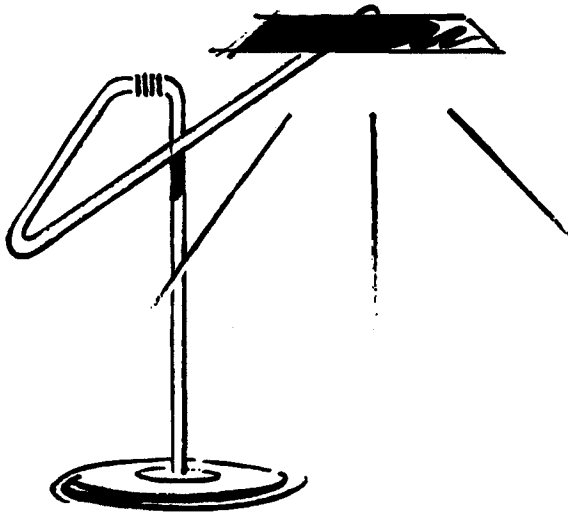**SDG&E**

San Diego Gas & Electric
Marketing Programs & Planning
8306 Century Park Court
San Diego, California 92123

1996 Residential Appliance Efficiency Incentives Program
High Efficiency Lighting

First Year Load Impact Evaluation

March 1998

Study ID No. 983

Table of Contents

Section 1

Executive Summary

The development of improved fluorescent lighting as an alternative to standard incandescent lighting has expanded the opportunities for energy usage reduction. Compact fluorescent lights provide a method of direct replacement to incandescent bulbs with the benefits of lower watt usage, longer lamp life, and quality of light which more closely resembles that of incandescent light bulbs.

The Compact Fluorescent Lighting Program strives to educate and increase consumer awareness of this energy efficient technology and to encourage installation of compact fluorescent lamps (CFL) or bulbs and fixtures. The program is designed to help stimulate enough demand to make it more economical for retailers to stock and sell these devices.

Gross Load Impact Analysis

The gross load impact analysis of the 1996 Residential High Efficiency Lighting Program was conducted by SDG&E staff.

Data from the following sources were used to estimate the average wattage replaced by these CFL products:

1. direct mail response ("bounceback") cards from CFL purchases (bulbs, fixtures and replacement lamps) returned during the program year 1996;
2. field operations lighting forms and the replacement bid program database.

The estimated replaced wattage is 59.58 watts per CFL.

Data from the Peakday survey was used to estimate the installation rate, hours of operation and on-peak usage. The installation rate estimated from the Peakday survey is 81.3%. The estimated hours of operation is approximately 3.9 hours per day. The estimated annual gross energy savings per CFL are **84.73 kWh**.

The Peakday survey conducted last September 23, 1997 showed that approximately 20% of those surveyed were using the CFL products at the time of SDG&E's summer system peak. This results in an estimated gross demand savings of **0.0098 kWh per CFL**.

Net-to-Gross Analysis

The net-to-gross analysis of the 1996 Residential High Efficiency Lighting Program was conducted by Hagler Bailly Consulting.

The net-to-gross methodology consisted of a survey of 1996 program participants to determine free-ridership, that is, the extent to which SDG&E's program influenced their CFL purchase decisions and a survey of nonparticipants selected from around the country (less the state of California) to estimate program spillover. The program free-ridership is estimated to be 14.27%. It was determined that the spillover analysis did not provided reliable results. Therefore, the results from the spillover analysis were ignored. The net-to-go-gross ratio recommended by this study is **85.73%**.

Organization of This Report

The remainder of this report is organized as follows:

Section 2—Program Overview: This section describes the various elements of SDG&E's PY96 Residential High Efficiency Lighting Program.

Section 3—Gross Load Impact Analysis: This section discusses the methodology used to estimate the first year gross load impacts.

Section 4—Net-to-Gross Analysis by Hagler Bailly Consulting: This section presents the net-to-gross analysis conducted by Hagler Bailly Consulting.

Appendices—These sections contain all the appendices referenced in the report and the M&E Protocols Reporting Requirements Tables 6 and 7.

Section 2

Program Overview

Program Description

The development of improved fluorescent lighting as an alternative to standard incandescent lighting has expanded the opportunities for energy usage reduction. Compact fluorescent lights provide a method of direct replacement to incandescent bulbs with the benefits of lower watt usage, longer lamp life, and quality of light which more closely resembles that of incandescent light bulbs.

The Compact Fluorescent Lighting Program strives to educate and increase consumer awareness of this energy efficient technology and to encourage installation of compact fluorescent lamps (CFL) or bulbs and fixtures. The program is designed to help stimulate enough demand to make it more economical for retailers to stock and sell these devices.

The program's product line continued to be comprised of modular, high power factor/ low harmonic distortion lamps, which provides users with a higher quality product. During the year, the product line was expanded to include compact fluorescent replacement lamps and recessed downlights.

Several channels of distribution were used for disseminating lamps to customers. The primary channel was through retailers, with the secondary channel through SDG&E field operations and the DSM Replacement Bid Pilot programs.

SDG&E CFL Retail Program

SDG&E provides rebates to the CFL manufacturer (Lights of America), who, in turn, passed the savings on through their product distribution chains, thus providing substantial cost reduction to retail customers. CFL products included 30-watt interior hard-wired ceiling fixtures, 13-watt bulbs, 18-watt bulbs, 20-watt bulbs, 27-watt bulbs, and 30-watt bulbs. The CFL bulbs were modular consisting of a lamp and an electronic ballast. In addition, replacement lamps for each of the bulbs were also available.

SDG&E Field Operations ("Internal" Distribution)

CFL bulbs were also provided to SDG&E customers through its field operations. Usually, the bulbs were provided to customers who received home audits from SDG&E personnel. CFL bulbs were also distributed at SDG&E-sponsored community events. The same wattage bulbs offered through the retail program were also available through field operations.

DSM Replacement Bid Pilot ("SESCO" Program)

The DSM Replacement Bid Pilot is the result of the CPUC's goal to test DSM bidding. This pilot replaced SDG&E's Residential Appliance Efficiency Incentives Program originally proposed in SDG&E's 1993 General Rate Case. Under CPUC guidelines and requirements for this pilot, SDG&E contracted with SESCO, Inc. in 1994 to conduct programs for SDG&E residential customers. The SESCO program offers free conservation improvements to selected homes. The pilot programs was be implemented over a two-year period (ending March 1, 1997). In 1996, SESCO provided comprehensive weatherization treatment to 3,909 homes. The measures installed by SESCO, at no charge to the customer, included weatherstripping, caulking, low-flow showerheads, water heater and pipe wraps, compact fluorescent lamps, and ceiling insulation. In addition, SESCO also installed compact fluorescent lamps and low-flow showerheads in an additional 5,868 homes that did not receive weatherization treatment. SESCO provided the following bulbs: 17 watt and 22 watt integral bulbs (the lamp and ballast are a single unit), and 22 watt and 30 watt modular bulbs.

SESCO marketed their program to potential participants with a direct mail piece. As follow-up, SESCO telephoned or mailed additional letters to customers if they did not receive a response to the direct mail piece.

The following table shows the distribution of compact fluorescent lamps (CFL) and fixtures by distribution method.

Table 1

Distribution of Compact Fluorescent Lamps and Fixtures

Method of Distribution	Number of Lamps
Retail Program—bulbs	206,773
Retail Program--fixtures	83,394
Other Internal Distribution Methods	40,943
Bidding Program	78,869
Total	**409,979**

Section 3

Gross Load Impact Analysis

Data Collection

Bounceback Card Database

To supply SDG&E with a database of participants for the retail compact fluorescent program, SDG&E designed a direct mail response ("bounceback") card requesting customer name, address, and phone number along with data on the bulb purchase. Lights of America affixed a bounceback card to each compact fluorescent bulb shipped in conjunction with the SDG&E subsidy. (See Appendix A for a copy of the bounceback card.) Customers returned bounceback cards to SDG&E for inclusion in the database. A total of 19,740 CFL bulbs and 1,160 CFL fixtures purchased in 1996 are documented in the database. Replacement wattage reported in these cards was used to modify the wattage savings.

This database served as the sampling frame for selecting the survey participants in the Peakday Survey. Some demographic data was collected in this survey and compared to the demographic information in the MIRACLE XII for customers who own CFL bulbs.[1] The demographics for the survey respondents are comparable to those in MIRACLE XII (November 1995). This suggests that self-selection bias in the bounceback card database is minimal. A more random method of sampling would have been excessively expensive, given the penetration rate of 18% for CFL bulbs in the general population.

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[1]Home Energy Survey for 1993, San Diego Gas & Electric, February 1994, pp. 286-288.

SDG&E Field Operations CFL Database

Field personnel who provided residential customers with CFL bulbs filled out forms that provided installation information (number of bulbs provided to customer, number of bulbs installed and wattage replacement). And customer information. This form was also used to document bulbs distributed at various company-sponsored community events. A total of 44,208 forms were entered into the CFL database. Replacement wattage reported in these forms was used to modify the wattage savings.

Peakday Survey

During the month of October 1997, a telephone survey of residential customers who had purchased (retail) and received (field operations) CFL bulbs was conducted. This survey was used to estimate the number of CFL bulbs installed that were turned on during SDG&E's summer peak hour.[2] A hot day that was comparable to the peakday was selected to represent that day. A simple random sample of CFL fixtures purchasers (n=338) and of CFL bulb purchasers (n=1,499) was extracted from the Bounceback Card database. Another random sample of residential customers (n=1,500) was also extracted form the Field Operations CFL database. The sample was then randomly sorted and assigned sequential survey numbers. CIC Research then conducted the phone survey with the following instructions: (1) CIC was to begin conducting the phone surveys within one-half hour of being notified by SDG&E that a peak demand period was imminent; (2) approximately 350 bulb purchasers, 120 fixture purchasers, and 275 field operations customers were to be contacted in the listed order; (3) at least three attempts were to be made to contact each listed name, after that, the next name after the specified number was contacted and so on down the list; (4) complete records for each contact attempt were to be kept; (5) during the three days immediately following the peak demand period, numerous attempts were to be made to contact customers (first sample identified customers only) who could not be reached on the peakday. The interviewer always requests to speak with the person most familiar with the CFL bulbs. This was to minimize the potential for the respondent not being familiar with the term "compact fluorescent bulbs."

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[2]SDG&E's 1997 was on September 4 at 3:30pm.

Data collected included (1) number of purchased/received CFL bulbs that are currently installed, (2) number of CFL bulbs turned on October 1, 1997 at 3:00pm, (3) number of hours CFL bulb/fixture is turned on a day, (3) age level of respondent (greater than or less than 55 years of age), and (4) annual income level of respondent (greater than or less than $25,000). A copy of the survey instrument is included in Appendix A.

Bounceback Card Results

Average Watts Reduced Per CFL

The value for the average Watts reduced per lamp was derived using SDG&E's program databases to estimate the average Watts reduced by lamp. The database contained the wattage of the basecase lamp, usually an incandescent lamp, and the CFL. Information on the replaced lamp was obtained through customer bounceback cards if the CFL was purchased through retail outlets, or from SDG&E personnel that distributed CFLs to customers as documented in the field operations database. The SESCO program results reported actual wattage reductions, therefore, no further adjustments were made.

An average Wattage reduction for each CFL category was calculated. The total Watts reduced for each CFL category was calculated by multiplying the per lamp Watt reduction by the quantity of each type of CFL and the type of delivery mechanism. Table 2 shows the total Watts reduced for each installed CFL Wattage category for Program Participants. Table 3 shows the average Watts reduced per Participant CFL, and is based on the data from Table 2.

Table 2

Total Watts Reduced

SDG&E's 1996 CFL Program Participants

CFL Watts	Average Removed Watts		Average Watts Reduced			Total Bulb Distribution			Total Watts Reduced		
	Internal	Retail	Internal	Retail		Internal	Retail	SESCO	Internal	Retail	SESCO
13	73.95	68.52	60.95	55.52		17,115	56,962		1,043,159.3	3,162,530.2	
18	82.58	83.59	64.58	65.59		18,293	74,103		1,181,361.9	4,860,415.8	
20		80.00		60.00			251			15,060.0	
27	87.81	99.20	60.81	72.2		2,812	42,774		170,997.7	3,088,282.8	
30	98.00	79.52	68.00	49.52		2,723	116,077		103,474.0	5,748,133.0	
Total						40,943	290,167	78,869	2,498,992.9	16,874,421.9	5,054,220.0

Table 3
Average Watts Reduced Per CFL
SDG&E's 1996 CFL Program
Participants

Total Watts reduced	24,427,634.8
Total number CFL in 1994	409,979
Average Watts reduced per CFL	**59.58**

Installation Rates and Hours of Operation

The percentage of residential purchasers who reported that they had installed their cfl bulbs was **92.7%**, with an average estimated daily usage of **5.36** hours. Bounceback card responses represent purchases of bulbs and fixtures at a subsidized cost. It can be surmised that the required purchase of a bulb, even at a lower cost, provides additional incentive to install. It is also suspected that customers have a tendency to return cards when bulbs are installed rather than prior to installation.

The SESCO surveyed the homes which received CFLs through their program to verify installation rates. CFLs that were removed by the homeowner were not included in the calculation of benefits. Therefore, the installation rate for the SESCO-distributed CFLs is **100%**.

Table 4 gives the installation rates and hours of use reported in bounceback cards.

Table 4

Installation Rate and Hours of Operation

Installation Rates	
Installed	19,376
Total Responses	20,900
Installation Rate	92.7%
Hours of Operation	
Total Daily Hours Reported	82,732.15
Total Responses	15,448
Average Hours of Operation	5.36 hrs./day

Peakday Survey Results

Retention Rate

The Peakday Survey conducted in September 1997 inquired whether the CFL products purchased or received were still installed. This information is used to derive the retention rate for these products. The survey responses are weighted by the number of CFLs distributed through the retail and internal channels. Table 5 shows the survey results.

Table 5

Peakday Survey Retention Rates

	No. of CFL Products	No. Installed	Retention Rate	Weight
Internal	516	380	73.6%	0.124
CFL Bulbs (Retail)	1,631	1,259	77.2%	0.624
CFL Fixtures (Retail)	431	411	95.4%	0.252
Overall Retention Rate			**81.3%**	

Hours of Operation

The Peakday Survey also inquired as to the number of hours the CFL products purchased or received were used on a daily basis. This information is used to derive an updated hours of operation number. The survey responses are weighted by the number of CFLs distributed through the retail and internal channels. Table 6 shows the survey results.

Table 6

Peakday Survey Hours of Operation

	No. of CFL Products	No. Hours	Avg Hrs./Day	Weight
Internal	203	830.1	4.089	0.124
CFL Bulbs (Retail)	295	1,229.7	4.169	0.624
CFL Fixtures (Retail)	112	349.9	3.124	0.252
Overall Hours of Operation per Day			**3.896**	

System Peak Coincident Factor

Approximately twenty percent of the respondents who participated in the Peakday Survey reported that their installed CFL products were turned on during SDG&E's summer system peak hour. Table 7 shows the results of the survey for the retail and field operations respondents.

Table 7

Peakday Survey Number of CFLs Operating during System Peak

	No. of CFL Products	Turned On	% Turned On	Weight
Internal	194	27	17.26%	0.124
CFL Bulbs (Retail)	292	60	12.82%	0.624
CFL Fixtures (Retail)	109	25	57.80%	0.252
Overall Retention Rate			**20.33%**	

Gross Energy Savings

The gross annual energy savings per CFL were estimated using the equation for energy savings shown in Equation 1.

Equation 1

Gross Energy Savings per CFL

$$kWh_{Saved} = [Watts_{Reduced\ Per\ Lamp}] \times [Hours\ of\ Operation\ Per\ Day] \times [\frac{1\,kWh}{1000\ Watts}] \times [Installation\ Rate] \times 365\ days$$

$$= 59.58\ Watts \times 3.896\ hours\ per\ day \times 0.001 \times 0.813 \times 365\ days$$

$$= \mathbf{84.73\ kWh\ per\ cfl}$$

Demand Impacts

The gross demand reduction per CFL was estimated using the basic formula for demand reduction shown in Equation 2. The gross demand reduction was estimated for the individual CFL.

Equation 2

Gross Demand Savings per CFL

$$kW_{Peak\ Reduced} = [Watts_{Reduced\ Per\ Lamp}] \times [Peak\ Coincident\ Factor] \times [\frac{1\,kW}{1000\ Watts}] \times [Retention\ Rate]$$

$$= 59.58\ Watts \times .2033 \times 0.001 \times 0.813$$

$$= \mathbf{0.0098\ kW\ per\ cfl}$$

Section 4

Net-to-Gross Analysis
by
Hagler Bailly Consulting

**Residential Appliance Efficiency
Incentives Program:
High Efficiency Lighting
1996 First Year Statewide Load Impact Study
Net-To-Gross Analysis**

Final Report

SDG&E Study ID #: 983

Prepared for:

San Diego Gas & Electric and Pacific Gas & Electric Company[*]

Prepared by:

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February 25, 1998

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* The net-to-gross ratio developed in this study (SDG&E Study ID #: 983) does not apply to PG&E's PY 1996 High Efficiency Lighting Program. In PY 1996, high efficiency lighting measures rebated through PG&E's Residential Appliance Efficiency Incentives Program were offered as part of PG&E's Multifamily Property Direct Incentives Program. The Program provides incentives for a variety of energy efficiently measures for common-use areas of multi-family buildings. The Multifamily Property Direct Incentives Program is sufficiently different from the CFL education, coupon, or direct-install approaches discussed in the present study to warrant a separate study, including a separate net-to-gross analysis. The results of PG&E's study are reported in *Impact Evaluation of Pacific Gas & Electric Company's Residential Appliance Efficiency Incentives Program: High Efficiency Lighting 1996 First Year Load Impact Study*, PG&E Study ID # 372. Prepared by Xenergy, Inc. 1998.

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LIST OF FIGURES

CHAPTER 1
EXECUTIVE SUMMARY

This report presents the results of Hagler Bailly's net-to-gross analysis of the 1996 Compact Fluorescent Lighting (CFL) Program of San Diego Gas & Electric (SDG&E).

1.1 SUMMARY OF METHOD AND RESULTS

The methodology employed in this study was in compliance with the requirements specified in "Protocols and Procedures for the Verification of Costs, Benefits, and Shareholder Earnings from Demand-Side Management Programs" ("Protocols"), as adopted by California Public Utilities Commission Decision 93-05-063, revised January 1997, pursuant to Decisions 94-05-063, 94-10-059, 94-12-021, 95-12-054, and 96-12-079.

Several steps were taken in preparing the net-to-gross estimate including examining possible spillover effects. These steps are described in detail in Chapter 2, the results are presented in Chapter 3, and a discussion of the results and methodological issues is presented in Chapter 4.

The final net-to-gross ratio for SDG&E's 1996 CFL program was determined based on participants' self-reported responses in a free-rider survey. A total of 206 participants (who purchased a total of 950 CFLs) were surveyed and asked a number of questions to determine the extent to which the program discount influenced their CFL purchase decisions. Our approach to determining the rate of free ridership was based on participants' self-reported responses and was consistent with the Protocols and with the California DSM Advisory Committee (CADMAC) *Quality Assurance Guidelines* regarding procedures for using self-report methods. For example, we included "set-up" questions which were used to guide respondents through a process of establishing benchmarks against which to remember the decision making process. In addition, our survey instrument also made use of multiple questionnaire items to measure free-ridership and address inconsistencies.

The free ridership rate was found to be 14.27%, which leads to a net-to-gross ratio of 0.8573.

1.2 REPORT ORGANIZATION

This chapter has provided a brief summary of the results of our net-to-gross analysis for CFLs. A complete description of the methods used to determine the net-to-gross ratio is presented in Chapter 2. The results are presented in Chapter 3. Chapter 4 contains a discussion of the methods

and results. Appendix A contains the M&E Protocols Table 6, Appendix B contains the M&E Protocols Table 7, and Appendix C contains a copy of the free rider survey instrument.

The reader is encouraged to refer to the *Residential Market Effects Study*[1], prepared for PG&E and SDG&E by Hagler Bailly, for results related to the market effects analysis completed for CFLs.

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[1] *Residential Market Effects Study: Refrigerators and Compact Fluorescent Lights.* Prepared by Hagler Bailly for SDG&E and PG&E. March 1998. SDG&E Study ID #3902. PG&E Study ID #3302.

CHAPTER 2
OBJECTIVES AND METHODOLOGY

2.1 PURPOSE OF STUDY

This study was intended to produce a net-to-gross ratio applicable to SDG&E's 1996 CFL Program. The methodology employed and described in this chapter was in compliance with the requirements specified in "Protocols and Procedures for the Verification of Costs, Benefits, and Shareholder Earnings from Demand-Side Management Programs" ("Protocols"), as adopted by California Public Utilities Commission Decision 93-05-063, revised January 1997, pursuant to Decisions 94-05-063, 94-10-059, 94-12-021, 95-12-054, and 96-12-079.

2.2 PROGRAMS EVALUATED

SDG&E offered a CFL Program in 1996 under the umbrella of the Residential Appliance Efficiency Incentives (RAEI) program. The evolution of SDG&E's 1996 CFL Program is described briefly below:

- SDG&E began its efforts to promote the use of CFL products in 1990. At that time, technologically advanced CFL products were being introduced in the marketplace. SDG&E initiated discussions with manufacturers and retailers and found that there was a general lack of customer awareness of these more advanced lighting products. SDG&E designed its early programs to influence this barrier – by purchasing CFLs in bulk from two manufacturers, the utility provided the products to residential customers at no cost in the hopes of increasing their awareness and encouraging their use of CFLs.

- During 1990 and 1992, SDG&E used several channels to distribute CFLs to customers including direct installation during in-home energy audits, distribution to customers through contact with field office personnel, and distribution to its own employees. In addition, SDG&E developed consumer information materials that accompanied the installation and distribution of CFLs. These materials were designed to educate customers about this "advanced technology," and discuss the many applications, simple installation methods, and (especially) life cycle cost benefits.

- In 1992, SDG&E solicited bids from CFL product manufacturers in preparation for its retail program launch. Jointly, Lights of America and SDG&E initiated the retail "buy-down" program in pilot form toward the end of 1992. This pilot program provided useful

insight into retail market processes and a total of 5,000 CFLs were sold through this pilot effort in four weeks.

▣ By 1993, SDG&E's retail program had stimulated enough demand to make it more economical for retailers to stock and sell the newly introduced, high quality and improved performance CFLs. While the retail program served as the primary channel for CFL program delivery, SDG&E continued to distribute CFLs through its field personnel and other programs as secondary channels. SDG&E's CFL programs continued through these mechanisms through 1997.

2.3 METHODOLOGY

Our methodology was designed to yield a net-to-gross ratio in two ways and allow us to disaggregate total savings into savings attributable to true participants, free riders, and spillover. We calculated the net-to-gross ratio using the results of a free-ridership survey and we calculated the net-to-gross ratio using an analysis of the rate of CFL purchases in the population using data from the customer survey implemented for the *Residential Market Effects* report. This second method produced a net-to-gross ratio that takes spillover into account.

There were five steps associated with developing the net-to-gross ratio applicable to SDG&E CFL programs. A six step was necessary to disaggregate total savings into its component parts. The seventh and final step relates to estimating the level of precision for our net-to-gross ratio. These seven steps are:

1. Calculate the **total number of CFLs** purchased in 1996 in the target area (including those purchased and distributed through utility programs and those purchased outside of utility programs).

2. Determine the extent of **naturally occurring conservation** (bulbs purchased) in 1996 in the target area.

3. Calculate **net number of CFLs purchased** in 1996 in the target area by subtracting naturally occurring conservation (Step 2) from total target area purchases (Step 1).

4. Determine the **number of CFLs distributed through SDG&E's 1996 programs** .

5. Calculate the **net-to-gross ratio** by comparing net purchases (Step 3) with the number of CFLs distributed through 1996 programs (Step 4).

6. Disaggregate total purchases to quantify the level of **"true program purchases"**, **"free rider purchases"** and **"spillover purchases."**

7. Estimate the net-to-gross **precision.**

The following sections describe the calculations for each of these analysis steps in general terms. The next chapter will provide the results of the calculations completed for each analysis step.

Step 1: Total CFLs Purchased in 1996 in the Target Area

Through a random-digit dial phone survey we determined the purchase rate for CFLs in the SDG&E and PG&E territories.[1] We asked people if they are aware of and have ever purchased or received a CFL and how many CFLs they purchased in 1996. We calculated the number of CFLs purchased per household by dividing the number of CFLs purchased by the respondents by the total number of households surveyed. To calculate the total number of CFLs purchased in the target area in 1996 we multiplied the number of CFLs purchased per household by the number of households in the target area.

Step 2: Determine Extent of Naturally Occurring Conservation in 1996 in the Target Area

The comparison area (which was the entire country minus California) provides us with an estimate of the level of naturally occurring conservation in California. (Throughout this report, when we refer to "California" we are referring to the service territories of SDG&E and PG&E only, and when we refer to "the rest of the country" we are referring to the entire country minus California.) Using the same method discussed above, we calculated the average per-household number of CFLs purchased in 1996 in the comparison area. We then multiplied this average by the total number of households in the target area to get an estimate of the level of naturally occurring conservation (NOC) in California.

Step 3: Calculate Net Savings in 1996 in the Target Area

Subtracting naturally occurring conservation (Step 2 results) from total savings in the target areas (Step 1 results) gives us the total "net" number of CFLs purchased in 1996 in the target area.

Step 4: Collect Number of CFLs Purchased Through Utility Programs in 1996 (Gross Purchases)

SDG&E provided a count of the number of CFLs distributed through their 1996 programs, which we used as the gross estimate of the number of CFLs for use in this analysis. PG&E did not offer a CFL program under the Residential Appliance Efficiency Incentives Program and so did not provide gross impact numbers. As a result, for this state-wide study, the only gross impacts are from SDG&E only. The net-to-gross ratio based on statewide data compares total effects in both SDG&E and PG&E territories with the gross impacts claimed for SDG&E territory. This issue is discussed in more detail in Chapter 4.

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[1] For a more extensive description of the methodology, see *Residential Market Effects Study: Refrigerators and Compact Fluorescent Lights.* Prepared for San Diego Gas & Electric and Pacific Gas & Electric by Hagler Bailly. March 1998. SDG&E Study ID #: 3902. PG&E Study ID #: 3302.

Step 5: Calculate Net-to-Gross Ratio

The net-to-gross ratio is determined by dividing the total "net" number of CFLs purchased in 1996 in the target area (Step 3 results) by the number of CFLs distributed through utility programs in 1996 (Step 4 results). A high net-to-gross ratio indicates that more of the expected or predicted savings were found in the analysis.

Step 6: Disaggregation of Total Savings to Estimate True Program Impacts and Spillover

The total savings from CFLs in the target areas is composed of four components:

1. Savings from true participants
2. Savings from free riders
3. Spillover
4. Naturally occurring conservation (or total NOC minus free riders)

Figure 2-1 shows these components divided into equal parts. We will present another version of this graph in the next chapter with the actual results.

In this graph, the entire bar represents the total savings from CFLs purchased in the target area in 1996 and is comprised of two main pieces: 1) total program effects and 2) naturally occurring conservation. As we discussed above (Step 3), total program effects (net savings) are calculated by subtracting NOC (Step 2) from total savings (Step 1). The "Program Effect" semicircle in the graph is comprised of savings from true participant purchases and spillover purchases.

Naturally occurring conservation (the "Naturally Occurring Conservation" semicircle in the graph and calculated in Step 2) is composed of CFLs purchased by free riders and undiscounted NOC (purchases of CFLs that were not affected by the program and were not discounted).

To further disaggregate total savings and allow us to calculate spillover, additional calculations were applied to the program effect semicircle and the NOC semicircle. For this study, we estimated the free rider component using a self-report survey. The free ridership rate allows us to fix the lower bound of the discounted semicircle, which allows us to calculate the amount of spillover. The math for this calculation is as follows:

Total discounted savings - free riders = true participants
Total program effects - true participants = spillover

Figure 2-1. Components of Total Savings – Theory
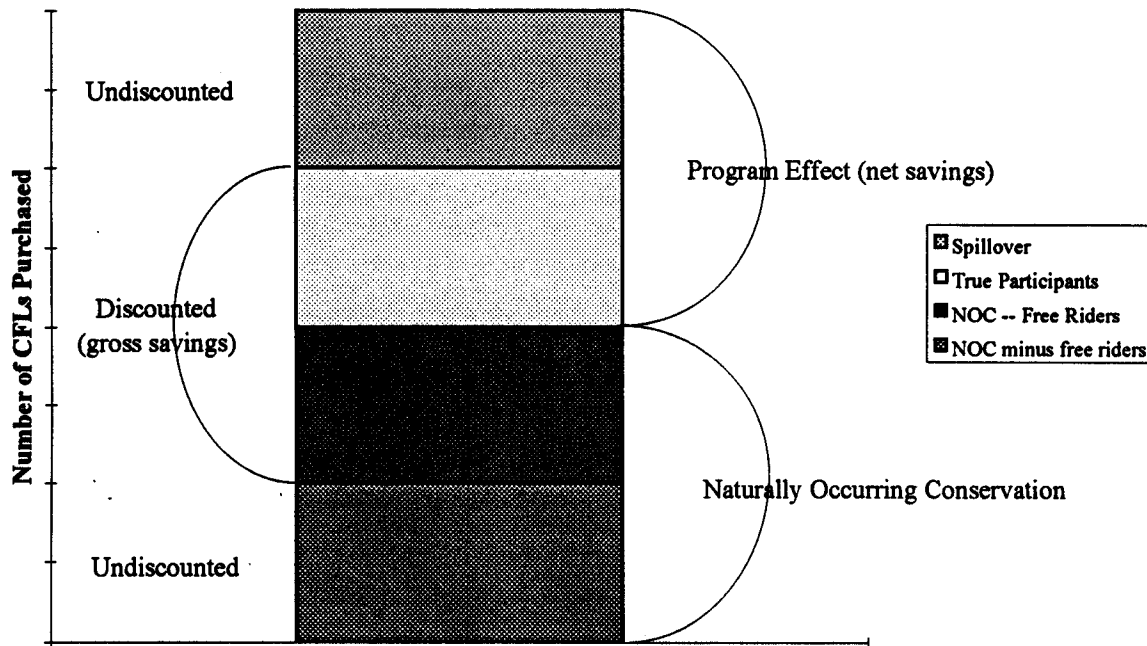
(Components divided into equal parts for illustration only.)

To measure the free-ridership rate, we implemented a separate survey of participants in SDG&E's 1996 CFL programs (see Step 6a below). This free ridership rate was multiplied by the total number of CFLs distributed through SDG&E's 1996 program (Step 4) to determine the level of "free rider purchases".

Step 6a: Calculation of Free Ridership Rate

The free ridership rate for SDG&E's 1996 CFL Program was determined based on participants' self-reported responses regarding whether or not they would have purchased CFLs had SDG&E's program not been offered. A total of 206 participants (who purchased a total of 950 CFLs) were surveyed and asked a number of questions to determine the extent to which the program discount influenced their CFL purchase decisions. The criteria for assessing free ridership based on participant responses is outlined below.

Participants who reported that their CFL purchases met at least one of the following criteria were not considered to be free riders:

▨   Had not planned to buy any CFL before learning of the discounted price

▨   Would not have paid the full price for the same CFL if the discounted price was not available

▣   Indicated that the discounted price had an impact on their decision to purchase the CFL (e.g., would not have purchased without it, influenced decision of when to buy and/or how many to buy, etc.)

Of the remaining, CFL purchases were classified as free rider purchases because participants reported that they:

▣   Had planned to buy a CFL before learning of the discounted price

▣   Would have paid the full price for the same CFL if the discounted price was not available

▣   Indicated that the discounted price had no impact on their decision to purchase a CFL (e.g., would have purchased same amount, same time)

▣   Indicated that the discount had some influence on their decision, but it was really regarded as "a bonus".

For some CFL purchases, it was difficult to assign either a 100% free ridership rate or a 100% non-free ridership rate. Of the respondents who made these CFL purchases, all indicated that the discounted price had some influence – yet their response to the open-ended question led us to interpret their purchases as only partial free rider purchases. As a result, a partial free ridership rate of 50% was assigned to these cases.

Table 2-1 presents the specific question wording and logic used to determine free ridership rates.

If a participant purchased more than one discounted CFL, questions CF4a and CF4b were used to determine the quantity of CFLs that would have been purchased anyway (i.e., "free rider" purchases) and the quantity of CFLs that would not have been purchased without the discounted price. As mentioned above, the 206 participants who responded to the survey purchased a total of 950 discounted CFLs.

Our approach to determining the rate of free ridership was based on participants' self-reported responses and was consistent with the Protocols and with the California DSM Advisory Committee (CADMAC) *Quality Assurance Guidelines* regarding procedures for using self-report methods. For example, we included "set-up" questions which were used to guide respondents through a process of establishing benchmarks against which to remember the decision making process. In addition, our survey instrument also made use of multiple questionnaire items to measure free-ridership and address inconsistencies.

A copy of the free rider survey instrument is included in Appendix C.

Table 2-1. Free Rider Questions and Logic

Question Number	Question Wording	Skip Pattern and Free Ridership Determination Logic
CF3	Had you planned to buy any compact fluorescent light bulbs <u>before</u> you heard of the discounted price?	NO – *not a free rider* YES/DK – ask CF4a
CF4a	As I mentioned earlier, the price you paid for the compact fluorescent light bulbs was discounted by 75%. If this discount had not been available, would you most likely have paid the full price for the [NUMBER] compact fluorescent bulb(s)?	NO – if more than one CFL purchased ask CF4b; else *not a free rider* YES – skip to CF5 DK – skip to CF6
CF4b	How many compact fluorescent bulbs would you have purchased at that time if the price had not been discounted by 75%?	Record quantity. *Free rider*
CF5	So, you are saying the discounted price had no impact on your decision to purchase this/these compact fluorescent light bulbs?	NO/DK – ask CF6 YES – *free rider*
CF6	Can you clarify for me in your own words what impact, if any, the discounted price had on your decision to purchase compact fluorescent light bulbs?	Open-ended question. *Verbatim responses used to determine free ridership.*

Step 7: Precision Estimate

The precision estimate for the market effects net-to-gross estimate was calculated using the same method used in the 1994 study with the following equation.[2]

$$\sigma_{\bar{x}_1 - \bar{x}_2} = \sqrt{s^2 pooled\left(\frac{1}{N_1} + \frac{1}{N_2}\right)}$$

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[2] *Residential Appliance Efficiency Incentives Program High Efficiency Refrigeration: 1994 First Year Statewide Load Impact Study.* SDG&E Study ID #914. Xenergy, Inc., prepared for Southern California Edison and SDG&E, February 1996.

where:

$\sigma_{\bar{x}_1 - \bar{x}_2}$ = standard error of the difference

S^2 pooled = pooled variance estimate

N_n = number of observations

The range of net savings = net savings estimate $\pm \ \sigma_{\bar{x}_1 - \bar{x}_2} * t$

where

t = critical value for t test at appropriate confidence interval.

The precision estimate for the free rider net-to-gross estimate was calculated as follows:

$$\text{Error width} = 2z\sqrt{\frac{p(1-p)}{n}}$$

Where:

p = proportion of the characteristic in the population

n = sample size

We used the free ridership rate for p. The net-to-gross ratio range is the original estimate plus or minus ½ of the error width.

The next chapter will present the results of the analyses completed in each of these seven steps. Chapter 4 includes a discussion of some of the issues that can help in interpreting the results.

CHAPTER 3
RESULTS

This chapter presents the results of Hagler Bailly's net-to-gross analysis for SDG&E's 1996 CFL Program. These results were derived using the methodology described in Chapter 2. The results are presented Table 3-1 and are discussed in more detail in the sections that follow.

Table 3-1. Net Savings Analysis Summary

	SDG&E	PG&E	SDG&E Plus PG&E
Number of CFLs purchased in target area in 1996 net of naturally occurring conservation	142,699	187,698	472,669
Number of CFLs distributed to customers through utility programs in 1996	409,979	0	409,979
Market effects net-to-gross ratio	**0.3481**	**NA**	**1.1529**
Free ridership rate	0.1427	NA	0.1427
Free rider rate net-to-gross ratio	**0.8573**	**NA**	**0.8573**
Free rider CFLs distributed through programs	58,504	0	58,504
CFLs distributed through programs (excluding free riders)	351,475	0	351,475
Spillover CFLs	-208,776	187,698	121,194

The net-to-gross ratio calculated using data from the market effects survey produces a net-to-gross ratio of 1.1529. The net-to-gross ratio produced using only the free rider survey produces a net-to-gross ratio of 0.8573. Because of several issues that affect the calculation of the "market effects net-to-gross ratio", we are recommending the use of the net-to-gross ratio calculated using the free rider survey. We discuss those issues in Chapter 4.

Step 1: Total CFLs Purchased in 1996 in the Target Area

Hagler Bailly completed 3,930 screening surveys and found that respondents in SDG&E territory had purchased on average 0.3203 CFLs in 1996, 0.226 CFLs in PG&E territory, and 0.1841 CFLs nationwide (Row C in Table 3-2).

We calculated the number of CFLs purchased per household (Row C in Table 3-2) by dividing the number of CFLs purchased by the respondents (B) by the total number of households surveyed (A). To calculate the total number of CFLs bought in the target area (E) we multiplied the number of CFLs per household (C) by the number of households in the target area (D). Almost 1.5 million CFLs were purchased in 1996 in the two territories.

Table 3-2. CFL Net-To-Gross and Spillover Calculations

		SDG&E	PG&E	SDG&E Plus PG&E	National
A	Total Screeners	893	1,022	1,915	2,010
B	Number of bulbs purchased by respondents in 1996	286	231	517	370
C	Number of CFLs per household	0.3203	0.2260	0.2700	0.1841
D	Households	1,047,800	4,455,118	5,502,918	
E	Number of CFLs purchased in territory	335,578	1,006,979	1,485,644	
F	Naturally occurring conservation	192,879	820,096	1,012,975	
G	Net CFLs purchased in 1996	142,699	186,882	472,669	
H	Number of CFLs distributed to customers through utility programs in 1996	409,979	0	409,979	
I	Market Effects Net-to-gross ratio	0.3481	NA	1.1529	
J	Free ridership rate	0.1427	NA	0.1427	
K	Free Rider Rate Net-to-gross ratio	0.8573	NA	0.8573	
L	Free rider CFLs distributed through programs	58,504	0	58,504	
M	CFLs distributed through programs (from true participants, excluding free riders)	351,475	0	351,475	
N	Spillover CFLs	-208,776	186,882	121,194	

Step 2: Determine Extent of Naturally Occurring Conservation in 1996 in the Target Area

The comparison area (which was the entire country minus California) provides us with an estimate of the level of naturally occurring conservation in California. Using the same method discussed above, we calculated the average per-household number of CFLs purchased in 1996 in the comparison area (0.1841). We then multiplied the average by the total number of households in the target areas to get an estimate of the level of naturally occurring conservation (NOC) in California (F). (For example, 5,502,918 households * 0.1841 = 1,012,975 CFLs.)

Step 3: Calculate Net Savings in 1996 in the Target Area

Subtracting naturally occurring conservation (F, Step 2 results) from the total number of CFLs purchased in 1996 in the target area (E, Step 1 results) gives us the total "net" CFL purchases in 1996 in the target area (G). This results in nearly 473,000 "net" CFL purchases in 1996 in the target area.

Step 4: Collect Number of CFLs Purchased Through Utility Programs in 1996 (Gross Purchases)

SDG&E provided a count of the number of CFLs distributed through their 1996 programs (H) (which represents the "gross" part of the net-to-gross ratio). SDG&E distributed nearly 410,000 CFLs through its program in 1996. PG&E did not claim any CFL purchases – this creates an issue that is discussed in more detail in Chapter 4.

Step 5: Calculate Net-to-Gross Ratio

The net-to-gross ratio (I) is determined by dividing the total "net" CFL purchases in 1996 in the target area (G, Step 3 results) by the total number of CFLs distributed through 1996 utility programs (H, Step 4 results). The resulting net-to-gross ratio is about 1.15, indicating that more than the expected or predicted savings from utility rebate programs have been realized in 1996 in the target area.

Step 6: Disaggregation of Total Savings to Estimate True Program Impacts and Spillover

Step 6a. Calculate Free Ridership Rate and Associated Net-To-Gross Ratio

Table 3-3 presents the results of the free rider survey according to the method outlined in Chapter 2. As shown, the free ridership factor lies somewhere between 12.95% and 15.58%, depending on what is done about partial free riders. We have assumed that partial free riders should be assigned a "50% weight", to reflect at least a partial program influence. Therefore, free ridership based on the surveyed participants' self-reported responses has been calculated at 14.27% and the net-to-gross ratio (or one minus the free ridership rate) based on the free rider survey is 85.73%.

Table 3-3. Free Ridership Rate Determination

		Number of Respondents	Number of CFLs	Percent of CFLs
Non-Free Rider	Did not plan on buying CFL before hearing about discount	93	408	42.95%
	Would not have paid full price if discount was not available [1]	63	269	28.32
	Discounted price influenced timing/quantity of purchase	13	66	6.95%
	Needed discount, discount was the incentive needed	13	59	6.21%
			802	84.42%
Free Riders	Would have paid full price if discount was not available [1]	63	46	4.84%
	Rebate had no impact on purchase decision	11	64	6.74%
	Would have purchased anyway at that time	5	7	0.74%
	Probably would have purchased anyway, discount was a bonus	2	6	0.63%
			123	12.95%
Partial Free Riders	Some influence	2	8	0.84%
	Some influence, timing was important	2	8	0.84%
	Some influence, wanted to save money/electricity over long term	2	9	0.95%
			25	2.63%

[1] A total of 63 respondents reported that they would not have paid the full price for all of the CFLs they purchased. These 63 respondents purchased 315 CFLs, 269 would not have been purchased at full price and 46 would have been purchased at full price.

Step 6b: Disaggregate Net Impacts

As described in Chapter 2, the total savings from CFLs in the target areas is composed of four components (Figure 3-1):

1. Savings from true participants
2. Savings from free riders
3. Spillover
4. Naturally occurring conservation (or total NOC minus free riders)

Figure 3-1. Components of Total Savings
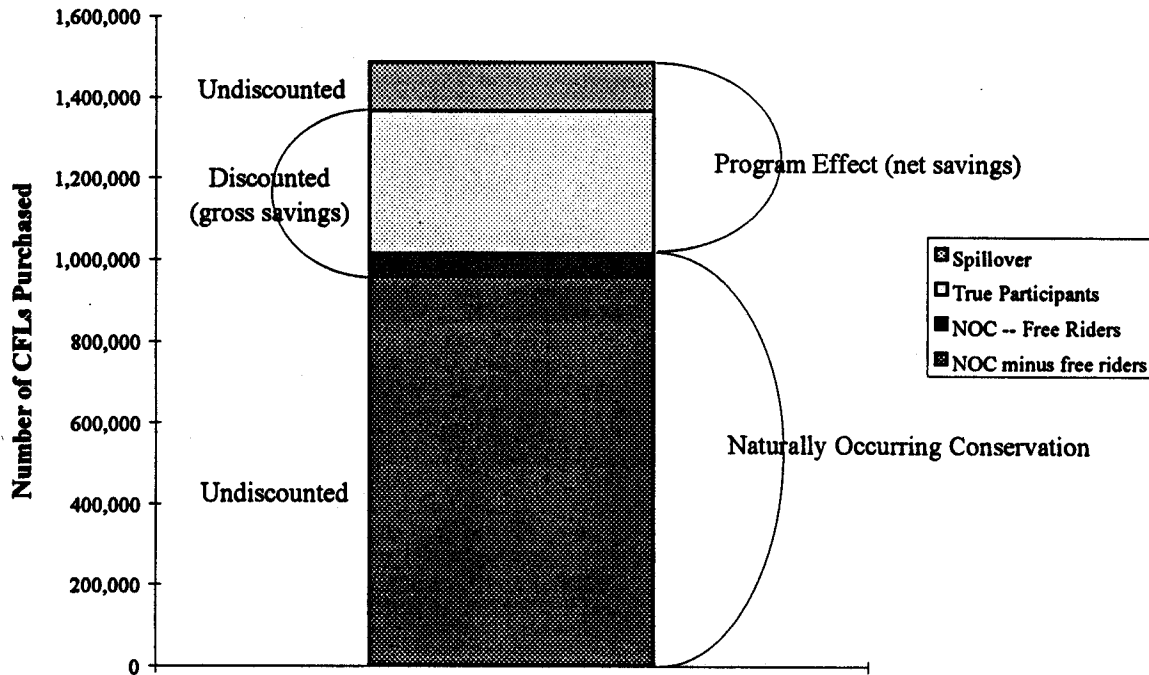
The free ridership rate derived from the analysis completed in Step 6a was found to be 14.27%. Multiplying this free ridership rate by the total number of CFLs distributed through utility programs produces 58,504 CFLs purchased by free riders (L). Subtracting these free rider CFLs from the total yields 351,475 CFLs purchased by "true participants" (M) (or purchases that were the result of the program's direct influence – the discounted price).

Subtracting the true participant CFL purchases (M) (351,475) from the total "net" CFL purchases in the target area (G, Step 3 result, 472,669) results in "spillover CFL purchases" (121,194) (N). These spillover CFL purchases result in energy savings benefits in the target area that have been realized (a) outside of the direct influence of the utility programs (i.e., undiscounted bulb purchases), and (b) over and above what naturally occurred in the market.

As shown above in Table 3-2, we calculated spillover results for the two utility territories separately, but found the spillover results for SDG&E's service area to be "negative". We discuss the implications of this finding in Chapter 4.

Step 7: Precision Estimate

The analysis discussed above produced a free-rider net-to-gross rate of 0.8573 and a market effects net-to-gross ratio of 1.1529. The 90% confidence interval around the free rider net-to-gross ratio ranges from 0.8082 to 0.9064 (see Table 3-4). The 80% confidence interval around

the free rider net-to-gross ratio ranges from 0.8190 to 0.8956. The 90% confidence interval around the market effects ratio ranges from 0.3414 to 1.9645. The 80% confidence interval around the market effects ratio number ranges from 0.5205 to 1.7854.

Table 3-4. Precision Estimate

Confidence interval:	Original	90% Minimum	90% Maximum	80% Minimum	80% Maximum
A Number of households in territory	5,502,918				
B Purchase rate, CA	0.2700				
C Purchase rate, US	0.1841				
D Net purchase rate	0.0859	0.0254	0.1464	0.0388	0.1330
E Net CFLs purchased in target area in 1996	472,669	139,954	805,385	213,374	731,965
F Number of CFLs distributed to customers through utility programs in 1996	409,979	409,979	409,979	409,979	409,979
G **Market effects net-to-gross ratio**	**1.1529**	**0.3414**	**1.9645**	**0.5205**	**1.7854**
H Free ridership rate	0.1427				
I Free rider CFLs distributed through programs	58,504				
J CFLs distributed through programs (excluding free riders)	351,475				
K 1/2 Error band width		4.01%	4.01%	3.12%	3.12%
L **Free rider net-to-gross ratio**	**0.8573**	**0.8229**	**0.8917**	**0.8305**	**0.8841**

(Note: The data used in the calculations have more decimals than shown in this table, as a result, repeating the calculations with the data shown may not yield exactly the results shown.)

Calculation note: The calculations shown in lines A through J in this table are identical to those discussed earlier in this chapter. To simplify the table we abbreviated the calculations as follows: The net purchase rate (D) is the purchase rate in California (B) minus the rate in the rest of the country (C). Multiplying the net purchase rate by the number of households (A) yields the net CFLs purchased in the target area in 1996 (E). The precision estimate method described in Chapter 2 produces the minimum and maximum net purchase rates shown on line D.

The free rider net-to-gross ratio minimum and maximum values are calculated by adjusting the original value (0.8573) by the percentage shown on line K.

CHAPTER 4
DISCUSSION

The preceding chapters presented the CFL net-to-gross methodology and results, incorporating the results from our market effects study to account for spillover effects and our free rider survey to account for free ridership. Three approaches and the results associated with each were presented:

1. Net-to-gross analysis based on the market effects observed in California (SDG&E and PG&E territories combined).

2. Net-to-gross analysis based on the market effects observed in SDG&E's territory alone.

3. Net-to-gross analysis based on SDG&E's 1996 program participants' self-reported responses regarding free ridership.

The calculations involved in the first two approaches were based on the number of CFLs purchased (not the energy consumed). The resulting "market effects net-to-gross ratios" were determined by calculating the number of CFLs purchased in 1996 in (1) California and (2) SDG&E's territory alone (based on purchase rates determined by our market effects survey), subtracting naturally-occurring CFL purchases (determined using the purchase rate in the rest of the country), and comparing it with the number of CFLs distributed through SDG&E's 1996 CFL Program. This methodology was used by Xenergy in the 1994 statewide study for CFLs[1] and is comparable to the method used by Hagler Bailly for determining the net-to-gross ratio applicable to the SDG&E and PG&E 1996 refrigerator rebate programs. The method should produce a conservative estimate of the net-to-gross ratio since the national sample will include areas that have utility CFL programs.

The methodology used in the 1994 study incorporated the effects of spillover and free ridership and did <u>not</u> produce estimates of these factors separately. Hence, from that research it was not possible to determine whether spillover and free ridership effects were small or large and were canceling each other out. Our study produced results using a methodology that was similar to the 1994 study, but also calculated a separate free ridership rate. This free ridership rate was used to determine the magnitude of spillover effects observed in the market.

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[1] *Residential Appliance Efficiency Incentives Program, High Efficiency Lighting, 1994 First Year Statewide Load Impact Report.* SDG&E Study ID #914. Xenergy, Inc., prepared for Southern California Edison and SDG&E, February 1996, page 4-2.

Our approach to determining the rate of free ridership (an input to all three approaches) was based on participants' self-reported responses and was consistent with CADMAC's concerns and recommended methods for such calculations. For example, we included "set-up" questions which were used to guide respondents through a process of establishing benchmarks against which to remember the decision making process. In addition, our survey instrument also made use of multiple questionnaire items to measure free-ridership and address inconsistencies.

The market effects net-to-gross analysis described in Chapters 2 and 3 is sound in principal and theory, it has been previously accepted as valid, and it produced intuitively expected results for refrigerators. However, there are two issues that lead us to recommend that the final net-to-gross ratio be based solely on the free rider survey (which produced a 0.8573 net-to-gross ratio) rather than the market effects analysis (which produced a 1.1529 net-to-gross ratio). We will discuss these issues below.

The first issue relates to the gross impact numbers (number of CFLs distributed through the program). SDG&E had CFL programs in 1996 and provided gross impact numbers but PG&E is not claiming impacts for CFL programs in 1996 and so did not provide gross impact numbers. As a result, it is difficult to interpret the spillover analysis results since the analysis is predicated on the assumption that the calculations include gross impacts for both SDG&E and PG&E. The net-to-gross ratio based on statewide data compares total effects in both SDG&E and PG&E territories with the gross impacts claimed for SDG&E territory. If PG&E's gross impacts were not zero, the results would be easily interpreted.

This method is best understood as providing evidence of spillover from current and past programs. However, this is offset by the fact that it does not give credit for effects current programs will have on purchase patterns in future years. SDG&E typically has been the only utility in the state to offer a consistent CFL program throughout the year but SDG&E, PG&E, and other utilities in the state have offered programs in the past. While it is certainly possible that current SDG&E programs affected purchase patterns in PG&E territory, it is also possible that prior PG&E programs (or even prior programs from other utilities) continued to have an impact on purchase patterns in PG&E territory. It is also likely that PG&E performed some actions in 1996 that encouraged the purchase of CFLs. Because in this case there is no accounting for PG&E actions in 1996, it is difficult to support using the statewide net-to-gross ratio.

The second issue relates to market effects net-to-gross analysis calculations completed for SDG&E's territory alone. Because of the issues discussed above with the statewide gross impact estimate, it was a natural reaction to attempt to isolate the market effects observed in SDG&E's territory alone. In Chapter 3, we presented a breakout of the net-to-gross calculations by service territory as well as combined for both SDG&E and PG&E. As shown, these calculations lead to "negative spillover." We believe that negative spillover cannot exist in a market – rather, we believe that two issues with the gross impact estimates may have led to this anomaly:

1. There may have been "leaks" in the program, that is CFLs distributed to customers who do not reside in SDG&E's service area and thus would not have been measured by our customer survey, which focused on residential customers in SDG&E territory.

2. CFLs may have been distributed to non-residential SDG&E customers who were not surveyed and thus not figured into the penetration rate.

Further, we speculate that in order to have spillover in SDG&E's territory alone be zero (or positive) a combination of the following would need to be true:

🖫   Only 45% of the 409,979 CFLs distributed through SDG&E's 1996 program eventually made it into the hands of SDG&E's residential customers.

🖫   The penetration rate for CFLs in 1996 in SDG&E's service area is substantially higher than that found through our survey as well as other prior studies. (It would need to be around 52%, rather than the 32% we found, if 100% of the CFLs distributed through SDG&E's 1996 program were actually distributed to residential customers.)

It is doubtful that such a large fraction of the CFLs distributed through the program left the service area and/or were provided to non-residential customers. It is also doubtful that our penetration rate of 0.3203 is that far off the mark, given that it is essentially identical to the 0.32 penetration rate found in the 1994 statewide study completed for SCE and SDG&E combined.

CHAPTER 5
CONCLUSIONS

Our analysis shows that customers in SDG&E and PG&E territories are buying substantially more CFLs than those in the rest of the country. As a result, the data indicate that there may be substantial spillover effects occurring in the combined SDG&E and PG&E territories, producing an estimated net-to-gross ratio of 1.15. However it is difficult to interpret this result since the analysis is predicated on the assumption that the calculations include gross impacts for both SDG&E and PG&E. PG&E is not claiming impacts for CFL programs in 1996 and so did not provide gross impact numbers.

As a result of this difficulty, we recommend that the final net-to-gross ratio be based on the results of the self-report survey only. The free ridership rate was found to be 14.27%, which leads to a net-to-gross ratio of 0.8573.

Appendix C

Table 6
Results Used to Support PY96 Second Earnings Claim

M&E PROTOCOLS TABLE 6 - RESULTS USED TO SUPPORT PY96 SECOND EARNINGS CLAIM FOR THE RESIDENTIAL APPLIANCE EFFICIENCY INCENTIVES PROGRAM
FIRST YEAR LOAD IMPACT EVALUATION, MARCH 1998, STUDY ID NO. 983

Designated Unit of Measurement: LOAD IMPACTS PER BULB
END USE: High Efficiency Lighting

1. Average Participant Group and Average Comparison Group	PART GRP	COMP GRP	5. A. 90% CONFIDENCE LEVEL LOWER BOUND PART GRP	UPPER BOUND PART GRP	5. B. 80% CONFIDENCE LEVEL LOWER BOUND PART GRP	UPPER BOUND PART GRP
A. Pre-Install Usage:						
A. i. Pre-install - kW	na	na	na	na	na	na
A. ii. Pre-install - kWh	na	na	na	na	na	na
A. iii. Base kW	na	na	na	na	na	na
A. iv. Base kWh	na	na	na	na	na	na
A. v. Base kW/ designated unit of measurement	na	na	na	na	na	na
A. vi. Base kWh/ designated unit of measurement	na	na	na	na	na	na
B. Impact year usage:						
B. i. Impact Yr. kW	na	na	na	na	na	na
B. ii. Impact Yr. kWh	na	na	na	na	na	na
B. iii. Impact Yr. kW/designated unit	na	na	na	na	na	na
B. iv. Impact Yr. kWh/designated unit	na	na	na	na	na	na
2. Average Net and Gross End Use Load Impacts	AVG GROSS	AVG NET	AVG NET	AVG NET	AVG NET	AVG NET
A. Load Impacts	0.0098	0.0084	0.0016	0.0152	0.0031	0.0137
A. i. Load Impacts - kW	0.0098	0.0084	0.0016	0.0152	0.0031	0.0137
A. ii. Load Impacts - kWh	84.73	72.64	72.5979	72.6802	72.6070	72.6711
A. iii. Load Impacts - Therms	na	na	na	na	na	na
B. Load Impacts/designated	B. i. Load Impacts/designated unit - kW	0.0098	0.0084	0.0016	0.0152	0.0031	0.0137
B. ii. Load Impacts/designated unit - kWh	84.73	72.64	72.5979	72.6802	72.6070	72.6711
B. iii. Load Impacts/designated unit - Therms	na	na	na	na	na	na
C. % change in usage						
C. i. a. % change in usage - Part Grp - kW	na	na	na	na	na	na
C. i. b. % change in usage - Part Grp - kWh	na	na	na	na	na	na
C. i. c. % change in usage - Part Grp - Therms	na	na	na	na	na	na
C. ii. a. % change in usage - Comp Grp - kW	na	na	na	na	na	na
C. ii. b. % change in usage - Comp Grp - kWh	na	na	na	na	na	na
C. iii. a. % change in usage - Comp Grp - Therms	na	na	na	na	na	na
D. Realization Rate:						
D.A. i. Load Impacts - kW, realization rate	1.225	1.180	0.224	2.136	0.435	1.925
D.A. ii. Load Impacts - kWh, realization rate	0.979	0.922	0.922	0.923	0.922	0.922
D.A. iii. Load Impacts - Therms, realization rate	na	na	na	na	na	na
D.B. i. Load Impacts/designated unit - kW, real rate	1.225	1.180	0.224	2.136	0.435	1.925
D.B. ii. Load Impacts/designated unit - kWh, real rate	0.979	0.922	0.922	0.923	0.922	0.922
D.B. iii. Load Impacts/designated unit - Therms, real rate	na	na				
3. Net-to-Gross Ratios	RATIO		RATIO		RATIO	
A. i. Average Load Impacts - kW	0.8573		0.8229	0.8917	0.8305	0.8842
A. ii. Average Load Impacts - kWh	0.8573		0.8229	0.8917	0.8305	0.8842
A. iii. Average Load Impacts - Therms	na		na	na	na	na
B. i. Avg Load Impacts/designated unit - kW	0.8573		0.8229	0.8917	0.8305	0.8842
B. ii. Avg Load Impacts/designated unit - kWh	0.8573		0.8229	0.8917	0.8305	0.8842
B. iii. Avg Load Impacts/designated unit - Therms	na		na	na	na	na
C. i. Avg Load Impact based on % chg in usage in impact year relative to base usage in impact year - kW	na		na	na	na	na
C. ii. Avg Load Impact based on % chg in usage in impact year relative to base usage in impact year - kWh	na		na	na	na	na
C. iii. Avg Load Impact based on % chg in usage in impact year relative to base usage in impact year - Therms	na		na	na	na	na
4. Designated Unit Intermediate Data	PART GRP		PART GRP	PART GRP	PART GRP	PART GRP
A. Pre-install average value	na		na	na	na	na
B. Post-install average value (hours/year, residential)	na		na	na	na	na
6. Measure Count Data	NUMBER					
A. Number of measures installed by participants in Part Grp	409,979					
B. Number of measure installed by all program participants in the 12 months of the program year	409,979					
C. Number of measures installed by Comp Grp	na					
7. Market Segment Data	Czone 7					
Number of participants - gas	na					
Number of participants - electric	na					

Appendix D

Table 7
Data Quality and Processing Documentation

Table 7

Data Quality and Processing Documentation

A.   **Overview Information**

1.   **Study Title and Study ID No.:** Residential Appliance Efficiency Incentives Program: High Efficiency Lighting: 1996 First Year Statewide Load Impact Study: Net-To-Gross Analysis. SDG&E Study ID #983.

2.   **Program, Program year (or years) and program description:** 1996 Compact Fluorescent Lighting (CFL) incentive program. This program provided rebates to CFL manufacturers under the condition that the incentive would be passed on through their distribution chain. SDG&E also provided CFLs to SDG&E customers through its various field operations and through the DSM Pilot Bidding program. See Section 2--Program Description for details.

3.   **End uses and/or measures covered:** The program covered new, compact fluorescent light bulbs, fixtures and CFL replacement lamps.

4.   **Methods and models used:** The gross methodology employed in this study is explained in Section 3 of the report. It consists of updating the *ex ante* engineering estimates using inputs from various SDG&E program databases and the Peakday survey.
The net-to-gross methodology is explained in Section 4 of the report. The net-to-gross methodology consisted of a survey of 1996 program participants to determine free-ridership, that is, the extent to which SDG&E's program influenced their CFL purchase decisions and a survey of nonparticipants selected from around the country (less the state of California) to estimate program spillover.

5.   **Participant and comparison group definition:** Program participants include all people who purchased CFLs whose price was reduced because of rebates from SDG&E to the manufacturers. The comparison group was individuals who purchased CFLs for their own, residential use in 1996 in the United States, excluding California.

6.   **Analysis Sample Size:** The population included 409,979 CFLs in SDG&E's program tracking database.

a.   SDG&E Program Databases: Wattage Replacement Estimate

Method of Distribution	Number of Lamps	Sample Used to Calculate Wattage Replacement
Retail Program—bulbs	206,773	19,740
Retail Program--fixtures	83,394	1,160
Other Internal Distribution Methods	40,943	2,951
Bidding Program	78,869	78,869
Total	**409,979**	**102,720(25%)**

*Table 7*   Page D-1

b.   Peakday Survey

Method of Distribution	Planned Sample Size	Actual Sample Size
Retail Program—bulbs	350	327
Retail Program--fixtures	120	119
Other Internal Distribution Methods	270	271
Total	**740**	**717**

c.   Net-to-gross Analysis: The sample used for the net-to-gross analysis was comprised of 206 individuals who purchased CFLs in 1996 and returned the program tracking postcard.

B.   Database Management

1.   **Flow chart illustrating relationship between data elements:**
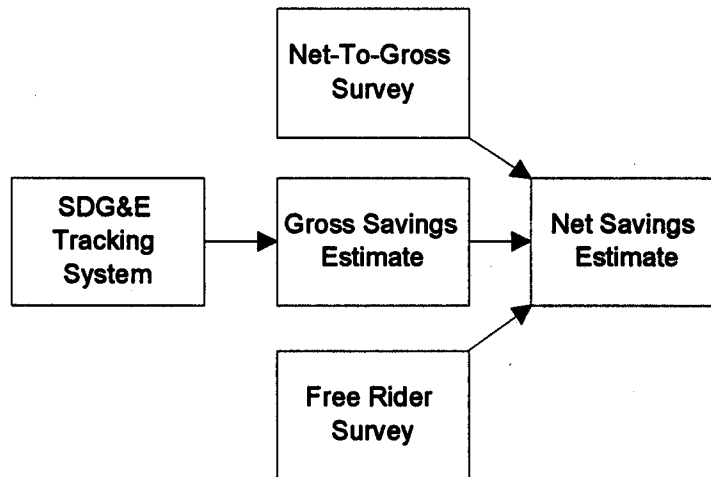
2.   **Specific data sources:**
    a.   Gross impacts analysis, see Section 3.
    b.   NTG analysis, see Section 4: Chapter 2, Section 2.3 of the report.
3.   **Data attrition process:**
    a.   Gross impacts analysis, see Section 3.
    b.   NTG analysis, see Section 4: Chapter 2, Section 2.3 of the report.
4.   **Internal/Organizational data quality checks and procedures:** Not applicable.
5.   **Summary of data collected but not used:** Not applicable.

C.   Sampling

1.   **Sampling procedures and protocols:**
    a.   Gross impacts analysis, see Section 3.
    b.   NTG analysis, see Chapter 2, Section 2.3, Steps 1 and 2.

Table 7

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2.   **Survey information:**
    a.   Gross impact analysis, see Appendix A for the bounceback and filed operations forms, and Appendix B for the Peakday Survey
    b.   NTG analysis, Appendix C of Section 4 provides the survey instrument. Screening calls were completed in 3,930 households (1,919 in California and 2,011 nationally for the control group) to collect information on 1996 CFL purchases and for refrigerator purchases.[1] The CFL portion of the survey was completed with 1915 people in California and 2010 nationwide. Four people in California and one in the national sample could not or would not answer the CFL questions. They were dropped from the analysis and were not counted as part of the population for calculating CFLs purchased per household.
3.   **Statistical descriptions:** Not applicable.

D.   Data Screening and Analysis

1.   **Procedures used for treatment of outliers, missing data points, and weather adjustments:** Data were manually checked for reasonable values. Any respondents who provided questionable data (such as extremely large numbers of CFLs purchased) were re-called to verify the values given. Data was corrected in several instances. In one case, the respondent was re-classified as a commercial establishment and dropped from the analysis.
2.   **Controlling for the effects of background variables:**
    a.   Gross impact analysis, not applicable.
    b.   NTG analysis, see Section 4, Chapter 4.
3.   **Procedures used to screen data:**
    a.   Gross impact analysis, data was screened for reasonable responses, e.g., wattages were validated to make sure such bulbs are available in the market.
    b.   NTG analysis, see Section 4, Chapter 2, Section 2.3.
4.   **Regression Statistics:** No regression models were used. Not applicable.
5.   **Specification:**
    a.   No regression models were used. Not applicable.
    b.   No regression models were used. Not applicable.
    c.   No regression models were used. Not applicable.
    d.   No regression models were used. Not applicable.
    e.   No regression models were used. Not applicable.
6.   **Error in measuring variables:** Not applicable.
7.   **Autocorrelation:** Not applicable
8.   **Heteroskedasticity:** Not applicable.
9.   **Collinearity:** Not applicable.
10.   **Influential data points:** Not applicable.
11.   **Missing data:** See discussion under sampling point two above.
12.   **Precision:** See Chapter 3, Step 7.

E.   Data Interpretation and Application

1.   The rationale for choosing this method is presented in Chapter 2, section 2.3.

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[1]   See the following report for a complete discussion of the survey method and purpose: *Residential Market Effects Study: Refrigerators and Compact Fluorescent Lights.* Prepared by Hagler Bailly for SDG&E and PG&E. February 1998. SDG&E Study ID #3902. PG&E Study ID #3302.

Table 7

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