Pacific Gas and Electric Company

The Energy-Saver Showerhead Coupon Program

Profile #14, 1992

Executive Summary

The purpose of the Energy-Saver Showerhead Coupon Program was to replace existing inefficient showerheads with water-efficient ones. Because California law forbids the sale of inefficient showerheads, replacement will eventually happen but this program was designed to accelerate replacement. PG&E's effort was highly successful. The first year's distribution exceeded the program's initial goal by 420%.

The main delivery mechanism was rebate coupons obtained and redeemed at the point of purchase. These coupons allowed the consumers to receive up to a $4 rebate toward the cost of each showerhead they purchased. The coupons were returned to PG&E by the participating retailers who were then reimbursed for the rebates. This type of program requires a minimum amount of administrative cost and almost no labor cost.

The program also included two much smaller components, direct installation and a special events giveaway. Together the two smaller components were responsible for the distribution of only 26,833 showerheads while the Energy-Saver coupons were responsible for the distribution of over 526,000 showerheads. All three components are described at length in the Implementation section. Although the program title makes reference only to the Energy-Saver coupons, the savings and cost numbers in this profile include the contributions from all three components.

One of the most unique and potentially helpful aspects of this program was its evaluations. Both a telephone survey and on-site data collection were done. The information that was gathered was invaluable in determining the net to gross ratio (how many showerheads actually resulted in a net energy savings) and for estimating the average annual savings per showerhead.

The annual energy savings from the first year of the program are 11.5 GWh of electricity, 4.1 therms of natural gas, and 797 kW of capacity. This was achieved at a total cost of $2.6 million. The penetration rate for the estimated number of targeted showerheads was ~8.1% after the first year. The program is being continued in 1992 and plans have been developed to extend it through 1995.

Because showerhead retrofits are a common utility DSM measure this profile contains an expanded discussion of the different types of delivery mechanisms that utility companies have commonly employed to implement a showerhead program. (See Delivery Mechanisms section). This discussion includes a comparison of cost and estimated penetration rates for the different mechanisms.

The Energy-Saver Showerhead Coupon Program

Utility:	Pacific Gas and Electric Company
Sector:	Residential
Measures:	Water-efficient showerhead retrofit
Mechanism:	Point of Purchase Rebates
History:	Began in 1991, continuing in 1992

1991 Program Data

Energy savings:	11.5 GWh
Energy savings (gas):	4.1 million therms
Lifecycle energy savings:	115 GWh
Lifecycle energy savings (gas):	41 million therms
Peak capacity savings:	797 kW
Cost:	$2,601,708
Participation:	8.1%

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

Pacific Gas and Electric (PG&E) is an investor-owned gas and electric utility with a service territory (broken down into 25 divisions) encompassing 94,000 square miles in northern and central California. In 1991, PG&E served 4.26 million electric customers and 3.5 million gas customers.

Electric sales exceed gas sales and represent 75% and 25% respectively, of the company's total operating revenues. In 1991, PG&E's electric sales volume increased slightly compared to 1990, to 74,195,890 MWh. During the same year gas sales dropped as PG&E began shifting its focus from gas sales to expanding its gas transmission capability.

1991 PG&E SOURCES OF ELECTRICITY

PG&E owned	
Hydro	7.6%
Natural gas	22.5%
Oil	0.2%
Geothermal	7.2%
Nuclear	15.5%
subtotal	**53.0%**
Qualifying facilities	
Gas cogeneration	12.0%
Hydro	1.0%
Geothermal	0.6%
Solar	0.2%
Wind	3.6%
Biomass	2.6%
subtotal	**20.0%**
Other purchases	**27.0%**

PG&E 1991 ELECTRIC STATISTICS

Number of Customers	4,257,145	
Electricity Sales	74,196	GWh
Electricity Sales Revenue	$6.971	billion
Summer Peak Demand	16,630	MW
Generating Capacity	20,312	MW
Reserve Margin	22%	
Average Electric Rates		
Residential	10.97	¢/kWh
Commercial	10.08	¢/kWh
Industrial	6.81	¢/kWh
Agricultural	9.54	¢/kWh

[R#4]

PG&E has developed its electric supply plan with four main objectives: maximizing customer energy efficiency, reducing dependence on oil for power generation, participating in the competitive bulk power supply market, and conducting aggressive research and development of renewable energy resources.

In 1991 PG&E's electricity supply came from three general sources: 53% from PG&E owned and operated facilities, 20% from Qualifying Facilities (QF), and 27% from a variety of purchases and other production. A 20% contribution from QFs is relatively large compared to most other utilities and is the result of a deliberate effort by PG&E to diversify its electricity supply and expand the role of renewable energy. The table at left contains a breakdown of the contributions from PG&E owned facilities and its Qualifying Facilities. The 27% that is mostly purchased power is not broken down by energy source because of the complicated nature of these purchases.[R#4,10].

Utility DSM Overview

Pacific Gas and Electric has been a leading U.S. utility in demand-side management since 1976. Over the years the giant west coast utility has spent over $2 billion dollars on its conservation and load management activities, including a small sum for solar DSM programs. In California DSM is defined in four ways: conservation, load management, fuel substitution, and load building and retention. The data presented in this section refers only to conservation and load management and expenditures are expressed in levelized dollars.

PG&E refers to its DSM programs as Customer Energy Efficiency (CEE) programs. These programs were significantly expanded in 1990 when the California Public Utilities Commission issued a decision authorizing the utility to implement new DSM programs and enhance existing ones. The combined goal of all of the CEE programs is to achieve a total 2,500 MW reduction in peak electric demand growth by the year 2000. In 1991, CEE program expenditures were equivalent to 2% of the utility's total energy revenues [R#3,4].

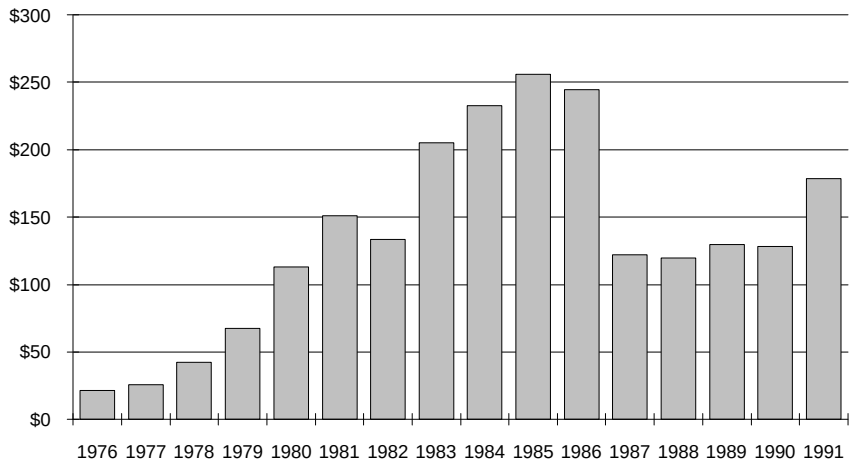
CURRENT PG&E DSM PROGRAMS

Residential
- New Construction Program
- Appliance Efficiency Incentives Programs
- Direct Assistance for Low-Income Customers
- Energy Management Services
- Information Programs

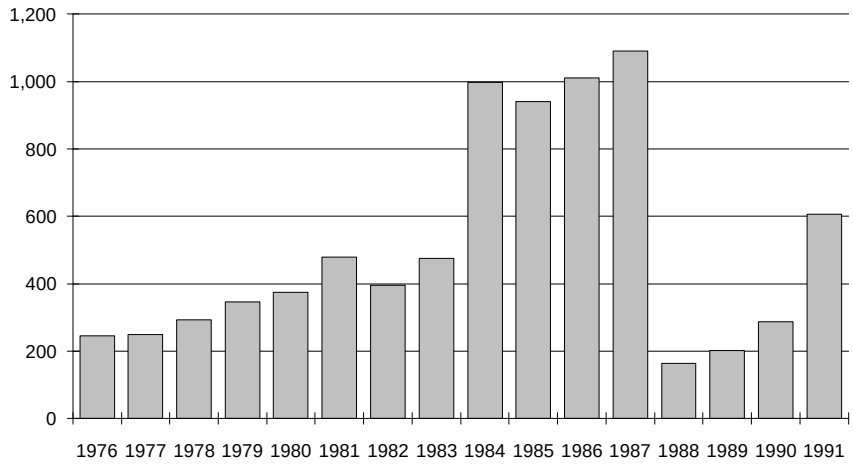
Nonresidential
- Commercial New Construction Rebates
- Nonresidential Energy Efficiency Incentive Program
  - Direct Rebates
  - Customized Electric Rebates
  - Customized Gas Rebates
  - CIA Energy Efficiency Incentives
  - Commercial Market Sector Pilot Projects
- CIA Energy Management Services
- Nonresidential Information Programs
- Load Management Programs
- Fuel Substitution
- Load Retention and Load Building
- CEE Demonstration Projects

DSM Overview Table	Annual C & LM Expenditure (x1,000)	Annual Energy Savings (GWh)	Annual Capacity Savings (MW)	Annual Gas Savings (Million Therms)
1976	$21,413	246	64	47
1977	$25,737	249	48	67
1978	$42,245	292	59	50
1979	$67,246	347	175	76
1980	$113,082	375	277	66
1981	$151,093	479	81	87
1982	$133,601	396	63	99
1983	$204,913	476	84	75
1984	$232,788	997	211	59
1985	$256,044	941	110	119
1986	$244,701	1,010	129	140
1987	$121,931	1,091	498	48
1988	$119,708	163	296	12
1989	$129,593	202	97	14
1990	$128,292	288	676	25
1991	$178,767	607	676	32
Total	$2,171,154	8,159	3,544	1,016

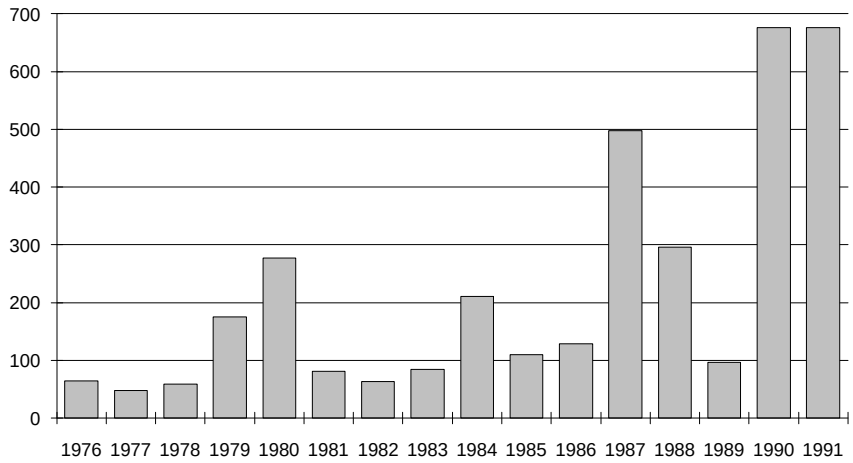
ANNUAL ELECTRIC C&LM EXPENDITURE ($1,000,000)



ANNUAL ENERGY SAVINGS (GWH)



ANNUAL CAPACITY SAVINGS (MW)



Program Overview

The Energy-Saver Showerhead Coupon Program is a relatively new program (begun in late 1990) and is delivered as one of PG&E's Appliance Efficiency Incentive Programs. The program's main goal is to replace old inefficient showerheads with more water-efficient ones, thus saving both gas and electricity by reducing the demand for hot water. The main mechanism for delivering this program was a rebate coupon for the first $4 of the cost of a water-efficient showerhead or the total cost if less than $4. The coupon was redeemed, by the customer, at the time of purchase of the showerhead. There were also two other minor delivery mechanisms that were part of the program which are discussed in the Implementation section of this profile. All three components are considered in the calculations in the Savings and Costs sections.

In 1991, PG&E customers purchased 526,598 water-efficient showerheads using the rebate coupons. This exceeded the program's expected penetration goal by about 420%.[R#1] However, not all of these showerhead sales resulted in an increase in energy savings. An analysis of a customer survey done by PG&E indicated that only about 31% of the showerheads purchased with rebate coupons resulted in a net gain in energy savings. (See Monitoring and Evaluation section.)

The total savings from the first year of this program, including the two minor delivery mechanisms, was estimated to be 10.9 GWh of electricity, .76 kW of peak summer capacity, and 3.9 million therms of natural gas. This was achieved at a cost of ~$2.72 million.

The extensive evaluation was helpful to the program planning and revision process. Although the first year was exceptionally successful in surpassing penetration goals, the evaluation revealed areas for program improvement. As a result, the 1992 program, although quite similar, has incorporated changes that are designed to decrease the number of showerheads that are purchased with rebate coupons but never installed and thus improve the program's cost effectiveness.

MARKETING AND DELIVERY

Both the marketing and delivery of this program were done mainly through participating retail stores. Marketing and promotional efforts included point-of-purchase displays and educational materials placed on the retail store shelves next to the showerheads. Rebate coupons were placed in the stores for easy availability to the customers. The coupons were also made available to customers in conjunction with other residential DSM programs. The only other marketing of the program was done through a PG&E newsletter that was mailed to customers with their utility bill.

The showerheads were delivered in one of three ways. First, and by far the most common method was to encourage customers to buy a water-efficient showerhead by offering to let them redeem a rebate coupon at the time of purchase for the first $4 of the cost of the showerhead (or the total cost if the showerhead cost less than $4). The participating retail stores then returned coupons to the utility for reimbursement via the Electric and Gas Industies Association (EGIA), a quasi independent organization for processing rebates. (The returned coupons not only helped PG&E keep track of the number of showerheads rebated but they also contained information, such as the customer's name and address, which was helpful for doing the follow up program evaluation.) In 1991 about 277,00 Energy-Saver rebate coupons were returned to PG&E, indicating the purchase of 526,598 showerheads. PG&E made a slight modification in this method for the 1992 version of the program. Instead of receiving a rebate on the first $4 of their water-efficient showerhead purchase, customers receive a 50% discount up to a maximum of $4 per showerhead. This change was prompted by PG&E's finding that some customers where purchasing more showerheads than they could use. This purchasing of extra showerheads seemed to be encouraged by the fact that some showerheads cost less than the $4 rebate and thus were free to the customer. Many of these "extra showerheads" were never permanently installed. An additional change limits the purchase per coupon to one instead of the maximum of four allowed under the 1991 program. These 1992 program modifications were designed to increase the net-to-gross ratio (see Monitoring and Evaluation) and cut costs.

Secondly, there was a direct installation delivery mechanism. This was a relatively small component of the program, compared to the rebate-coupon part, but it did result in the installation of 12,162 showerheads. The installations were done by PG&E personnel in conjunction with on-site visits such as home weatherization and home audit surveys or for elderly or handicapped individuals. The direct installations retrofits were done only after the installer measured the flow rate of the existing showerhead and determined that it exceeded the flow-rate of a water-efficient showerhead.

The third method (also a relatively small component) was to distribute the showerheads during special events such as county fairs and home owners association meetings. Most of the showerheads distributed during special events were giveaways. (PG&E bought showerheads with a rated flow rate of 2.75 gpm for these special events givaways.)[R#6] In 1991 this method resulted in the distribution of an additional 14,671 water-efficient showerheads. The total number of showerheads distributed through all three mechanisms was 553,431.[R#1] The Delivery Mechanisms section of this profile has a more complete discussion of the various common delivery options currently used by different utilities for their showerhead programs.

INSTALLED MEASURES

The only installed measure for this program was the installation of water-efficient showerheads. In California where state law prohibits the sale of inefficient showerheads, "water-efficient" has, since 1978, meant that the showerhead's rated flow rate was 2.75 gpm or less. In 1992, however, the regulation was changed to prohibit the sale of showerheads whose rated flow rate exceeds 2.5 gpm.

Because the utility did not directly install all of the water-efficient showerheads distributed, the installed number is less than the total number distributed through the three methods. Of the 526,598 showerheads purchased through the 1991 Energy-Saver Showerhead Coupon Program, follow up surveys indicated that only 352,820 (67%) were installed.[R#3] If the same installation percentage held true for the 14,671 showerheads distributed at special events, about 9,830 more installations were added. The only method that assures that a showerhead is installed is the direct installation method. This added 12,162 showerheads for a total of 374,812 installations from the three distribution methods. However, not all of these resulted in a net energy savings. (See the discussion on net-to-gross ratio in the Monitoring and Evaluation section).

STAFFING REQUIREMENTS

The staffing necessary for delivering this type of program is low. The bulk of the program was delivered through a coupon rebate, which required staffing to organize the program, distribute the coupons to the participating dealers, and keep track of the number of coupons that were turned in by the dealers. Because this program was part of a larger DSM effort, many people shared responsibility for completing the tasks necessary for delivery. However, an estimate of "full time equivalent" (FTE) staff is one person at PG&E's headquarters for planning and supervising, 2-3 FTE people entering rebate coupon information into the data base, 1 FTE person delivering coupons to the participating dealers, and approximately 3 FTE people doing the direct installations. In addition there was temporary staff required to do the telephone survey and the on-site data collection for the program evaluation. The staff required for the survey and evaluation were hired by the private consultant that did the program evaluation.[R#2]

MONITORING

The main monitoring mechanism for this program was the return of the rebate coupons by the participating retail dealers. As these coupons were turned in to the retail dealers for reimbursement, EGIA staff entered pertinent information into the data base. From this they were able to keep track of both cost and the number of showerheads sold under the program. The direct installation and special events components of the program were monitored through different mechanisms. The PG&E field personnel who did the direct installations of showerheads recorded it on a form that was used to monitor several other DSM measures as well. This form was turned in to the main office and the information regarding the direct installation of the showerheads, as well as the other efficiency measures, was recorded. The monitoring of the showerhead distribution through the special events component was done primarily through the local offices. For example, if a home owners association requested showerheads for their meeting, a representative picked the showerheads up at the local PG&E office. Although the special events showerheads were giveaways, the person receiving the showerhead was required to fill out a form. These forms were then returned to the local PG&E office so the local office supervisors could keep track of how many showerheads were being distributed by this mechanism.

EVALUATION

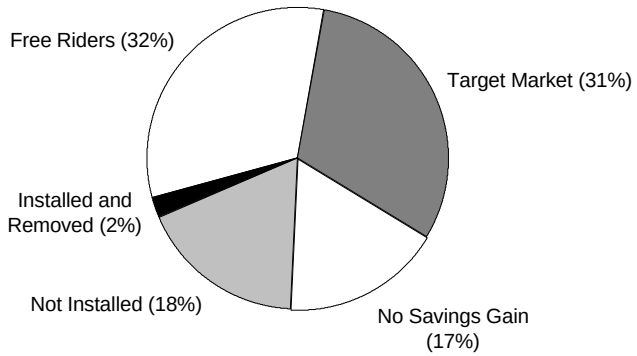
The evaluation of this program was done with two objectives in mind: to determine the net-to-gross ratio of effective showerheads to the total rebated showerheads, and to verify components of the energy-savings calculation, including average daily time of showerhead use and flow rate.

The data collection for evaluation of this program was done using two methods: a telephone survey and on-site data collection. The telephone survey was done first and was used to address evaluation questions concerning showerhead installation and persistence, factors affecting a program net-to-gross ratio, factors related to estimation of energy savings per showerhead, and issues regarding satisfaction with the water-efficient showerhead. Both program participants and nonparticipants were identified and surveyed. The survey of 115 nonparticipants was done to study the showerhead purchases of customers who did not participate in the program. The sample of participants to be surveyed was systematically selected using the information on retail coupons redeemed during 1991. The sample was proportionally stratified to be representative of customers in each of PG&E's 25 service-territory divisions. This was possible because the customers supplied zip code information on the rebate coupons which was entered in the data base. The sample began with the names of 3,000 customers from which PG&E achieved its goal of completing 511 full surveys (359 customers with gas water heaters and 152 with electric). The surveys of both participants and nonparticipants were conducted during the same time period, from late December to mid-February.

The telephone survey was the main evaluation tool for determining the net-to-gross ratio. (This is the ratio between the number of showerheads that yielded an energy savings as a direct result of the program and the total number that were distributed.) This ratio was determined by five factors.

1) Was the program showerhead installed?
2) Did the program showerhead replace a high-flow showerhead?
3) Is the showerhead currently installed?
4) Did the program affect the timing of the showerhead purchase?
5) Did the program affect the efficiency level (flow-rate) or features of the showerhead?

The participants' answers to these questions provided specific data used to determine the net-to-gross ratio. Initially PG&E assumed that one quarter of the rebated showerheads replaced other water-efficient showerheads and that the rest



resulted in a net energy savings for a net-to gross ratio of .75. However, the evaluation survey revealed information that lead to the inclusion of other factors. For example, of the showerheads that were distrubuted, 17% replaced other water-efficient showerheads, 20% were either not installed or removed, and 32% were free riders (see Free Ridership in Cost section). Based on these percentages the net-to-gross ratio was 0.31.[R#9] In other words only 31% of the

showerheads distrubuted through the Energy-Saver Sowerhead Coupon Program resulted in a net energy savings.

The second evaluation approach involved on-site data collection and was used to better understand actual showerhead use conditions, and thus refine PG&E's program savings calculations. This part of the evaluation was necessary because some of the information concerning water use can be reliably measured only by using an on-site data collection method. A smaller sampling of 161 participants and 160 nonparticipants was used for this part of the evaluation. To minimize the cost associated with widely dispersed samples, four representative PG&E service territory divisions were chosen, and 80 on-site surveys were done in each division. Candidates for on-site data collection were contacted by telephone to determine whether or not they would agree to such a visit.

The on-site data collection effort focused on different questions than the telephone survey. The effort here was to collect engineering values for determining energy consumption for both normal and water-efficient showerheads. For example, people were asked to estimate the average number of showers taken per day and the average time taken per shower. In addition the on-site interviewers took measurements of the average inlet and outlet water temperatures and measured the showerheads' flow rates. Two flow rate measurements were taken: the full throttle and the customer throttle flow rate. (The customer throttled flow rate was used in the calculation of program energy savings because it is more likely to simulate actual hot water use.) When the average showerhead flow rates were compared for participants and nonparticipants, PG&E was able to use the on-site data to determine average energy savings.[R#2]

DATA QUALITY

The quality of the data on energy savings is related to the survey effort described above. It was relatively easy to determine how many showerheads had been distributed but it took considerably more effort to find out how many of those resulted in a net energy savings within the PG&E service territory. The net to gross ratio revealed that net energy savings were realized from only 31% of the showerheads distributed through the Energy-Saver Showerhead Coupon Program. The shower-usage information gained from the survey helped PG&E determine the average annual energy savings for each showerhead that met their criteria for net savings. By contacting their customers directly, PG&E was able to collect data that enabled them to make quite accurate average energy-savings estimates per showerhead.

Armed with the survey information and data, PG&E made estimates of program savings using engineering estimates, with separate computations for the rebate coupon and direct installation components of the program. The separate computation was done because the direct installation program had both a higher cost and net-to-gross ratio. However, the overall savings and costs numbers were affected only slightly because direct installation was such a small component of the program.

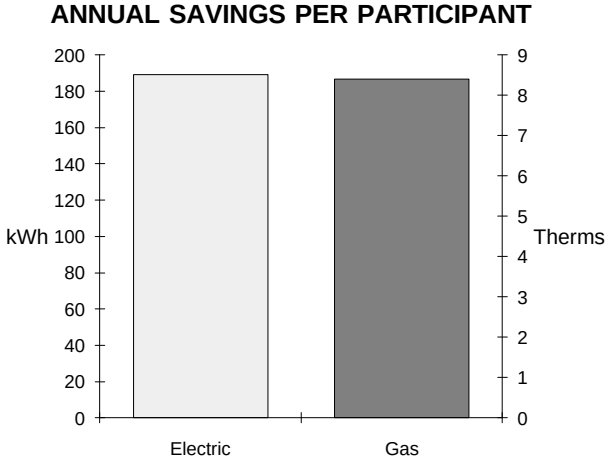
The cost data was easy to compile accurately, due to the simplicity of the program and the comprehensive record keeping. The bulk of the cost was from the ~$4 per showerhead rebate. This was a very accurate expenditure because each rebate was recorded as it was paid and PG&E simply tallied them up at the end of the year. The program manager estimated that the administrative cost of the rebate coupon part of the program to be about 10% of the rebates.[R#3] Together these costs amounted to ~$2.32 million. The 14,671 showerheads given away at special events cost PG&E about $3.30 each for another $48,400 expenditure. A 10% administrative cost brings this up to $53,255. The direct installation component cost ~$40,000 for showerheads plus 3 FTE personnel to do the installation. At a utility cost of $40,000 per person this component was around $160,000. Even if some of the assumptions for estimating the cost of the smaller components are inaccurate it would have little effect on the total program cost.

PG&E uses a measure lifetime estimate for this program of 10 years. This was done for two reasons: it does not overstate the showerhead manufacturers' claims, and the California PUC limits the lifetime that a utility can claim for a showerhead DSM program to 10 years. There is another consideration and that is the "net measure lifetime". For example, if a water-efficient showerhead replaces an inefficient one that would have had to have been replaced anyway in one or two years, the net measure lifetime would be one or two years. The lifecycle savings and cost of saved energy would therefore be very different than if a water-efficient showerhead replaced an inefficient one which had many years of life left before needing replacement. The net measure lifetime is a difficult factor to determine and PG&E does not consider this factor in estimating measure lifetime for this program. However, if net measure lifetime were considered, a lifetime of 7.5 years might be more accurate for these particular circumstances. [R#3]

Savings Overview Table (1991)	Annual	Lifecycle
Electric (kWh)	11.5 GWh	115 GWh
Gas (therms)	4.1 million	41 million
Capacity (MW)	.797 MW	

The Energy-Saver Showerhead Coupon Program saves both natural gas and electricity. It also saves water but this discussion will be limited to energy savings. PG&E estimates that the average net-to-gross adjusted savings from all the water-efficient showerheads distrubuted through this program are 8.4 therms/y with a natural gas water heater and 189 kWh/y with an electric water heater.[R#9]

The percentage of gas and electric water heaters for the PG&E service territory is about 89% and 11% respectively. PG&E assumed that these percentages were representative of the program participants.[R#3] The total number of showerheads distributed through the three components of the program was 553,431.[R#1] Therefore, the annual energy savings from all components of the program is calculated to be about 4.1 million therms of gas and 11.5 million kWh of electricity. In addition the program saved ~.797 MW of capacity in its first year of operation.[R#3]

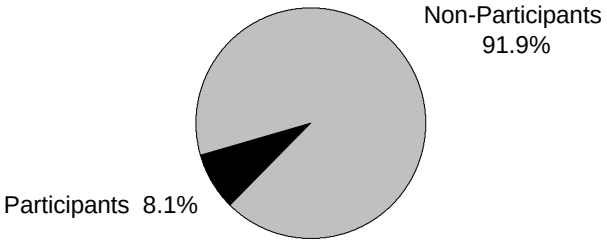


MEASURE LIFETIME

The measure lifetime typically has two elements: the life of the purchased water-efficient showerhead and the number of participating customers who will continue to use a water-efficient showerhead after the first one breaks or wears out. The first element is the most important and all calculations in this profile assume a 10-year measure lifetime. The second element is not a factor for this program because California law requires that only water-efficient showerheads (a maximum rated flow rate of 2.5 gpm) be sold in the state. Therefore, it can probably be assumed that when one of the program's showerheads needs replacing it will be replaced with another water-efficient one because of the law rather than due to any impact of the program.

PARTICIPATION RATES

There are approximately 3.69 million residential customers in the PG&E service territory. It is estimated that they have an average of 1.5 showerheads each for a total of 5.53 million showerheads. Because of a long-standing effort to remove inefficient showerheads from service, only 40% of the showerheads in the PG&E service territory are of the old inefficient type.[R#3] That leaves about 2.21 million target showerheads for the program. Together, the three components of the showerhead program replaced an estimated 179,955 of these in 1991. Therefore the participation rate for targeted showerheads was ~8.1%. It is perhaps more valuable



to discuss participation in these terms rather than customer participation because it gives a clearer indication of how many more showerheads are left to replace in the target group. It appears that there is something on the order of 2 million inefficient showerheads left in PG&E's territory.

PROJECTED SAVINGS

Using PG&E's estimated measure lifetime of 10-years the projected savings (lifecycle savings) from the first year of the program would be 115 GWh and 41 million therms of gas. However, the measure lifetime estimate, and thus the lifecycle savings, may be high for the reasons described at the end of the Data Quality section. The program is continuing in 1992 and plans have been developed to extend the program through 1995. Savings estimates for these years are currently not available. However, preliminary results from the first half of 1992 indicate that the program modifications have resulted in an increased installation rate thus increasing the program's net-to-gross ratio.

Cost of the Program

The main cost of this program was the ~$2.22 million for rebates and administration. The cost of the other two components (special events and direct installation) plus the phone survey and the on-site data collection added another $377,000 for a total of ~$2.6 million.[R#1,3,6]

Costs Overview Table	Cost	Utility Cost per Showerhead
Coupon Rebate	$2,017,377	$4.22
Special Events	$50,770	$3.46
Direct installation	$153,267	$12.60
Survey	$173,383	
Administration	$206,910	
Overall	$2,601,708	$4.70

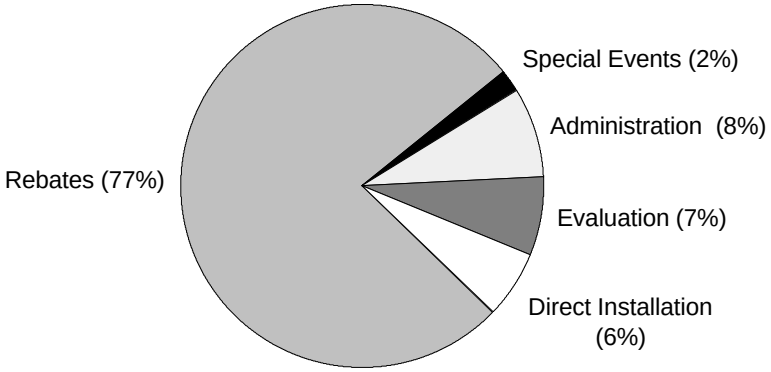
COST EFFECTIVENESS

The cost effectiveness of this program is driven by the net-to-gross ratio. The larger the net-to-gross ratio the more cost effective the program because the program cost of installing a showerhead that results in a net energy savings goes down as this ratio goes up. As the cost of installing an energy saving showerhead goes down so does the program's cost of saved energy. The Cost of Saved Energy Table contains calculations of the cost of saved energy for several discount rates. These numbers can be compared with PG&E's average residential rate of ~11 ¢/kWh. Because this program affects gas as well as electric usage, the table also contains calculations for the cost of saved gas energy. These numbers can be compared to PG&E's average residential gas rate of 58.2 ¢/therm.

Comparing the cost of saved energy to the residential rates for either gas or electricity is a measure of cost effectiveness from the customers' point of view. The utility on the other hand may use their avoided cost to determine cost effectiveness. Unfortunately, avoided cost is often a somewhat nebulous number dependent on a variety of assumptions that can easily change from one year to the next. For example, PG&E's 1991 avoided cost varied from 2.8 ¢/kWh to 4.4 ¢/kWh depending on the time of day and time of the year. This range does not include the total average cost of delivering a kWh to the customer but only the marginal cost of delivering an additional kWh.

COST COMPONENTS

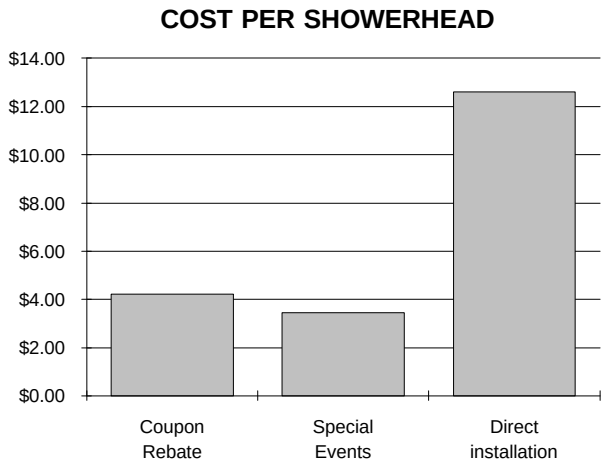
The main cost components for this program are the cost of redeeming rebate coupons, administration, the direct installation component, the special events giveaway, and the program survey. Of these costs, the most difficult to determine is the cost of the direct installation component because it involves cost of materials, administration, and labor which was sometimes shared among other programs. However, because this cost is relatively small any uncertainty will have a minimal effect on the total cost of the program. The accompanying pie chart shows the proportional representation of these costs.



Cost of Saved Energy Table for 1991	Discount Rates						
	3%	4%	5%	6%	7%	8%	9%
Electricity (¢/kWh)	0.29	0.31	0.32	0.34	0.35	0.37	0.39
Gas (¢/therm)	6.62	6.96	7.31	7.67	8.04	8.42	8.80

COST PER CUSTOMER

The evaluation survey indicated that each individual who took advantage of the Energy-Saver Coupon program purchased an average of 1.9 showerheads.[R#2] This means approximately 277,157 customers participated. In addition about 7,722 customers participated in the special events giveaways and about 12,000 in the direct installation, bringing the total up to 296,879. With a total program cost, including the survey, of $2.6 million, the cost per customer was about $9.16. Another way of breaking down the cost is



to determine the cost per distributed showerhead. This cost was different for the three components of the program. The cost per showerhead for the coupon rebate program was ~$4.21, for the special events giveaway ~$3.46, and for the direct installation ~$12.60. It should be noted that neither the net-to-gross ratio nor the target market penetration are the same for all three components.

FREE RIDERSHIP

Free ridership was a significant element in this program. The results of the program's impact evaluation final report indicates that the free ridership accounted for 32% of the showerheads distributed.[R#9] This number is based on answers to questions in the telephone survey and represents the percentage of showerheads that would have been purchased and installed even in the absence of the program. This high degree of free ridership is in part responsible for the low net-to-gross ratio of only 31%.[R#9]

In addition there were those who could be considered "partial free riders" because their purchase behavior was only somewhat influenced by the program. For example, the phone survey indicated that the program influenced the timing of some purchased as well as the energy saving features of the purchased showerhead. The showerhead purchase by these customers result in a gray area between free ridership and the target market which is difficult to assess. To take this into account, PG&E's impact evaluation breaks down the target market into two categories: Early Replacers (87%) and Extra Features (13%). The Extra Features category represents a group of installed showerheads whose purchase and resulting energy savings were partially influence by the program.

Environmental Benefit Statement

Marginal Power Plant	Heat Rate BTU/kWh	% Sulfur in Fuel	CO2 (lbs)	SO2 (lbs)	NOx (lbs)	TSP* (lbs)
Coal	**Uncontrolled Emissions**					
A	9,400	2.50%	24,794,000	588,000	119,000	12,000
B	10,000	1.20%	26,439,000	228,000	77,000	57,000
	Controlled Emissions					
A	9,400	2.50%	24,794,000	59,000	119,000	1,000
B	10,000	1.20%	26,439,000	23,000	77,000	4,000
C	10,000		26,439,000	152,000	76,000	4,000
	Atmospheric Fluidized Bed Combustion					
A	10,000	1.10%	26,439,000	70,000	38,000	19,000
B	9,400	2.50%	24,794,000	59,000	48,000	4,000
	Integrated Gasification Combined Cycle					
A	10,000	0.45%	26,439,000	47,000	8,000	19,000
B	9,010		23,782,000	17,000	6,000	1,000
Gas	**Steam**					
A	10,400		14,421,000	0	33,000	0
B	9,224		12,524,000	0	78,000	4,000
	Combined Cycle					
1. Existing	9,000		12,524,000	0	48,000	0
2. NSPS*	9,000		12,524,000	0	23,000	0
3. BACT*	9,000		12,524,000	0	3,000	0
Oil	**Steam--#6 Oil**					
A	9,840	2.00%	20,873,000	316,000	37,000	35,000
B	10,400	2.20%	22,138,000	314,000	47,000	23,000
C	10,400	1.00%	22,138,000	45,000	38,000	12,000
D	10,400	0.50%	22,138,000	132,000	47,000	7,000
	Combustion Turbine					
#2 Diesel	13,600	0.30%	27,704,000	55,000	86,000	5,000
Refuse Derived Fuel						
Conventional	15,000	0.20%	32,890,000	85,000	112,000	25,000

Avoided Emissions Based on 11,500,000 kWh Saved (1990 - 1991)

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 PG&E's level of avoided emissions saved through its Energy-Saver Showerhead Coupon 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 the table 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.

PG&E AVOIDED EMISSIONS

PG&E has one of the most diverse fuel mixes of any utility company in the U.S. Therefore, it is especially difficult to assess the environmental benefits of the kWh or therms of gas saved by this or any of their DSM programs. However, in their 1991 annual report, PG&E claims that together all of their Customer Energy Efficiency programs "cut air emissions by 300,000 tons of carbon dioxide, 120 tons of sulfur dioxide, 445 tons of nitrogen oxide, and 15 tons of particulates".[R#4] These prevented air emissions are based on the assumption that the avoided generating plant would be oil fired.[R#6] The Energy-Saver Showerhead Coupon Program saved a little less than 2% of all the electricity savings from the CEE programs. If the proportion holds true for gas savings, ~2% of the above avoided emissions would give a ballpark estimate of the contribution from this showerhead program.

*** Acronyms used in the table**

TSP = Total Suspended Particulates

NSPS = New Source Performance Standards

BACT = Best Available Control Technology

Lessons Learned / Transferability

It appears that even among those who would have bought water-efficient showerheads in the absence of this program, the rebate coupon can influence the number of showerheads purchased (quantity effect), persuade individuals to buy a showerhead sooner than they might otherwise have (timing effect), and encourage them to purchase a more efficient showerhead (lower gallons-per-minute flow rate).

This program had a strong evaluation element which was very valuable. The results of the evaluation survey revealed that some of PG&E's important assumptions regarding the program were in error. The evaluation provided a means of correcting these assumptions and resulted in a more accurate estimate of the program savings and cost of saved energy.

After the evaluation it also became clear that some modifications would improve the cost effectiveness of the program. With the original program customers were allowed to buy up to four showerheads with each coupon and they received a rebate of up to $4 on each one. This was modified to allow only one showerhead to be purchased per coupon and the rebate was changed to 50% of the cost of the showerhead up to $4. The reason these changes were made was because many people were buying more showerheads than they had fixtures for, with the idea that they would try out several and use the one they liked thus never installing the showerheads that were rejected. Because many of the showerheads were priced below $4 the customers could conduct these preference experiments at no cost to themselves. Because with the 1992 program the customers are paying a least half of the cost of the showerhead, they may be less likely to buy more than they need.

Although this program, because of its simplicity, could be easily transferred, it must be noted that these savings estimates are only valid for the PG&E program. For example, different parts of the country may have different levels of water-efficient showerhead penetration which would effect the net-to-gross ratio of showerheads that result in a net energy savings. Regional variations in the incoming water temperature will also affect savings.

In general, showerhead DSM programs tend to be among the easiest and most cost-effective programs to implement, especially when the cost is shared by both gas and electric utilities. Because a water-efficient showerhead delivers large energy savings to the consumer this type of program also has a very positive public relations aspect. This may be a consideration to a utility that is planning several DSM programs and may wish to improve its credibility with its customers, which in turn can have a positive effect on the participation rate for other programs.

Delivery Mechanisms

Implementation of water-efficient showerheads is a popular utility DSM option. There are, however, a variety of ways these showerheads can be delivered to the customer. Besides the rebate method described in this profile there are at least four other methods including: the depot, door-to-door installation, direct mail, and the deliver and canvass method.

The depot method uses a central location to distribute the showerheads (often the utility's bill paying office). This requires the customer to pick up the showerhead and thus invest a minimal amount of time and effort. This method of delivery lends itself well to smaller communities or utilities that have established a high degree of consumer confidence in the benefits of DSM programs. This type of delivery mechanism is typically promoted through bill stuffers, newspaper articles, and local advertisements. Program participation can vary widely for this mechanism. For example, some analysts approximate participation rates of only ~30%. However, as reported in The Results Center Profile #5, Osage Municipal Utility utilized the depot method and achieved a participation rate of over 70%. The advantage of this method is the administrative and delivery costs are low. Program planners who have run this type of program estimate the cost per customer to ~$1-2 above hardware costs. In the case of Osage, administrative and delivery costs were negligible.

The door-to-door installation method involves the hiring of workers to install the showerheads in customers' homes. Typically homeowners are notified with a flier before the visit, but rarely are specific appointments set up. Because it is expensive to send personnel to do the installation, this method is often incorporated into a program where several energy-efficiency measures are installed at the same time. For example, the installer may also put in compact fluorescent lamps, weatherstrip the door, and wrap the water tank. Unless done in conjunction with other measures, the already high cost of direct installation can become prohibitive. Most contractors bid the installation of showerheads at between $10 and $15 per customer plus hardware costs. This type of program is often used when targeting low-income groups because they are not likely to otherwise invest in this measure. Program evaluations reveal that around 50-60% of the households approached have a household member at home and of these about 90% will let someone come in and install the fixture. Approximately 6% will subsequently remove the showerhead. This results in a participation rate of 42-51%.

The direct mail method requires the customer to respond to the program's advertising efforts in order to receive a showerhead. The advertisement is usually in the form of bulk mailings or utility bill inserts which offer the customers free showerheads by mail. Interested customers then notify the utility and are sent a kit containing a showerhead and sometimes a low-flow faucet aerator. The customers do the installations themselves. The main costs for this method are hardware, postage, and handling. Typically these costs, other than the hardware, are $3-5. Participation rates for this method is in the range of 10-50%. This percentage can be affected by the utility's credibility, customer awareness of the advantages of efficiency, and amount of marketing and promotion. The advantage of this method is that it requires very little administration and staff time. Some showerhead manufacturers even have developed turn-key operations that the utility can implement, further reducing the utility's investment of time.

The deliver and canvass method requires the utility to send people into the community and drop off the showerhead at customer's homes. Well planned programs can be expanded to include prenotification, delivery, a follow-up visit, and installation for disabled or elderly customers. The cost components for this method are planning, distribution, follow up canvassing, and hardware. When this method is contracted out the cost is approximately $6-9 per customer excluding hardware costs. The participation rate for this delivery mechanism is relatively high at 65-75%. The administration and delivery costs, however, are also relatively high compared to the depot method. This method seems to be the most versatile as it is appropriate for a variety of situations. Among its advantages are:

- High participation rates.
- The program includes customer involvement and education. People begin to accept the whole idea of efficiency when they are involved in the retrofit. (This is also true of the depot and direct mail method.)
- This is a proven method -- many utilities have used it successfully.

Perhaps no single showerhead delivery mechanism is the best for all situations. However, an analysis of the choices should reveal one that is best suited for a particular utility with its particular needs and goals.[R#7]

Regulatory Incentives

The California Public Utilities Commission (CPUC) considers the Customized Electric Rebate Program to be a "resource program" for the purpose of assigning it an appropriate incentive mechanism. Resource programs typically apply technologies that reduce customers' energy use while maintaining or improving their living standards, if they are residential customers, or their output levels, if they are commercial, industrial, or agricultural customers. Resource programs are cost-effective alternatives to supply-side resources and are thus valuable as "resources" to the utility. Non-resource programs might include education or auditing programs which are very important to successful implementation of a utility's entire DSM portfolio but whose energy savings are not easily quantifiable.

The relatively simple incentive mechanism approved by the CPUC for PG&E's resource programs includes both rewards and penalties. Every year each resource program is assigned a minimum performance standard (MPS). The MPS is the level of the net present value (NPV) of lifecycle benefits that a program must achieve to avoid penalties. The lifecycle benefits include both actual and committed results and are computed by the utility cost test (the avoided energy costs minus the utility's costs to implement the program). When program achievements are greater than the MPS, the utility receives 15% of the NPV of the lifecycle benefits of the program. When program achievements are less than the MPS, the utility is required to pay a penalty of 15% of the difference between the MPS and the NPV of the achieved lifecycle benefits. The formulae are:

NPV Lifecycle Benefits = (NPV Avoided Energy Costs) - (NPV Program Expenditures)

Shareholder Incentive Reward = 0.15 * (NPV Lifecycle Benefits)

Shareholder Incentive Penalty = 0.15 * (MPS - NPV Achieved Lifecycle Benefits)

A minimum performance standard was not determined for the Energy-Saver Showerhead Coupon Program specifically. Instead, a MPS was determine for the entire Appliance Efficiency Incentives Program (AEIP), under which the showerhead program operated. Therefore, as long as the parent program (AEIP) meets the MPS, the regulatory incentives do not demand that each component of the program also meet the MPS.

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