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# Southern California Edison

## Low Income Relamping

### Profile #2, 1992

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<b>Executive Summary</b>	<b>2</b>
<b>Utility Overview</b>	<b>3</b>
<i>SCE 1991 Statistics Table</i>	
<b>Utility DSM Overview</b>	<b>4</b>
<i>Utility DSM Overview Table; Current Residential DSM Programs at SCE Table; Annual DSM Expenditure (chart); Annual DSM Energy Savings (chart); Annual DSM Capacity Savings (chart)</i>	
<b>Program Overview</b>	<b>6</b>
<b>Implementation</b>	<b>7</b>
<i>Marketing &amp; Delivery; Installed Measures; Staffing Requirements</i>	
<b>Monitoring and Evaluation</b>	<b>10</b>
<i>Monitoring; Evaluation; Data Quality</i>	
<b>Program Savings</b>	<b>12</b>
<i>Savings Overview Table; Annual Energy Savings (chart); Cumulative Energy Savings (chart); Annual Peak Capacity Savings (chart); Cumulative Peak Capacity Savings (chart); Measure Lifetime; Participation; Customers Serviced Table; Participation (chart); Annual Savings per Participant (chart)</i>	
<b>Cost of the Program</b>	<b>14</b>
<i>Cost Effectiveness; Free Ridership; Cost of Saved Energy Table; Total Program Costs (chart); Program Cost per Participant (chart); Costs Overview Table; Cost Components; Cost Components (chart)</i>	
<b>Environmental Benefit Statement</b>	<b>16</b>
<i>Avoided Emissions Analysis Table</i>	
<b>Lessons Learned / Transferability</b>	<b>18</b>
<b>Regulatory Incentives / Shareholder Returns</b>	<b>20</b>
<b>References</b>	<b>21</b>

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# Executive Summary

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Southern California Edison (SCE) is unquestionably a national DSM leader. SCE has spent nearly a billion dollars on DSM since 1973. Its Low-Income Relamping Program is the oldest program of its kind operating today. SCE has cultivated a unique, synergistic relationship with community-based organizations (CBOs) to market and deliver the program. The CBOs provide a variety of social services to specific portions of the low-income community. For instance, the Maravilla Foundation specifically serves the Latin American community. These organizations are uniquely suited to provide energy services and education, as well.

SCE has had difficulty using traditional DSM approaches and utility personnel to provide assistance services to its low-income customers. Many of these customers are recent immigrants to the United States, who often tend to be distrustful of governments and large institutions such as the utility. By paying the full costs of the compact fluorescent lamps and using the CBOs to interact with the customers, SCE can provide services to these customers in a nonthreatening manner. This relationship also provides SCE with a cost-effective means for fulfilling its PUC-mandated obligation to provide assistance to low-income customers. The CBOs benefit by earning much needed funds which aid in the operation of their organizations.

Although the general quality of data obtained from SCE is good, two shortfalls exist. First are concerns regarding the calculation of energy savings and in particular duty factors, persistence, etc. The other shortfall exists in quantifying the administrative costs of the program. The relamping effort is a sub-program of the larger Customer Assistance Program (CAP) for which cost data are not separated among the sub-programs.

To date, Southern California Edison has installed over 1.3 million compact fluorescent lamps through this program. These lamps have resulted in energy savings of 121 GWh and peak capacity savings of 14 MW, since the program's inception in 1985. From 1985 to 1991, the program has cost a total of \$23.5 million. In the 1991 program year, the program saved 3 MW while providing over 5 lamps per home at an average cost per participant of \$75.

## Low Income Relamping Program

Utility: Southern California Edison (SCE)

Sector: Residential, Low-income Customers

Measures: Compact Fluorescent Lighting

Mechanism: Utility pays 100% cost of lamps and pays community-based organizations to implement the program

History: Introduced in June of 1985, has been run for more than 6 years, still in operation

### 1991 Program Data

Annual energy savings: 27,175,302 kWh

Lifecycle energy savings: 244,577,718 kWh

Capacity savings: 3.01 MW

Cost: \$4,215,730

### 1985-1991 Program Data

Energy savings: 121,800,000 kWh

Lifecycle energy savings: 1,096,493,283 kWh

Capacity savings: 13.85 MW

Cost: \$23,547,118

## Conventions

For the entire 1992 profile series all dollar values have been adjusted to 1990 U.S. dollar levels unless otherwise specified. Inflation and exchange rates were derived from the U.S. Department of Labor's Consumer Price Index and the International Monetary Fund's International Financial Statistics Yearbook:1991.

The Results Center uses three conventions for presenting program savings. Annual savings refer to the annualized value of increments of energy and capacity installed in a given year, or what might be best described as the first full-year effect of the measures installed in a given year. Cumulative savings represent the savings in a given year for all measures installed to date. Lifecycle savings are calculated by multiplying the annual savings by the assumed average measure lifetime. Caution: cumulative and lifecycle savings are theoretical values that usually represent only the technical measure lifetimes and are not adjusted for attrition unless specifically stated.

# Utility Overview

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SCEcorp is the parent holding company of Southern California Edison Company and three non-utility subsidiaries collectively known as The Mission Group. Southern California Edison Company, the largest subsidiary, provides electric service to central and southern California. Its service territory covers 50,000 square miles and is home to more than 10 million people. SCEcorp has more than 4 million customers and more than 17,000 employees. [R#12]

In the year ending September 30, 1991, SCEcorp generated 78,127 GWh, 56.3% from utility-owned facilities, and 43.7% was purchased power. Of the utility-owned generation, 39% was from nuclear plants, 30% was from gas-fired plants, and 25% was from coal-fired plants. SCEcorp has virtually no oil-based power generation. [R#5]

Most of SCEcorp's electricity sales are to commercial customers. Revenue from electricity sales closely parallels the sales percentages in kWh. Commercial customers purchased 25,236 GWh in the year ending September, 1991, comprising 36% of the total kWh sales and 38% of the operating revenue from electricity sales. Residential customers purchased 30% of electricity sold, for 34.6% of the revenue; and industrial customers purchased 21%, for 16% of the revenue for that period. [R#5]

SCEcorp has focused on retaining its large commercial and industrial customers, as many consider leaving the

## SCE 1991 STATISTICS

Number of Customers	4,078,559
Energy Sales	71,146 GWh
Energy Sales Revenue	\$6.904 billion
Summer Peak Demand	16,709 MW
Generating Capacity	20,875 MW
Reserve Margin	24.93 %
<b>Average Electric Rates</b>	
Residential	11.00 ¢/kWh
Agricultural	9.46 ¢/kWh
Commercial	10.09 ¢/kWh
Industrial	7.48 ¢/kWh

[R#12]

service territory or installing their own electric generating systems. [R#3] Between September 1990 and September 1991 revenues increased in all except the agricultural sectors. While earnings rose, actual electricity sales (in kWh) decreased in most sectors. Residential sales decreased 3.4%, and overall sales decreased 0.1%. [R#5]

# Utility DSM Overview

Southern California Edison has been one of the nation's leading utilities in demand-side management. SCE has offered DSM programs since the mid-seventies and has pioneered in many areas, paying particular attention to data collection and evaluation. After sharing the national leadership for energy-efficiency with Pacific Gas and Electric in the late 1970s, Edison sharply reduced its DSM expenditures in the early and mid-1980s, citing its excess capacity situation. SCE's spending in 1990 and 1991 indicate that the utility has renewed its commitment to DSM.

## CURRENT RESIDENTIAL DSM PROGRAMS AT SOUTHERN CALIFORNIA EDISON

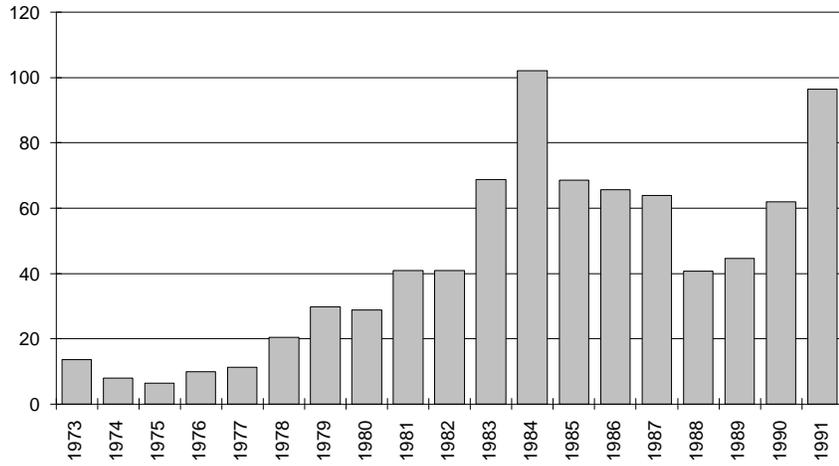
Action Line (toll-free conservation hotline)
Compact Fluorescent Bulb Program
Air Conditioning Cycling Program
Residential Energy Management Program
Domestic/Seasonal/Time-of-Use Rates
Residential Energy Surveys
All-Electric Energy Challenge Program (educational)
Welcome Home Program (new construction incentives)
The Leading Edge Design Competition
Professional
Student
Zero Interest Program/Greater Eastern Desert Area (loan program)
Water Energy Partnership
Water Saving Toilet Flapper Installation
Traveling Exhibit Program
Informational Booklets
Water Usage Consideration in Energy Audits
Customer Assistance Program
Home Energy Assistance Surveys
Residential Utility Conservation Advisory Committee
Energy-Efficient Relamping
Energy Education Program
Energy Conservation Measures (evaporative coolers, weatherization, energy saving thermostats, heat pumps, and maintenance)
Toilet Flapper Program
Winter Energy Savings Program
Security Lighting Program
Direct Mail Relamping

Utility DSM Overview Table	Annual DSM Expenditure (x1000)	Annual Energy Savings (GWh)	Annual Capacity Savings (MW)
1973	\$13,541	96	10
1974	\$7,953	383	29
1975	\$6,316	609	100
1976	\$9,877	467	80
1977	\$11,215	586	101
1978	\$20,447	720	184
1979	\$29,705	1,121	308
1980	\$28,868	1,267	377
1981	\$40,835	1,352	616
1982	\$40,903	1,565	835
1983	\$68,762	1,568	848
1984	\$102,019	1,610	505
1985	\$68,630	1,518	489
1986	\$65,708	1,131	602
1987	\$63,969	849	445
1988	\$40,768	700	360
1989	\$44,586	683	268
1990	\$62,000	1,129	591
1991	\$96,489	1,039	514
Total	\$822,590	18,393	7,262

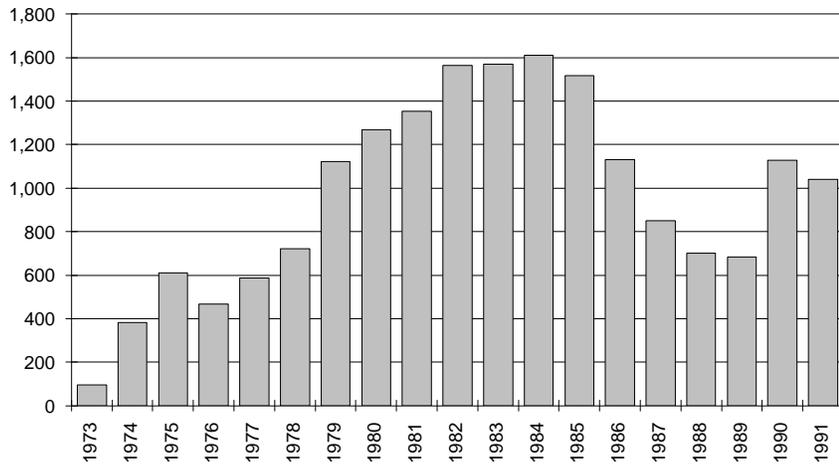
[R#2,13] Note: Years are March 1 -April 30

In 1990 and 1991, SCE's investments in DSM were equal to .9% and 1.4%, respectively, of its gross energy revenues. [R#2, 4, 12, 13] In 1991 SCE's DSM programs yielded energy savings equal to 1.4% of the total energy demand in the absence of any DSM programs. These programs also yielded peak capacity savings equal to 3.0% of the total peak capacity in the absence of any DSM programs.

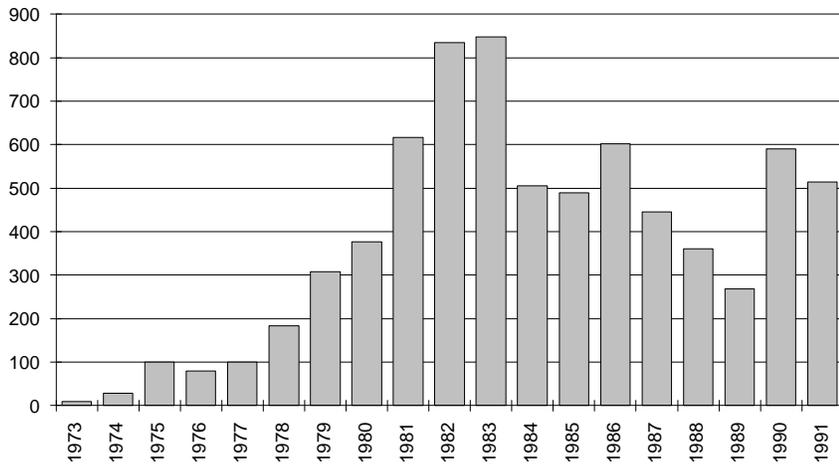
**ANNUAL DSM  
EXPENDITURE  
(\$1,000,000)**



**ANNUAL DSM  
ENERGY SAVINGS  
(GWH)**



**ANNUAL DSM  
CAPACITY  
SAVINGS (MW)**



# Program Overview

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The Relamping Program is designed to reduce low-income customers' electric bills, stimulate conservation awareness, develop a positive image of SCE, and encourage better bill paying behaviors. The first of its kind in the United States, this program distributes, free of charge, up to five energy-efficient compact fluorescent lamps (CFLs) to eligible households.

Promotion and implementation are accomplished through partnerships with numerous community-based organizations (CBOs). The CBOs provide services in a business-like manner. They are compensated by SCE for work performed and are responsible for the quality of that work as well as for product inventories.

The Relamping Program is one of nine programs included in SCE's Customer Assistance Program (CAP), see Utility DSM Overview for list of CAP programs. CAP was developed to comply with the California Public Utilities Commission's (CPUC) requirement that all utilities provide direct assistance programs for residential customers who can not afford the initial capital costs of efficiency measures. Within SCE's service territory, approximately 750,000 customers, 21 percent of its residential customer base, qualify for CAP services. [R#2,4]

CAP provides energy-efficiency services, free of charge, to low-income customers and customers with special needs, such as senior citizens, the physically handicapped, and those who speak little or no English. CAP utilizes one application form for all of its programs. When a customer applies for the Relamping Program, he or she is also, knowingly or not, applying for all other programs that may be applicable. Information about these other programs is provided by the CBOs when appropriate.

The Relamping Program is approximately 20%, by budget, of CAP. [R#2]

## PROGRAM HISTORY

- 1984, CFL testing and "in-home" test with utility personnel.
- 1985, June, program begins, three 15 W CFLs offered per home. Participation = 5%.
- 1987, four 15 W CFLs are offered per home. Participation = 19%.
- 1990, four 15 W and one 18 W CFL are offered per home. Participation = 41%
- 1991, five 15 W and one 18 W CFL are offered per home. Performance based CBO pay structure is implemented. Participation = 48%.
- 1992, five lamps will be available per home. Customers will select from 22 W and 30 W "Circline" fluorescent lamps (75 W and 100 W equivalents) and 13 W and 20 W CFLs (60 W and 75 W equivalents).
- 1994, end of planned funding for program, expect to have reached 475,000 customers, 63% participation. [R#2]

# Implementation

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## MARKETING AND DELIVERY

SCE, itself, does only a small amount of marketing for the Relamping Program. This effort includes distributing program brochures and contacting potential customers through direct mail. These customers can request service by returning a prepaid postcard included in the mailer or brochure, by writing a letter to SCE, or by calling the toll free "Action Line" telephone number.

Community-based organizations (CBOs) conduct most of the promotion and all of the delivery for the Relamping Program. These organizations are also the mechanisms for many other social service programs in their communities, such as dial-a-ride, nutrition, and job training programs, and thus are in an excellent position to deliver the relamping program as one of a variety of assistance programs. The CBOs advise and educate customers about programs available to them through SCE, the California Department of Economic Opportunity (DEO), county and city programs, and the CBOs themselves. By facilitating access to so many services at the same time, the CBOs are able to provide cost effective, "one stop" energy service.

CBOs implementing the Relamping Program include:

Southern California Indian Center

Proteus Training, Inc.

Ventura Committee on Human Concerns

Telacu, Inc.

(serving the Latin American community)

Long Beach Community Services Development Corporation, Inc.

Center for Employment Training

Inyo/Mono Advocates for Community Action

East San Gabriel Valley Consortium

Maravilla Foundation, Inc.

(serving the Latin American community)

Community Services Department of San Bernardino County

Vovi Friendship Association, Inc.

(serving the Vietnamese community)

Many of these organizations have established customer/client networks that include outreach and distribution

programs and maintain informational files about customers that can aid in targeting potential participants. Having these networks already in place saves time and money that SCE would have had to invest to develop its own systems. Furthermore, as the CBOs are well established and trusted within their communities, they can likely provide better outreach and market penetration than SCE.

Customer requests for service, generated by SCE's marketing efforts, are entered into the data base which arranges them geographically and produces referral reports that are sent to the CBOs. The CBOs have the responsibility to contact the referral customers, qualify them for participation, and provide service within two weeks of receiving the referral report. Reports of ineligible referral customers are provided to SCE by the CBOs. These customers receive a letter from SCE informing them why they are ineligible. They can dispute the decision if they believe it to be unjustified.

To qualify for service within CAP, and thus the Relamping Program, a customer's household income must not exceed 150 percent of the poverty level as defined by the federal Health and Human Services Department (or 200 percent for handicapped persons and senior citizens). SCE requires surveyors to review income documentation. Because the equipment cost per customer is relatively low, SCE does not believe it is worth the expense to keep copies of documents on file, as is done with many other low-income programs.

The CBOs provide service to both referral customers and those that they have identified. These services, all performed in a single home visit and at no charge to the customer, include: 1) installation of CFLs, 2) a simple energy audit, and 3) an energy-efficiency education session.

1) The surveyor installs as many as six CFLs in both indoor and outdoor fixtures and records the power consumption of the incandescent lamps replaced and the average number of hours per day that the customer estimates the fixtures to be in use. Surveyors encourage customers to relamp those fixtures that have the longest duty cycles and contain the highest wattage lamps.

2) The surveyor completes the simple energy audit portion of the required CAP application form. The surveyor records type and square footage of residence and which electric systems (appliances, HVAC, and lighting) are in-

## Implementation (continued)

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stalled in the home. This information is entered into the database which generates a report recommending additional energy-efficient and cost-effective measures (e.g. installing a heat pump, a whole house fan, an evaporative cooler, water heater tank insulation, water-efficient showerheads, etc.), also available through CAP, and estimates their potential energy savings.

3) The surveyor conducts a brief energy education session with the customer, covering basic lighting, water, and general energy conservation and efficiency. The operational and safety considerations of CFLs are discussed as well as their financial benefits, societal benefits, applications, and desirability over incandescent lamps. SCE literature, including a “CAP Fact Sheet” and a brochure entitled, “Saving Energy – It’s Free and Easy,” is distributed.

Three to four weeks after the relamping service is performed the customer receives a package from SCE containing the recommendations from the energy audit, a graph depicting actual monthly energy usage and billing costs over the previous 12 months, a chart relating average daily and monthly energy usage and costs, additional conservation literature, and a customer satisfaction survey.

Each CBO is compensated by SCE and may choose to be paid either a flat rate of \$25 per home serviced or a performance based rate of \$10 for the initial home visit and the first CFL installation and then \$5 for each additional CFL installation, up to five. The CBO submits the customers’ actual application forms and an invoice which states the number of homes serviced and which services were provided, to SCE for review and payment. SCE enters the information from the invoice into the data base and generates a “proof report” which summarizes the invoice. The report lists lamps installed, watts saved, the total number of applications submitted on the invoice, how many of those applications are accepted, and how many are rejected. Note: the CBO is paid only for service provided to customers whose applications are accepted and only for those lamps which it actually installs, not for those merely delivered.

Rejected applications are sent back to the CBO with an explanation such as the form is incomplete or the customer’s income is too large. In many cases the application can be corrected and resubmitted with the CBO’s next invoice. Applications rejected due to the customer’s income may not be resubmitted.

The CBO is not paid for having performed service to customers whose applications are later rejected. Any lamps installed in the homes of such customers are not counted as delivered (for purposes of program tracking). Further, these lamps are considered a loss to the CBO’s lamp inventory. The CBO is required to reimburse SCE for total lamp losses greater than 2% of its inventory, in any one reporting period.

Following participation in the Relamping Program many customers take advantage of other SCE programs such as the In-Home Energy Audit Program (HEAP) and the Evaporative Cooler Program (ECP). HEAP is an audit, more comprehensive than that conducted during the Relamping Program. Information about HEAP is included with the results of the “simple” audit. ECP provides and installs evaporative coolers to customers who live in desert regions and have either central or window wall air conditioning.

Being implemented in concert with the Relamping Program and during the same home visits, is the initial test program of the Southern California Water Conservation Partnership, of which SCE is a member. This program distributes and installs toilet flappers which reduce the amount of water used in the flush cycle. Following installation, installers conduct a mini-education session concerning the benefits of using a water conservation device and SCE’s interest in their distribution.

The CBOs encourage every participant to complete and return an application for the Low Income Rate Assistance (LIRA) program. LIRA provides a 15% rate discount to qualifying customers (all California utilities are required to have LIRA programs).

The CBOs also implement a traditional weatherization service program and the Energy Crisis Intervention Program, providing bill payment assistance, for the California Department of Economic Opportunity (DEO).

“Because of the relamping effort, SCE has been able to dramatically increase the participation rate of low-income customers in energy management programs,” reported former

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program manager, Dina Lane, in October of 1989. "As a direct result of this participation in the program, many of these same customers went on to attend energy education workshops, had their homes weatherized, and improved the overall energy efficiency of their residences."

## **INSTALLED MEASURES**

Up to five electromagnetically ballasted and one electronically ballasted, integral CFLs are available. The electromagnetic units require 15 watts to produce the equivalent lumens (light output) of 60-watt incandescents. The electronic units require 18 watts and are equivalent to 75-watt incandescents. SCE estimates the lifetimes of CFLs to be between 8,000 and 9,000 hours (manufacturers rate them between 9,000 and 10,000 hours).

In the early stages of planning the Relamping Program, several CFLs were tested in an independent laboratory. The tests evaluated lamp performance, possible power factor problems, and actual lumen output levels. Along with the laboratory tests, SCE conducted an "in-home" test of the lamps involving 200 utility employees. As a result of these tests, input from employees, and price negotiations with manufacturers, SCE selected two electromagnetically ballasted fluorescent lamps for program use, the Mitsubishi Marathon and the Panasonic Lightcapsule. In 1991, the electronically ballasted Panasonic Lightcapsule was also included. SCE recently solicited bids from manufacturers to supply CFLs for the 1992 program year. A total of thirteen manufacturers responded to SCE's bid request. More than forty CFLs were tested and evaluated in areas such as efficacy, power factor, lumen output, and total harmonic distortion. A mix of various wattages are expected to be made available to customers in the 1992 program year.

## **STAFFING REQUIREMENTS**

Most of the personnel involved in the Relamping Program provide implementation services and are employed by the CBOs. SCE, itself, relies upon a senior analyst, a junior analyst, and a clerical support person to administer the program. These SCE personnel are not involved with the program on a full time basis. In addition, a vendor provides extensive data processing services.

# Monitoring and Evaluation

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Monitoring and evaluation are coordinated by an extensive data processing system which is employed at every stage of customer service and follow up.

## MONITORING

All information recorded on the application form is entered into the Relamping Program data base. Also included in the data base is a "diary" which records any action that has been taken concerning a particular customer and any other relevant comments such as feedback from the customer.

Information from the customer satisfaction surveys is entered into the data base and compared to the information that was submitted on the application forms. An "exception report" is generated which lists all conflicting responses. Discrepancies often concern the number of lamps installed. In these cases, the utility contacts the customers to establish the correct information. If it is determined that fewer lamps were installed than the CBO reported, an adjustment is made to the CBO's next invoice.

A contractor summary report, generated by SCE and provided to each CBO, tracks each CBO's activity. The report contains all of the information found in the proof report (the number of accepted applications, homes serviced, lamps installed, etc., see Implementation section), as well as an accounting of all lamps shipped to the CBO. A summary table lists the number of lamps installed in accepted applicants' homes, the number shipped to the CBO from SCE, and the difference between the two. This difference is the number of lamps that the CBO should have in its inventory. The number that the CBO actually has may be less, due to theft, breakage, and lamps installed for customers whose applications were not accepted. Each CBO is allowed a 2% loss of its inventory. For any loss greater than 2%, the CBO is required to reimburse SCE for the difference. The cost of the lamps is either deducted from the CBO's invoices or a bill is sent from SCE to the CBO.

SCE employs a software program, called **Data Express**, which allows the Relamping Program staff to access virtually

any segment of data within the database. For example, the results of customer satisfaction surveys can be examined to monitor a particular surveyor's performance. If the staff find that a particular surveyor's name is appearing on the exception report too often, they can access all of that surveyor's applications for a particular period of time. They can then contact those customers to inquire about the quality of service they received. In this way, SCE insures that its customers are receiving high quality service and can rectify cases where they have not.

A backup screen to the Relamping Program data base provides customer information such as how many and what kind of lamps were installed, how much energy was saved, who was the surveyor, on what invoice was the application submitted, on what date was service performed, on what date was the application processed, was the customer a referral or did the CBO generate the contact, and what other services were delivered.

All referrals that, after 30 days, have not been reported to have been serviced or determined ineligible are listed on a "delinquent referrals report" which is sent to the CBO.

## EVALUATION

SCE evaluates the performance of the Relamping Program by analyzing the responses to the customer satisfaction survey. The survey verifies household income, the number of lamps received and installed, whether the surveyor provided information about energy conservation and lamp operation and safety, and if the customer is satisfied with the performance of the lamps. In October of 1989, the survey results indicated that over 94 percent of customers were satisfied with the performance of their lamps and 99 percent were pleased with the quality of service overall. [R#1] The overall rate of response to the customer satisfaction survey is between 25 and 30 percent (which SCE considers to be very good). [R#2]

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SCE evaluates CBO performance by routinely verifying invoices and applications submitted by two randomly selected surveyors per CBO. The customers are contacted and the information reported on the application forms is verified.

## **DATA QUALITY**

Energy savings are calculated by using customers' estimates of the average number of hours per day that their light fixtures operate. Naturally, there is cause for concern that customers may not have accurate perceptions of the duty cycles of their lighting systems. This fundamental data quality issue could be overcome by monitoring a random customer sample and then determining an adjustment factor (to correct engineering estimates) for this variable.

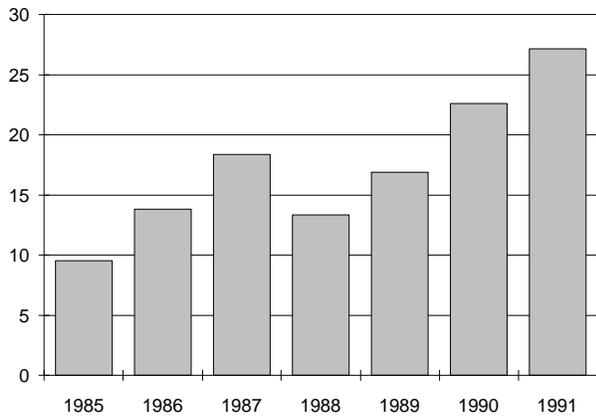
Administrative costs have been estimated at \$250,000 (1990 dollars) per year by SCE. [R#2] This figure has been difficult to determine as the Relamping Program is administered as a part of the entire Customer Assistance Program. Administrative costs for each of the individual CAP programs are not separated.

SCE has plans to address the aforementioned issues in its 1992 program year. A Residential Lighting Behavior Study, to be conducted in the summer of 1992, will examine residential lighting use. Areas of investigation will include fixture types, lamp wattages, duty cycles, etc. Also in 1992, SCE will continue using an accounting system, first employed in December 1991, to report its program costs. The new system more accurately reflects administrative costs than have previous methods. And finally, a conditional demand analysis of low-income program participants will be conducted. This analysis will verify program savings estimates by measure and by program.

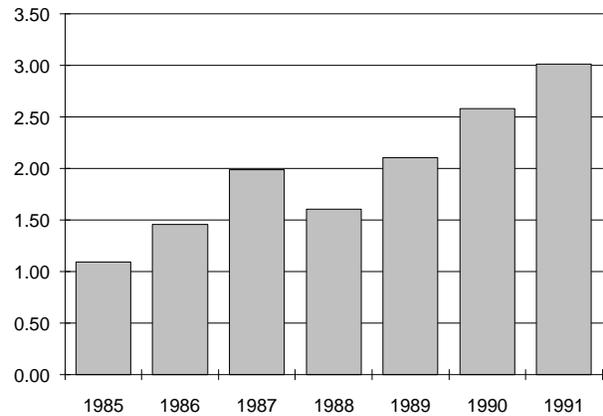
# Program Savings

Savings Overview Table	Annual Energy Savings (kWh)	Cumulative Energy Savings (kWh)	Lifecycle Energy Savings (kWh)	Annual Peak Capacity Savings (MW)	Cumulative Peak Capacity Savings (MW)
1985	9,575,497	9,575,497	86,179,473	1.09	1.09
1986	13,833,947	23,409,444	124,505,523	1.46	2.55
1987	18,394,848	41,804,292	165,553,632	1.99	4.54
1988	13,339,785	55,144,077	120,058,065	1.61	6.15
1989	16,903,434	72,047,511	152,130,906	2.11	8.26
1990	22,609,774	94,657,285	203,487,966	2.58	10.84
1991	27,175,302	121,832,587	244,577,718	3.01	13.85
Total	121,832,587	418,470,693	1,096,493,283	13.85	

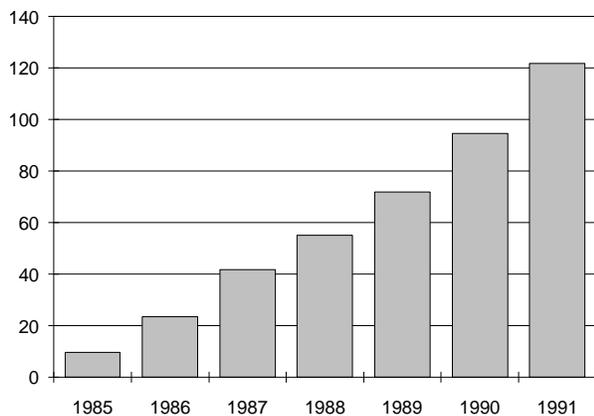
**ANNUAL ENERGY SAVINGS (GWH)**



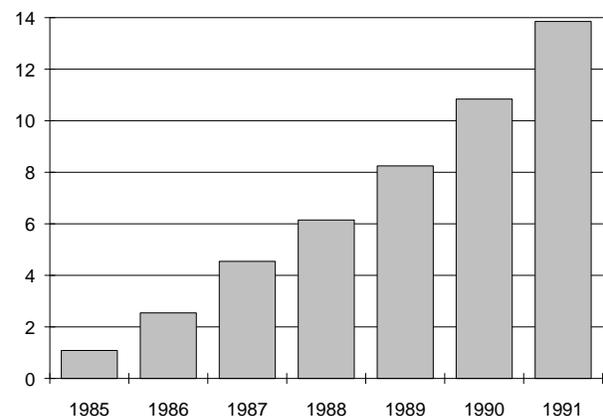
**ANNUAL PEAK CAPACITY SAVINGS (MW)**



**CUMULATIVE ENERGY SAVINGS (GWH)**



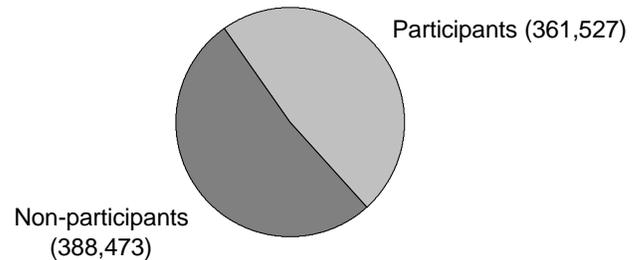
**CUMULATIVE PEAK CAPACITY SAVINGS (MW)**



By the end of 1991, the Relamping Program had accumulated total cumulative energy savings of 418,470,693 kWh/year. In terms of capacity savings, the program had avoided the need for 13.85 MW summer peak.

The additional social benefits associated with the creation of 200 new jobs can be attributed to the Relamping Program. As the CBOs are sparsely staffed, they have had to recruit and employ community residents to provide the level of service necessary to implement the program. In many cases these are full-time positions with full benefits.

funding), SCE expects this program to reach another 111,000 customers, achieving a 63% participation rate.



## MEASURE LIFETIME

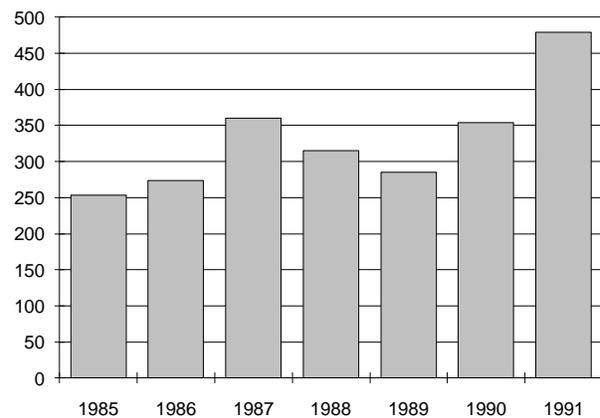
The lamps installed are estimated by SCE to have a lifetime of 9,000 hours. Average annual residential usage is estimated at 1,000 hours. The lifetime of the measure is thus approximately 9 years.

## PARTICIPATION

Approximately 750,000 customers in SCE's service territory qualify for the Relamping Program (as well as the other CAP programs). By the end of 1991 participation in the Relamping Program had reached 48% (361,527 customers).

Between 1992 and the end of 1994 (the end of approved

**ANNUAL SAVINGS PER PARTICIPANT (KWH)**



Customers Serviced Table	Participants	Lamps Installed	Lamps Installed per Participant	Average Annual Energy Savings / Lamp (kWh)	Average Annual Energy Savings / Participant (kWh)
1985	37,793	109,418	2.90	87.5	253
1986	50,482	146,053	2.89	94.7	274
1987	51,105	198,933	3.89	92.5	360
1988	42,332	160,517	3.79	83.1	315
1989	59,217	210,977	3.56	80.1	285
1990	63,913	258,321	4.04	87.5	354
1991	56,685	301,226	5.31	90.2	479
Total	361,527	1,385,445			
Average	51,647	197,921	3.77	88.0	332

[R#2]

# Cost of the Program

SCE spent \$4,215,730 on the Relamping Program in 1991. Of this expenditure, \$2,369,976 was for CFLs, \$1,595,755 was paid to CBOs, and \$250,000 was for SCE's administration and data processing costs. To date SCE has invested \$23,547,118 in the Relamping Program. (This figure does not include planning, evaluation, and research and development costs, as SCE does not report these factors for individual DSM programs. They are reflected in the overall utility DSM expenditure, however.)[R#2]

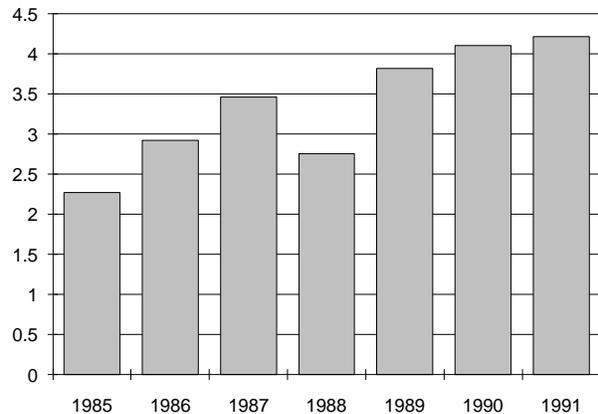
## COST EFFECTIVENESS

In accordance with the California Public Utilities Commission Standard Practice Manual, SCE evaluated the program's cost-effectiveness under the total resource cost test. By this procedure, the CFLs used in the Relamping Program were determined to be cost-effective, with a benefit to cost ratio of 10.7 to 1.[R#1]

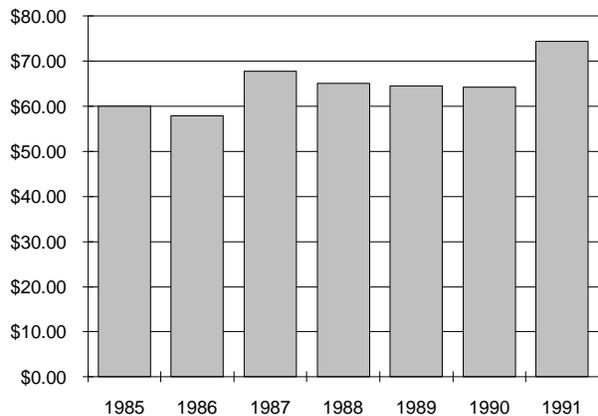
## FREE RIDERSHIP

Free ridership considers the number of customers that would have implemented the efficiency measures in the absence of utility incentives. As the Relamping Program's basic premise is that those who qualify for service cannot afford the initial cost of energy-efficiency measures, free ridership is not a concern.

**TOTAL PROGRAM COSTS (x1,000,000)**



**PROGRAM COST PER PARTICIPANT**

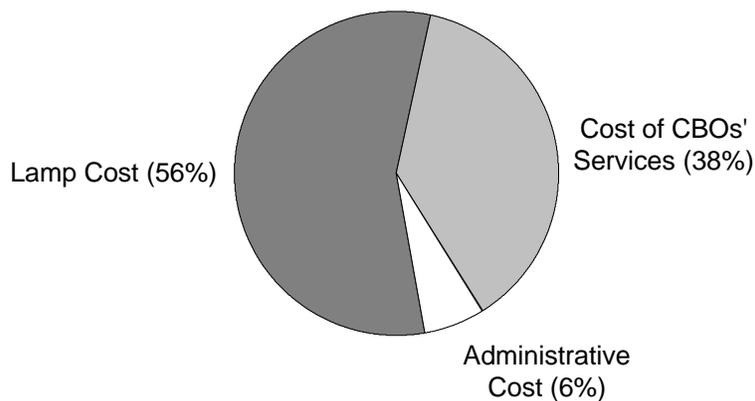


Cost of Saved Energy Table (¢/kWh)	Discount Rates						
	3%	4%	5%	6%	7%	8%	9%
1985	3.04	3.19	3.33	3.48	3.64	3.79	3.95
1986	2.71	2.84	2.97	3.10	3.24	3.38	3.52
1987	2.42	2.53	2.65	2.77	2.89	3.01	3.14
1988	2.65	2.78	2.91	3.04	3.17	3.31	3.45
1989	2.90	3.04	3.18	3.32	3.47	3.62	3.77
1990	2.33	2.44	2.55	2.67	2.78	2.90	3.03
1991	1.99	2.09	2.18	2.28	2.38	2.48	2.59

<b>Costs Overview Table</b>	Cost of CBOs' Services	Admin. Cost	Lamp Cost	Total Program Cost	Cost per Lamp Installed	Cost per Participant
1985	\$1,137,164	\$134,526	\$996,812	\$2,268,502	\$20.73	\$60.02
1986	\$1,440,316	\$173,146	\$1,306,282	\$2,919,744	\$19.99	\$57.84
1987	\$1,540,775	\$205,344	\$1,716,585	\$3,462,704	\$17.41	\$67.76
1988	\$1,262,038	\$163,406	\$1,330,066	\$2,755,511	\$17.17	\$65.09
1989	\$1,928,162	\$226,691	\$1,667,824	\$3,822,678	\$18.12	\$64.55
1990	\$1,683,071	\$243,270	\$2,175,908	\$4,102,249	\$15.88	\$64.18
1991	\$1,595,755	\$250,000	\$2,369,976	\$4,215,730	\$14.00	\$74.37
<b>Total</b>	<b>\$10,587,282</b>	<b>\$1,396,384</b>	<b>\$11,563,452</b>	<b>\$23,547,118</b>		

## COST COMPONENTS

In 1991, fully 56% of the total Relamping Program cost went directly into energy efficient equipment (CFLs). Another 38% was paid to the CBOs who implement the program. The remaining 6% represented administrative costs. [R#2]



# Environmental Benefit Statement

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Marginal Power Plant	Heat Rate BTU/kWh	% Sulfur in Fuel	CO2 (lbs)	SO2 (lbs)	NOx (lbs)	TSP* (lbs)
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## Coal Uncontrolled Emissions

A	9,400	2.50%	902,223,000	21,405,000	4,327,000	433,000
B	10,000	1.20%	962,064,000	8,286,000	2,794,000	2,071,000

## Controlled Emissions

A	9,400	2.50%	902,223,000	2,140,000	4,327,000	35,000
B	10,000	1.20%	962,064,000	829,000	2,794,000	138,000
C	10,000		962,064,000	5,524,000	2,762,000	138,000

## Atmospheric Fluidized Bed Combustion

A	10,000	1.10%	962,064,000	2,532,000	1,381,000	690,000
B	9,400	2.50%	902,223,000	2,140,000	1,731,000	130,000

## Integrated Gasification Combined Cycle

A	10,000	0.45%	962,064,000	1,703,000	276,000	690,000
B	9,010		865,397,000	617,000	208,000	41,000

## Gas Steam

A	10,400		524,762,000	0	1,197,000	0
B	9,224		455,715,000	0	2,854,000	135,000

## Combined Cycle

1. Existing	9,000		455,715,000	0	1,749,000	0
2. NSPS*	9,000		455,715,000	0	829,000	0
3. BACT*	9,000		455,715,000	0	115,000	0

## Oil Steam--#6 Oil

A	9,840	2.00%	759,524,000	11,508,000	1,358,000	1,289,000
B	10,400	2.20%	805,556,000	11,416,000	1,708,000	829,000
C	10,400	1.00%	805,556,000	1,630,000	1,372,000	433,000
D	10,400	0.50%	805,556,000	4,787,000	1,708,000	263,000

## Combustion Turbine

#2 Diesel	13,600	0.30%	1,008,096,000	2,007,000	3,116,000	170,000
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## Refuse Derived Fuel

Conventional	15,000	0.20%	1,196,826,000	3,084,000	4,060,000	902,000
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**Avoided Emissions Based on 418,470,693 kWh Saved (1985 - 1991)**

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In addition to the traditional costs and benefits there are several hidden environmental costs of electricity use that are incurred when one considers the whole system of electrical generation from the mine-mouth to the wall outlet. These costs, which to date have been considered externalities, are real and have profound long term effects and are borne by society as a whole. Some environmental costs are beginning to be factored into utility resource planning. Because energy efficiency programs present the opportunity for utilities to avoid environmental damages, environmental considerations can be considered a benefit in addition to the direct dollar savings to customers from reduced electricity use.

The environmental benefits of energy efficiency programs can include avoided pollution of the air, the land, and the water. Because of immediate concerns about urban air quality, acid deposition, and global warming, the first step in calculating the environmental benefit of a particular DSM program focuses on avoided air pollution. Within this domain we have limited our presentation to the emission of carbon dioxide, sulfur dioxide, nitrous oxides, and particulates. (Dollar values for environmental benefits are not presented given the variety of values currently being used in various states.)

## HOW TO USE THE TABLE

1. The purpose of the previous page is to allow any user of this profile to apply SCE's level of avoided emissions saved through its Relamping Program to a particular situation. Simply move down the left-hand column to your marginal power plant type, and then read across the page to determine the values for avoided emissions that you will accrue should you implement this DSM program. Note that several generic power plants (labelled A, B, C,...) are presented which reflect differences in heat rate and fuel sulfur content.

2. All of the values for avoided emissions presented in both tables includes a 10% credit for DSM savings to reflect the avoided transmission and distribution losses associated with supply-side resources.

3. Various forms of power generation create specific pollutants. Coal-fired generation, for example, creates bottom ash (a solid waste issue) and methane, while garbage-burning plants release toxic airborne emissions including dioxin and furans and solid wastes which contain an array of heavy metals. We recommend that when calculating the environmental benefit for a particular program that credit is taken for the air pollutants listed below, plus air pollutants unique to a form of marginal generation, plus key land and water pollutants for a particular form of marginal power generation.

4. All the values presented represent approximations and were drawn largely from "The Environmental Costs of Electricity" (Ottinger et al, Oceana Publications, 1990). The coefficients used in the formulas that determine the values in the tables presented are drawn from a variety of government and independent sources.

### \* Acronyms used in the table

TSP = Total Suspended Particulates

NSPS = New Source Performance Standards

BACT = Best Available Control Technology

# Lessons Learned / Transferability

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While the program is very straightforward and highly transferable to areas with high concentrations of low-income customers, two keys exist to successful implementation: the data processing system and efficient identification of eligible customers.

The data processing system, described in detail in the Implementation and the Monitoring and Evaluation sections, is critical to successful administration of this program. It allows very careful monitoring and tracking of the service provided to the customers and allows the program to be administered by a small number of staff people.

Identifying which customers are eligible for service and gaining their trust are two of the program's main challenges. While these tasks could be performed by utility personnel, SCE has found it to be more to the customers' benefit to contract this work to the CBOs. In this way, customers gain access to the many other important social service and DSM programs which the CBOs also implement. For example, senior citizens may be referred to meals on wheels or senior nutrition programs. For other examples, see the Implementation section.

The performance based CBO pay structure, described in the Implementation section, encourages much more efficient service than previous pay structures did. Since this new pay structure was implemented, at the beginning of the 1991 program year, the number of lamps installed per home increased 35 percent while the delivery cost per lamp decreased 14 percent as compared to the previous year (throughout the life of the Relamping Program, cost per lamp installed has dropped from \$21 to \$14).

Interestingly, although more lamps were distributed in 1991, fewer households were serviced than in 1990. Program planners had anticipated providing an average of between 4.5

and 5 lamps per household. The actual average for 1991 was 5.31 lamps per household. Consequently, the inventory of lamps could not reach as many homes as had been expected. In response to concern that concentrating the lamps in fewer homes might decrease the savings achieved per lamp, SCE has reduced the number of lamps available per household to five from six for the 1992 program year. As more lamps are offered, the savings per lamp may diminish because each household replaces its most inefficient and/or highly used lamps first. As the number of lamps available to a customer increases, he or she will likely use the fifth and sixth lamp to replace lamps with shorter duty cycles than would a customer who could only replace one or two lamps.

By 1991, the Relamping Program had served 48% of eligible customers. Program manager, Jack Parkhill, expects that as participation increases and the marketplace becomes saturated, the program may be redesigned or new services may be included. Possible changes may include: 1) replacing CFLs that have expired or will soon expire and/or 2) offering a 100-W incandescent equivalent CFL to all customers who have participated in the program. Other program changes may take advantage of technological advances that are presented to SCE by manufacturers seeking to provide CFLs to the program.

SCE is also considering distributing modular CFLs instead of the integral units. The modular units consist of two pieces, a ballast which has a lifetime between 40,000 and 50,000 hours and a replaceable lamp which has a lifetime of between 9,000 and 10,000 hours. The advantage of the modular unit is that the lamp can be replaced at the end of its lifetime while preserving the longer lived ballast. The integral units currently in use contain a one-piece ballast/lamp combination and must be entirely replaced when the lamp expires.

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In response to requests from many program participants, SCE is considering offering lamps with higher lumen outputs. Specifically being investigated is a 27-W CFL which is equivalent in brightness to a 100-W incandescent. Program personnel are concerned, however, that the level of energy saved per dollar invested may slightly drop if these new, brighter lamps are installed to replace anything but a 100-W incandescent. From the standpoints of customer satisfaction and proper lighting design, there will likely be many cases where it will be beneficial to increase a customer's lighting level in certain areas. Senior citizens, for instance, physiologically require more light than do younger people. For a utility implementing a similar relamping program from scratch, it may be desirable to design the program to permit slightly less energy savings, in some cases, in exchange for improving lighting levels that better suit a customer's needs.

As the Relamping Program evolves, utility personnel require a variety of information for planning and refinement. The customer satisfaction survey is modified from year to year to permit acquisition of required data. For example, a question recently added asked customers where the CFLs are installed. If many customers had responded that lamps were installed in closets, where usage is infrequent, a rule might have been enacted prohibiting such installations. Or, if a large number of lamps had been reported to have been installed in porchlight fixtures, more concern would have been placed on providing lamps specifically designed to perform well outdoors.

Similarly, the information that SCE includes in its data base is also evolving. In the past, the number of watt-hours saved per lamp has been included in the data base, but SCE has had no record of how the number was calculated. Starting with the 1992 program year, data entry personnel will be required to input the wattage of the lamp replaced and number of hours the fixture operates per day, as well as the

calculated number of watt-hours saved. All of this information is provided to the data entry personnel on the customer application forms. Including this information in the data base will permit a better understanding of customer lighting usage and how savings estimates are determined.

Program administrators believe that income eligibility is being accurately represented by the CBOs. Customer satisfaction surveys ask the customer's income and if the surveyor reviewed income verification documents prior to performing service. Results of the surveys indicate that 92% of the time the surveyor has verified income eligibility. As no significant degree of fraud is believed to be occurring and, as noted earlier, lamp costs are relatively low, SCE has not considered it necessary to go to the expense of requiring photocopies of income verification documents to be kept on file, as is done by many other low-income programs. [R#2]

# Regulatory Incentives and Shareholder Returns

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California has a long history of compensating its utilities for their demand side management expenditures. The Electricity Revenue Adjustment Mechanism (ERAM) was the first regulatory mechanism to remove the disincentive concerning lost revenue that was preventing most utilities from implementing DSM programs. ERAM allowed utilities to earn a rate of return on projected sales, before energy efficiency programs reduced actual sales. In 1989, the California Collaborative process modified DSM recovery mechanisms to allow utilities to earn a return on their DSM investments. This created an incentive for utilities' participation in DSM -- more than simple removal of the disincentive.

For SCE's 1992 general rate case, the California Public Utilities Commission developed an "S-shaped" incentive function for determining the levels of shared savings SCE may earn for the performance of applicable DSM programs (including the Relamping Program). The incentive function is designed to encourage SCE to be both as accurate as possible in projecting its DSM savings goals and as successful as possible in achieving them. The function utilizes a rate which varies with how well program performance matches its goals. The variable rate is designed to provide SCE with its highest rate of return on its DSM investments when SCE exactly meets its projected savings goals. The function employs a penalty for poor performance and a very small rate of return for low achievement and for performance far exceeding the projected goal.

For performance less than 50% of the goal, the value of the incentive is negative; SCE is penalized. At 50% the incentive value is exactly zero; beyond this performance level

the utility can accrue rewards. Between 50% and 75% (low achievement) a small, constant incentive rate is available. From 75% to 125%, the greatest rewards are possible. In this region of performance the incentive rate is parabolic, greatly increasing from 75% to its peak at exactly the performance goal and then decreasing to 125% of the goal. The incremental incentive value is large throughout this region, with the greatest value being at 100% of the goal. Beginning at 125% and continuing indefinitely, the same small, constant incentive rate is applied as between 50% and 75%. In this last region the incremental value of the incentive is small and constant.

The incentive value is determined by multiplying the incentive rate (variable as described above) by the incentive basis (IB). The incentive basis is the value of the total resource benefit (TRB) of the program less the average of utility and total costs. Utility costs represent the utility's investment in a DSM program and include the utility administrative cost (UAC) and the utility incentive cost (UIC). Total costs are defined as the participant cost (PC) and the utility administrative cost. As the Relamping Program is a direct installation program, its utility incentive cost is the full cost of the CFLs and its participant cost is zero. At the target incentive basis (100% of the program performance goal), the incentive available to be earned by SCE is designed to be equal to 10.59% of the utility cost (UAC + UIC). Thus, the highest rate of return SCE can earn on its investment in the Relamping Program is 10.59%. [R#11]

# References

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Special thanks to Jack Parkhill for his endless patience and help throughout the development of this profile.