the project. Contracted savings comprise all savings in the original contracts, including savings from contracts that were cancelled or contained measures that were never installed. The measure savings represent ex ante savings estimates for all measures that were actually installed. Finally, verified (or M&V) savings represent savings that were shown in the tracking database as being measured and verified (as of August 2007). Note that this table includes only electricity savings. For simplicity, we have ignored gas savings, since they were not significant in the 2004-2005 program (only 14,096 therms measured and verified on a single contract).

In completing the surveys, we faced a number of issues. The biggest factor was timing of the surveys: at least two and up to three and half years between the date the contract was signed and the time of the survey. Due to employee turnover, many project contacts (both EESP sponsors and customers) were no longer with their organization and many phone numbers were no longer current.

An additional difficulty was that contact information in the program database was incomplete. Out of 481 unique contact names, 308 were the name of the business, 28 provided the first name only, at least one was an additional contact with the EESP sponsor (which we learned only when we contacted him trying to complete a customer survey), and only nine of the 481 also included contact phone numbers. Because the contact information for project sponsors was fairly complete, this issue did not affect surveys for self-sponsoring customers, but it was a significant handicap in contacting EESP-sponsored customers.

Because of these issues, we adopted a multi-pronged approach to data collection. Self-sponsoring customers would be treated separately from EESP-sponsored customers. Customer interviews would be the only source of information about self-sponsors. A limited number of interviews would be conducted with EESP-sponsored customers as well, using the few available contact numbers supplemented with cold-calling phone numbers obtained from telephone services. Free ridership information for EESP-sponsored customers would be supplemented by information from EESP-surveys, with the recognition that EESP understand how the program benefits their bottom line and have an incentive to downplay free ridership

Due to the small number of self-sponsoring customers (incentives were paid on only 15 of the original contracts, further limiting the sample), we attempted to contact all of them, eventually completing eight. Among customers participating through vendors, we tried to choose a sample representing the range of vendors and measure types, rather than focusing on choosing customers receiving the highest incentives. These data would be weighted by the EESP sponsors share of energy savings, so it was more important to choose representative projects for each EESP than to capture the largest share of savings possible.

Table 5-3 indicates the customer population and sample for the self-sponsored customer and EESP-sponsored customer surveys. Our approach resulted in our capturing 27 percent of the overall measure electricity savings in 2004-05 and 60 percent of measure electricity savings for self-sponsors. Table 5-4 shows measure electricity savings for the sample and population for both groups.

Table 5-3
Interview Targets

Stratum	Population	Goal	Complete
Self-sponsors	15	10	8
Participated through vendor	~500	20	19
Total		*30*	*27*

Table 5-4
Comparison of Customer Stratification by Measure kWh Savings

Stratum	n	Sample kWh Savings	N	Population kWh Savings
Self-sponsors	8	17,275,088	15	29,017,746
Participated through vendor	19	3,346,680	~500	48,600,547
Total	*27*	*20,621,768*	*~515*	*77,618,293*

The EESPs that participated in the 2004-2005 CESB program varied widely, both in the types of projects done and the types of customers targeted. The vendors were classified broadly by measure specialty; Figure 5-1 shows the breakdown. Four of the participating EESPs routinely did multi-measure projects including HVAC and lighting. One of these specialized in large integrated projects, typically with only a single customer per project; another did a project involving over 300 smaller customers (small retail, restaurants, etc.) doing HVAC tune-ups and installing CFL lighting.

The top five EESP project sponsors collected more than 90 percent of the payments made by the program to EESPs and 66 percent of all incentives paid. Nine EESPs were interviewed, including the top four, representing 92 of incentives paid and 87 percent of measure electricity savings. Table 5-5 compares the electricity savings for the EESP sample with the population.

Figure 5-1
Participating EESPs by Measure Specialization (2004-05 CESB)

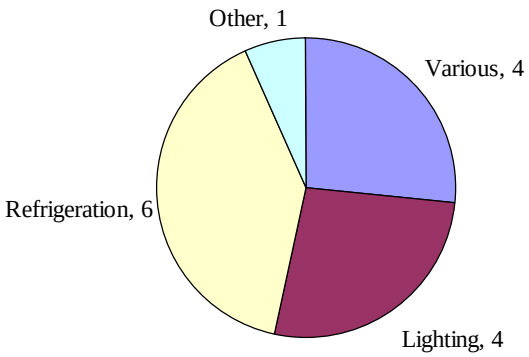


Table 5-5
Comparison of EESP Sample to Population—Measure kWh Savings

	n	Sample kWh Savings	N	Population kWh Savings
EESPs	9	42,091,531	15	48,600,547

5.2 Program-Related Decisions

In this subsection, we present the responses to a variety of questions customers were asked about the decision-making process for their CESB projects.

5.2.1 Origin of Decisions, Role and Significance of Third-party Firms

As shown in Table 5-6, customers in the 2004-2005 CESB were asked to describe what led to their decision to install the measures in their applications. The most common response was the need to reduce energy costs (64 percent). The need to replace older equipment was next at 14 percent; all other reasons were given by fewer than 10 percent of respondents. Some customers gave multiple responses, as their applications covered a wide diversity of sites or because they had several reasons for pursuing installation.

Table 5-6
Reason for Decision to Pursue Installation

Reason	Percent
Reduce Energy Costs	64%
Replace Older Equipment	14%
Improve Measure Performance	8%
Payback/ROI	6%
Acquire Rebate	6%
Protect Environment	3%
Total (multiple responses permitted)	*36*

Table 5-7 shows that 67 percent of measures installed by respondents replaced existing equipment that was fully functioning. Another 26 percent of the equipment was experiencing significant problems, and one respondent (4 percent) indicated that the project replaced a mixed of equipment ranging from non-functional to fully functional. One respondent indicated that only non-functional equipment was replaced. This is curious, because according to the CESB policy manual, the equipment being replaced must be functional for the project to be eligible for incentives through the program.

Table 5-7
Condition of Equipment Replaced

Condition	Percent
Fully Functional	67%
Functioning with Problems	26%
Failed/Did Not Function	4%
Mix of functional, with problems, and not functioning	4%
N/A, Ancillary Equipment (VSD, Controls, etc.)	0%
Total	***27***

The respondents first heard about the CESB program from various sources. As shown in Table 5-8, the most common response was that they learned about it from the EESP that eventually sponsored the project (42 percent). The next most common response, at 38 percent, was that they heard about the program from an SDG&E account executive or through program literature. Self-sponsors were significantly more likely (5 out of 7 responses) to have learned about the program through an account executive. Other responses together made up 19 percent.

Table 5-8
How Customers Learned about the Program

Source	Percent
EESP Project Sponsor	42%
SDG&E Account Exec or Program Literature	38%
Consulting Engineer	4%
Self-knowledge	4%
Business colleague/Professional Association/Tradeshow	4%
Other Word-of-Mouth	4%
Don't Know	4%
Total	***25***

As shown in Table 5-9, half of the respondents heard about the program before they first thought about installing the energy-efficient equipment installed under the program. Only 15 percent heard about the program after they had made the final decision on what equipment to install, and chose to take advantage of the incentives offered. Eleven percent heard about the program after beginning to research equipment, but before the final decision was made. The program may have influenced these participants to choose higher efficiency.

Table 5-9
When Customers Heard about Program

Response	Percent
Before first looked at installing equipment	52%
At the same time	22%
After beginning to research equipment but before final decision	11%
After final decision on what equipment to install	15%
Total	***27***

Customers were also asked to select an option that reflected the role third-party firms played in their decision to submit an application. Responses to this question are shown in Table 5-10 for all interviewees and by sponsorship type. Only seven (7) percent claimed to have developed the project ideas and pursued installation themselves (0 percent of self-sponsors and 11% of customers participating through an EESP. Thirty-seven percent said that a third party was responsible for developing the idea but that they decided on their own to pursue installation, while another 22 percent were convinced by the third party. Thirty-three percent developed the idea but were convinced by a third party to pursue installation. All answers differ considerably when segmented by sponsorship. The role of third parties was surprisingly important for self-sponsoring customers, with third parties involved in all of the eight projects at some level.

Table 5-10
How Customer Decided to Install Energy-Efficiency Equipment

Process Which Led To Installation	EESP-sponsored	Self-sponsored	Percent
Own idea, pursued on our own	11%	0%	7%
Third party's idea, pursued on our own	37%	38%	37%
Own idea, convinced by third party	42%	13%	33%
Third party's idea, convinced by third party	11%	50%	22%
Total	***19***	***8***	***27***

5.2.2 Reported Importance of Program to Implementation Decision

Customers were asked three key questions centering on the role of CESB incentives in their decision to implement the projects included in their program applications. The first two questions phrase the influence of the program and its incentives in terms of their significance or influence (see Table 5-11 and Table 5-12), while the other question is phrased in terms of what they would have done had the incentives not been available (see Table 5-13). Eighty-three percent of respondents indicated that they chose more efficient equipment because of the incentive and 71 percent reported that the incentives had a very significant influence on their decision, but at

the same time, only eight (8) percent would definitely not have installed the project without the program. Seventy-six percent probably or definitely would have installed the projects anyway, though the project schedule and equipment efficiency may have been affected by non-participation.

Table 5-11
Influence of Program on Equipment Efficiency

Influence of Program	Percent
Chose more efficient equipment because of the incentive	83%
Program had no effect on choice of efficiency	17%
Total	***23***

Table 5-12
Significance of Incentives in Decision to Install

Significance of Incentives	Percent
Very significant	71%
Somewhat significant	25%
Somewhat insignificant	4%
Very insignificant	0%
Total	***24***

Table 5-13
Likelihood of Installation without Program

Response	Percent
Definitely would NOT have installed	8%
Probably would NOT have installed	8%
Odds about 50-50 on installation	8%
Probably would have installed	42%
Definitely would have installed	33%
Total	***24***

Customers were asked what type of equipment they would have installed in the absence of the program. Most said that they would have installed equally efficient equipment (52 percent); four (4) percent said that they would rather install less equipment or no equipment at all than install less-efficient equipment (see Table 5-14).

Table 5-14
Type of Equipment Would Have Installed Without the Program

Response	Percent
Probably NOT as efficient	39%
Probably just as efficient	52%
Less equipment	4%
Not Applicable for Measure	4%
Total	***23***

Respondents were also asked when they would have installed the equipment in the absence of the program, with results shown in Table 5-15. Surprisingly, the "Never" responses included four from respondents who indicated that they "probably" or "definitely" would have installed equipment without the help of the program. The most common response was "Don't Know."

Table 5-15
Timing of Installation without Program

Timing	Percent
Within six months	26%
Six months to a year	0%
One to two years	9%
Two to three years	4%
Three to four years	4%
Four or more years	0%
Never	26%
Don't know	30%
Total	***23***

5.3 Analysis of Net-To-Gross (Free-Ridership)

This subsection presents the methodology used to calculate Net-To-Gross Ratios (NTGRs) for the 2004-2005 CESB Programs, and presents the NTGR for the program. Note that the NTGRs reported here are based only on free-ridership; that is, they do not include any adjustments for participant or non-participant spillover (thus, the NTGR equals 1.00 minus the free-ridership rate).

5.3.1 Methodology

The NTGR is an estimate of the percentage of the gross savings that are attributable to the CESB program. The method used to calculate the ratio is based on self-reported information

provided by participating customers and EESPs. Customer self-reported information has been used extensively as part of previous utility program impact evaluations for programs that require site-specific net-to-gross estimates. The method does not adjust for participant or non-participant spillover.

The estimation of free ridership based on the customer surveys was complex, involving questions about when the respondent learned about the program, the influence of the program on the efficiency decision, whether they would have retrofit the equipment without assistance from the program, and when the retrofit would have occurred without program assistance. The following five steps describe the process for estimating free ridership from the survey responses.

STEP 1

Customers were first screened according to ***when they made their final equipment decision relative to when they heard about program incentives***. If the final decision was made BEFORE learning about program incentives, the customer was determined to be a free rider and the free ridership factor for this response (FR1) was set to 1.00. No further questions were asked of these respondents. If any other response was given, the initial FR score was set to 0.00, and the final FR score would be determined based solely on the remaining questions in the free ridership battery. Table 5-16 presents the distribution of responses for self-sponsors and EESP-sponsored customers with the assigned free ridership factor.

Table 5-16
Assignment of Free Ridership Factors for Timing of Learning about Available Incentives (2004-2005 CESB)

Timing	FR1	Timing of Decision—Self-sponsors (n=8) (SS4)	Timing of Decision—EESP-sponsored (n=19) (SP5)
BEFORE they first looked at installing the equipment	0	63%	47%
At the same time	0	0%	32%
After they first looked at installing the equipment but before the final decision	0	13%	11%
After the final decision was made	1	25%	11%

STEP 2

Respondents were asked two questions about the influence of the program on their efficiency decision. The first question asked ***whether the organization chose more efficient equipment because of the program***; the second asked ***what efficiency would have been chosen without program assistance***. Essentially the same question framed differently, the questions nonetheless received different answers from many respondents. Table 5-17 shows the breakdown of responses for the first question by customer type and Table 5-18 does the same for the second question.

Table 5-17
Influence of Program on Choice of Energy Efficiency (2004-2005 CESB)

Significance	Program influence EE— Self-sponsors (n=6) (SS5)	Program influence EE — EESP-sponsored (n=17) (SP6)
Chose more efficient equipment because of the incentive	50%	94%
Program had no effect on choice of efficiency	50%	6%

Table 5-18
Energy Efficiency Choice in Absence of Program (2004-2005 CESB)

Significance	EE choice without Prog.— Self-sponsors (n=6) (SS8)	EE choice without Prog. — EESP-sponsored (n=17) (SP9)
Probably not as efficient	33%	41%
Probably just as efficient	67%	47%
Not applicable for measure	0%	6%
Less energy efficient equipment would have been installed (e.g. fewer sites) of the same efficiency	0%	6%

Table 5-19 shows the frequency of response combinations for both groups together. Eight of the EESP-sponsored customers and one of the self-sponsoring customers split their responses to the two questions (*"in every case, I chose more efficient equipment because of the program BUT without the program I would have chosen equipment that was just as efficient"*).

Table 5-19
Frequency of Combined Responses to Energy Efficiency Questions

	Chose more efficient equipment because of the incentive	Program had no effect on choice of efficiency
Probably not as efficient	38%	0%
Probably just an efficient	38%	17%
Not applicable for measure	4%	0%
Less energy efficient equipment would have been installed (e.g. fewer sites) of the same efficiency	4%	0%

Table 5-20 shows the free ridership factor assigned for each combination of responses. For the split responses, more weight was given to the first question, since responses to the second question may have been biased by the desire of the individual to be seen as environmentally conscious. "Not applicable for measure" indicated that there was no choice of efficiency; either high-efficiency equipment would have been installed or none at all (e.g. carbon monoxide sensors for ventilation control). These received a free ridership factor of 1.00.

Table 5-20
Assignment of Free Ridership Factors (FR2) for Energy Efficiency Choice, Based on Combined Response (2004-2005 CESB)

FR2	Chose more efficient equipment because of the incentive	Program had no effect on choice of efficiency
Probably not as efficient	0.0	0.5
Probably just an efficient	0.2	1.0
Not applicable for measure	1.0	1.0
Less energy efficient equipment would have been installed (e.g. fewer sites) of the same efficiency	0.5	0.5

STEP 3

Respondents were asked ***how likely they were to have retrofitted the equipment (with standard or efficient equipment) without the assistance of the program***. Table 5-21 presents the distribution of responses for self-sponsors and EESP-sponsored customers with the assigned free ridership factor.

Table 5-21
Assignment of Free Ridership Factors for Likelihood to Retrofit (2004-2005 CESB)

Significance	FR3	Likelihood to Retrofit— Self-sponsors (n=8)	Likelihood to Retrofit — EESP-sponsored (n=19)
Definitely would not have installed	0	33%	0%
Probably would not have installed	0.25	0%	11%
Odds were about 50-50 on installing	0.5	--*	11%
Probably would have installed	0.75	17%	50%
Definitely would have installed	1	50%	28%

*The 50-50 response was not offered on the self-sponsor survey.

STEP 4

Next, the issue of deferred free-ridership was considered. ***Deferred free riders are customers who, in the absence of the program, would have eventually installed exactly the same equipment that was installed through the program***. However, the effect of the program could have been to accelerate equipment installation and its subsequent savings. Responses to the timing questions (SS9a and 9b and SP10a and 10b) are summarized in Table 5-22.

Table 5-22
Forecasted Installation Date

Forecasted Installation of Same Equipment	FR4	Forecasted Installation— Self-sponsors (n=6)	Forecasted Installation — EESP-sponsored (n=17)
At the same time	1	50%	18%
Within 6 months	1	0%	0%
Six months to one year	0.9	0%	0%
1 to 2 years	0.75	0%	12%
2 to 3 years	0.5	17%	0%
3 to 4 years	0.25	17%	0%
4 or more years	0	0%	35%
Don't Know	0.25	17%	35%

STEP 5

The four free ridership factors developed in Steps 1 through 4 were weighted to create an overall free ridership score. Certain key survey questions become unimportant or hypothetical based on the results of other questions. For example, if a respondent "definitely would not" have retrofitted equipment without the program incentive, the questions about efficiency choice and timing of the installation are purely hypothetical, and should be given little, if any, weight. Timing is irrelevant if the respondent would have chosen standard efficiency equipment.

Weights for the four free ridership factors are determined sequentially, beginning with FR1 (the timing of the equipment decision relative to learning about the program), followed by FR2 (efficiency choice), FR3 (likelihood of retrofit), and finally FR4 (timing of retrofit in the absence of program incentives). The weight assigned to FR1 determines how much weight will be allocated between FR2, FR3 and FR4, the weight assigned to FR2 determines how much weight remains to be allocated between FR3 and FR4, etc. At each step, the previously determined weights (W1, W2, etc.) must be factored in.

The logic and specific weights are described below:

- If a respondent reported that they had already made the final decision about what equipment would be installed prior to learning about the program (FR1=1), the weight for FR1 was set to 1.00, and the remaining free ridership factors carry no weight. For any other response, the weight for FR1 was set to 0.00 and the free ridership would be determined by FR2, FR3 and FR4.

Table 5-23
Weight to FR1, Timing of Equipment Decision (2004-2005 CESB)

Timing	Weight to FR1 W1	Weight to FR2, FR3 and FR4
After the final decision was made	1	0
Any other timing	0	1

- Because the choice of efficiency in the absence of the program is paramount in determining free ridership, this factor was examined first in allocating weights between FR2, FR3, and FR4. Table 5-24 shows the weights assigned to FR2, the efficiency choice factor.

Table 5-24
Weight to FR2, Equipment Efficiency Choice (2004-2005 CESB)

Efficiency Choice Responses (two questions)	Weight to FR2 W2	Weight to FR3 and FR4
Chose more efficient because of program/without program equipment would probably not have been as efficient	0.9*(1-W1)	0.1*(1-W1)
Program no effect on choice of efficiency/without program equipment would have been just as efficient	0.1*(1-W1)	0.9*(1-W1)
Chose more efficient because of program BUT without program equipment would have been just as efficient	0.75*(1-W1)	0.25*(1-W1)
Less energy efficient equipment would have been installed (e.g. fewer sites) of the same efficiency	0.5*(1-W1)	0.5*(1-W1)
Not applicable for measure (e.g. VSD)	0*(1-W1)	1*(1-W1)

- Likelihood to retrofit equipment was evaluated next, because timing is irrelevant if no retrofit would have taken place. Table 5-25 shows the weights assigned to FR3, the likelihood of retrofit factor.

Table 5-25
Free Ridership Factor Weights

Likelihood to Retrofit	Weight to FR3 W3	Weight to FR4 W4
Definitely would not	1*(1-W1-W2)	1-W1-W2-W3
Probably would not	0.75*(1-W1-W2)	
Odds 50-50	0.5*(1-W1-W2)	
Probably would	0.25*(1-W1-W2)	
Definitely would	0*(1-W1-W2)	
Don't know	0.33*(1-W1-W2)	

- Once the weights for FR1, FR2 and FR3 have been determined, the weight to FR4 is determined as the residual, 1-W1-W2-W3, so that the weights sum to 1.

The overall free ridership score for each customer was calculated as the weighted average of the four free ridership factors

$$FR = W1 \cdot FR1 + W2 \cdot FR2 + W3 \cdot FR3 + W4 \cdot FR4$$

In addition, all cases of inconsistency or response discrepancy were reviewed to ensure that the final free ridership scores were as accurate and reliable as possible. Minor adjustments, if necessary, were made based on other responses in the net-to-gross sequence.

In addition to looking at the customer responses, we looked at the EESP surveys for an estimate of free ridership. We surveyed 9 of 15 EESPs, representing over 90 percent of the incentives paid to EESP-sponsored projects, which represents a much more robust sample than the EESP-sponsored customers surveyed do.

EESPs were asked about the effect of CESB incentives on their marketing efforts, compared to no incentives at all, and, if applicable, compared to SPC. If the EESP did not participate in SPC, they were asked to estimate how many of their ESB projects they would have been able to sell is the incentives were half as large. The results of the EESP survey are shown in Table 5-26.

Table 5-26
Free and Subsidized Ridership: EESP % of CESB Projects They Could Have Sold with Lower/No Incentives (2004-2005 CESB)

Timing	% with no incentives (n=8)	% with SPC or 50% reduction (n=8)
Weighted	1%	31%
Unweighted	6%	43%

The weighted "no incentives" result should approximate the free ridership rate, if EESP responses were accurate. The two EESPs with the largest share of incentives (together more than 60 percent) reported that they would have been able to sell very few of the projects without the program incentives, 0 percent and 2 percent. Given the range of customer sites included in their projects, which included small industrial, grocery chains, military sites, large hotels, and others types of firms that would not typically be considered hard to reach, these estimates seem implausibly low (the customer surveys suggest 27 and 38 percent). Other EESP with smaller shares of incentive dollars reported extremely low values, citing the specific target businesses, in one case, schools, and in the other, a county government. Two of the EESPs reported that

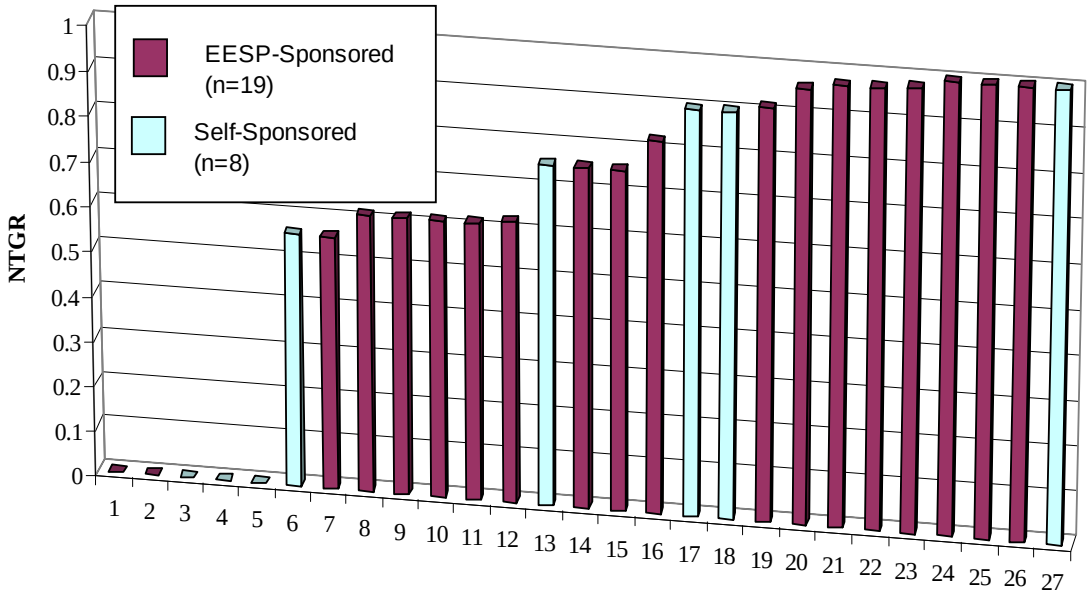
this was the first time they had done business in SDG&E's service territory. In these cases, the low free ridership estimate may, indeed, be accurate.

The SPC/reduced incentive values were collected as a metric for how often CESB may be "overpaying" for efficiency, in the sense that a lower level of incentives might have been sufficient to induce the project. Because the CESB incentives are high—up to 70 percent of measure cost for contracts signed in 2004 and up to 100 percent of measure costs for contracts signed in 2005—this is an issue of concern, particularly since CESB's target market (large non-residential) overlaps significantly with SPC.

5.3.2 Estimate of the 2004-2005 Net-To-Gross Ratio

Because we do not analyze spillover effects, the net-to-gross ratio is simply calculated as 1.00 minus the free ridership score (NTGR = 1.00 - FR). NTGRs were calculated for each customer project in the sample. These were then weighted by share of kWh savings to estimate the overall NTGR. The range of NTGRs calculated across the sampled customers is shown in Figure 5-2.

Figure 5-2
Range of NTGRs across Sampled Customers/Projects



The EESP survey represented a much larger share of incentives (90 percent of incentives for EESP-sponsored projects vs. eight (8) percent) than the self-sponsored projects. The survey approach differed significantly from the self-sponsor survey, which made it difficult to combine the results due to lack of compatibility. The EESP survey also resulted in very high NTG estimates for the EESP-sponsored market segment (particularly once weighted by the EESP's share of kWh savings), significantly higher than any of the estimates based on customer responses, raising questions on the accuracy or validity of the responses to EESP surveys. To properly frame the estimate, we based our calculations on the customer surveys.

We considered weighting the customer survey responses by incentives for each customer site but rejected the approach: EESP-sponsored respondents represent eight (8) percent of the total measure incentives for EESP-sponsored projects. Instead, two other weighting schemes were considered:

- Organize results by sponsoring EESP and weight results by the EESP's share of electricity savings. Because EESPs differ in the types of measures they install and the types of customers they tend to focus on, we believe that NTGRs may also vary systematically by vendor. Surveyed EESP-sponsored customers represented 7 different vendors (of the total 15 who participated in 2004-2005), representing 87% of measure savings for EESP-sponsored projects. In developing the weights, each vendor's share of savings was divided equally among their surveyed projects (not weighted by the size of the projects). That is, free ridership scores were weighted by the vendors' share of electricity savings but not by the relative size of the projects for any given vendor.

- Weight results by end-use share of incentives. CESB projects are categorized as gas, HVAC, lighting, refrigeration or other, with lighting representing almost half of contracted incentives. This weighting was explored because free ridership may vary by the type of measure installed.

Because there was a greater uniformity among projects by the same sponsor than among projects in the same measure category (HVAC projects range from HVAC tune-ups to complex custom retrofits), the NTGR calculations were based on sponsor weightings.

NTGRs were calculated for EESP-sponsored customers and self-sponsors independently, as well as for CESB participants overall. We explored both using measure savings and using M&V savings for the NTGR weights. Unfortunately, only a few of the self-sponsored projects had verified savings at the time of the surveys and we were unable to interview most of them. This

sharply biased the self-sponsor NTGR upward (0.9 compared to 0.5 when weighted by measure savings). Therefore, measure savings (*ex ante* savings) were used for the weighting factors. Table 5-27 shows the results. The 2004-2005 CESB NTGRs were higher for EESP-sponsored customers (0.73) than for self-sponsored customers (0.50). This may reflect the fact that customers that self-sponsor have a higher level of knowledge about energy efficiency and available incentives, compared to EESP-sponsored customers, which include large numbers of small businesses (restaurants, retail, etc.).

Table 5-27
Net-To-Gross Ratios for the 2004-2005 CESB Program

Estimate	EESP-sponsored Customer NTGR	Self-Sponsor NTGR	Overall NTGR
N	19	8	27
NTGR weighted by measure savings	0.73	0.50	0.64

5.4 Process-Related Issues

In this subsection, we present responses to questions concerning the implementation of the 2004-2005 CESB program. These questions were asked only of EESP-sponsored customers, and were asked on an open-ended basis. In some cases, we have post-coded responses, while in others we use direct (un-ascribed) quotations in order to allow respondents to speak in their own voices. The survey focused on what respondents liked and disliked about the program.

5.4.1 Most Liked and Disliked Aspects of the Program

We asked customers to express what they liked and disliked about the program. The ranges of responses were categorized and are shown in Table 5-28 and Table 5-29. Sixty-two percent of the respondents cited the main benefit as saving energy or money. Equal numbers of respondents mentioned how smooth the process was and identified non-energy benefits of the equipment that was installed (e.g. brightness or lifetime of lighting equipment, employee comfort).

Table 5-28
Best-Liked Features of CESB

Most-Liked Features of CESB	Percent
Saved money/energy	62%
Smooth process	19%
Non-energy benefits of equipment	19%
Total (multiple responses permitted)	***21***

Forty-eight percent of respondents indicated that there was nothing about the program that they disliked. Of the respondents who identified any dislikes about the program, the most common responses were the way that the program was marketed. They felt that the program needed to "get more information out." The second most common complaint were process issues, such as paperwork, coordination between SDG&E and the project sponsor, establishing vendor and product guidelines, and getting process information. Ten percent were dissatisfied with the equipment installed. One respondent mentioned a problem with one of the vendors. Another suggested that CESB should "start allowing rebates on much larger custom jobs," suggesting a lack of understanding of the program on the part of the respondent (since CESB does accept custom jobs with no fixed limit on project size).

Table 5-29
Most Disliked Features of CESB

Most-Disliked Features of CESB	Percent
Nothing	48%
Marketing	19%
Process Issues	14%
Equipment Installed	10%
Program Structure	5%
Vendor Issues	5%
Total (multiple responses permitted)	***21***

6. Appendix A: CPUC Reporting Table

Program ID:	1320-04							
Program Name:	2004-2005 Local Nonresidential Retrofit Customer Energy Savings Bid Program - Procurement							
	Year	Calendar Year	Gross Program-Projected MWh Savings	Net Evaluation Confirmed Program MWh Savings	Gross Program-Projected Peak MW Savings	Net Evaluation Confirmed Program Peak MW Savings	Gross Program-Projected Therm Savings	Net Evaluation Confirmed Program Therm Savings
	1	2004	32,859	2,793	5.9720	0.4747	125,830	0
	2	2005	151,616	11,686	26.1443	1.7678	325,254	34,083
	3	2006	151,616	44,479	26.1443	8.2364	325,254	62,184
	4	2007	151,616	59,758	26.1443	10.5568	325,254	63,798
	5	2008	151,616	59,826	26.1443	10.5615	325,254	63,798
	6	2009	151,616	59,826	26.1443	10.5615	325,254	63,798
	7	2010	140,406	56,626	24.7764	10.1968	325,254	63,798
	8	2011	140,406	46,156	24.7764	7.7427	325,254	51,540
	9	2012	132,567	46,156	23.9117	7.7427	325,254	51,540
	10	2013	83,004	46,156	14.2536	7.7427	162,696	51,540
	11	2014	81,576	45,960	14.2216	7.6999	161,466	51,540
	12	2015	81,576	45,569	14.2216	7.6145	161,466	51,540
	13	2016	81,438	45,569	14.2216	7.6145	161,466	51,540
	14	2017	80,011	45,569	14.2216	7.6145	161,466	51,540
	15	2018	80,011	38,837	14.2216	6.5871	161,466	51,540
	16	2019	74,859	35,408	13.6076	6.0967	161,466	51,540
	17	2020	53,234	29,673	8.9054	5.3419	161,466	22,686
	18	2021	8,666	22,157	1.1477	4.0571	161,466	16,916
	19	2022	5,778	13,287	0.7805	1.8598	161,466	16,916
	20	2023	5,778	6,596	0.7805	0.6921	161,466	12,072
	TOTAL	**2004-2023**	**1,840,250**	**762,087**	**320.7408**	**130.7618**	**4,505,217**	**883,912**