Sacramento Municipal Utility District
Residential Peak Corps
Profile #83

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Executive Summary

More than a decade before the Sacramento Municipal Utility District (SMUD) prematurely retired its Rancho Seco Nuclear Plant, ushering in a dynamic period of demand-side management, SMUD implemented its Residential Peak Corps program as a full-scale initiative. The program then, just as it is now, was intended to address Sacramento's needle peaks which occur on summer days when temperatures climb above 100° F, sometimes for several days in a row.

The Residential Peak Corps program provides peak clipping/load shifting through the remote cycling of central air conditioners. SMUD usually cycles participating central air conditioners 10 to 16 days per summer with typical cycling durations of up to four hours. The program currently offers three cycling options with participants receiving discounts on their summer electric bills. Participants selecting the "Peak Performer" option may have their air conditioning curtailed for up to four hours in order to save up to $20 per month. Others who agree to curtail their air conditioners for 40 minutes out of the hour select the "Saver Plus" or "67% option" and earn up to $15 per month in savings. For the "Basic Saver" or "50% option", air conditioners are cycled for 30 minutes out of the hour.

While SMUD uses direct mail, local radio, and print advertising effectively, program participation has been enhanced greatly by SMUD's Rule 15, a requirement that all new homes with central air conditioners receiving power from SMUD must participate in the Peak Corps program. While homeowners may elect to subsequently disconnect, fully 78% of Rule 15 participants have remained in the program.

Customer satisfaction has also been a cornerstone of the Peak Corps program. To ensure satisfaction, SMUD provides customers the option of calling the utility and changing their cycling option or even dropping out of the program with as little as 24 hours notice. For participants, SMUD staff believe that communication is key, not only educating customers about the program's intents and operations, but also by providing customers with adequate advance warnings of power interruptions. Thus SMUD routinely runs announcements on local radio and maintains a hot-line for customer call-ins and information.

Residential Peak Corps is one of SMUD's most successful DSM programs. In fact, the program currently serves nearly 100,000 customers, an impressive 45% of eligible customers, and provides control of more than 100 MW of peak demand at a current annual cost of about $3 million, or less than $250 per incremental shifted kilowatt.

SACRAMENTO MUNICIPAL UTILITY DISTRICT
Residential Peak Corps Program

Sector: *Residential*

Measures: *Dual Relay AC Cyclers*

Mechanism: *Program provides peak clipping and load shifting through the remote cycling of residential central air conditioners during selected summer afternoons. Customers have three cycling options. Each option cycles AC units for a certain amount of time; monthly customer incentives are based accordingly*

History: *Pilot program ran in 1978. Implementaion began on a full-scale basis in 1979 and continues today*

1993 PROGRAM DATA

Peak capacity savings:	*12.1 MW*
Cost:	*$3,031,900*

CUMULATIVE DATA (1979 - 1993)

Peak capacity savings:	*100.4 MW*
Cost (1992-1993):	*$5,950,100*

CONVENTIONS

For the entire 1994 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 U.S. Federal Reserve's foreign exchange rates.

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.

Sacramento Municipal Utility District (SMUD or the District) is a municipally-owned utility that was established in 1923. The service territory encompasses 900 square miles within and around the City of Sacramento, the capital of California. It is the fifth largest public utility in the nation serving 467,177 customers and selling 8,448 GWh to those customers in 1993. In 1993, the District had 2,299 full-time employees.[R#1,2]

California has been in a severe recession for several years now, in large part due to the decline of the aerospace and defense industry. During 1992, the total population of Sacramento decreased for the first time ever, and SMUD had 1,494 fewer customers at year end 1993 than year end 1992.[R#1,2]

The District is currently governed by a five-member Board of Directors elected for four-year terms, however, the Board will be expanded to seven members, with elections held in November 1994 and terms starting in January 1995. The Board of Directors makes policy decisions for the District and appoints the General Manager who is responsible for the utility's operations. There is no formal connection between the Board and City Government. [R#1,2]

In 1993, SMUD's electricity generation was primarily comprised of purchases, at 6,613 GWh, or 71% of the total power supply. The closure of SMUD's Rancho Seco nuclear power plant in 1990 that had supplied 2,812 GWh in 1988 and 1,439 GWh in 1989 forced the utility to increase the use of purchased power. The remainder of SMUD's power in 1993 came from hydroelectric sources (2,163 GWh or 23%), geothermal resources (506 GWh or 5%), gas turbines (3.1 GWh or <1%), and photovoltaics (2.7 GWh or <1%).[R#1,2]

The peak demand for 1993 was 2,145 MW and occurred in August. Peak capacity (including purchases) was 2,162 MW, creating a reserve margin of 0.8%. The utility uses a number of diverse resources to meet this peak. As noted above, purchased power comprises the bulk (1,550 MW or 72%) of the District's capacity.[R#1,2]

SMUD has not raised its electric rates since January 1990. Residential customers pay an average of 7.31 ¢/kWh, while Commercial/Industrial and all other customers pay an average of 6.72 ¢/kWh.

SMUD 1993 STATISTICS

Number of Customers	*467,177*
Number of Employees	*2,299*
Energy Sales	*8,448 GWh*
Energy Sales Revenue	*$589.6 million*
Peak Demand	*2,145 MW*
Peak Capacity	*2,162 MW*
Reserve Margin	*0.8 %*
Average Electric Rates	
Residential	*7.31 ¢/kWh*
Commercial, Industrial & Other	*6.72 ¢/kWh*

SMUD's resource plan through the year 2000 is designed to substantially reduce the need for purchased power through emphasis on energy efficiency and renewable energy. By the end of the decade the District plans to gain about 650 MW of capacity from its DSM programs, approximately equal to SMUD's projected growth. On the supply side, the utility plans to add 700-800 MW of gas-fired cogeneration in the next five years. These projects will be pursued in cooperation with existing and new local industries and will utilize some of the most efficient gas-fired turbine systems available.

In addition to these cogeneration systems SMUD plans to incorporate a variety of renewable supply options. The initial plan calls for the installation of 150 MW of solar thermal, 50 MW of wind, and an additional 200 MW drawn from a combination of photovoltaic, biomass, fuel cell, and geothermal sources, for a total of 400 MW of additional renewable energy. By the year 2000 this integrated resource plan will eliminate the need for any additional purchased power.

By following this plan of action SMUD is moving away from its dependence on purchased power in the direction of energy sustainability. Many scenarios for a sustainable energy future are based on the use of renewable resources to supply energy, efficiency measures to control demand, and the use of natural gas as a "transition fuel" to provide energy until the renewable resources are available. From a societal perspective SMUD's apparent progress in the direction of sustainability is commendable and the leadership of the utility deserves credit for pursuing this path. ■

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Utility DSM Overview

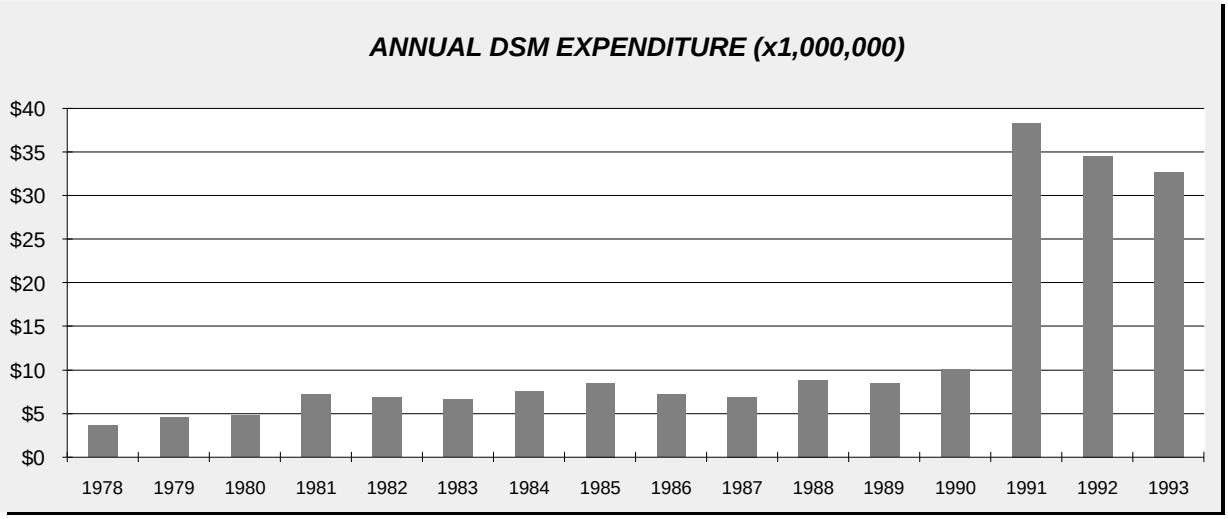
Sacramento Municipal Utility District began its energy efficiency efforts in 1976 with the creation of a Conservation Department. Initially this department focused on customer education and basic residential efficiency measures such as attic insulation retrofits, rebates for energy-efficient construction, and a test of direct load control for air conditioners. These efforts were expanded in the early 1980s in part as a response to state and federal mandates such as the California Energy Commission's (CEC) "Load Management Standards" and the U.S. Department of Energy's (DOE) "Residential Conservation Service" program.[R#3]

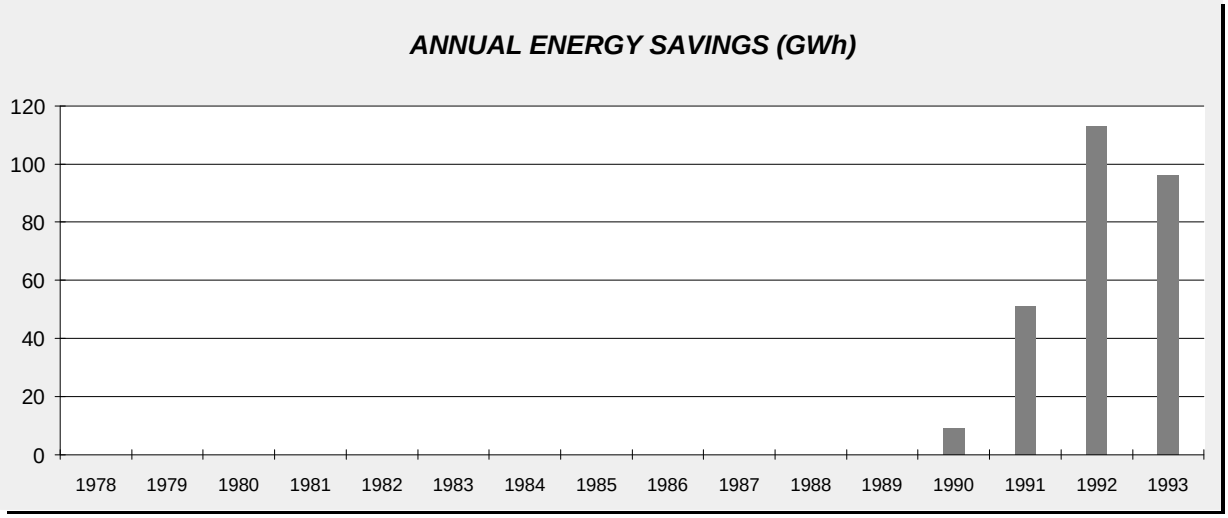
In response to significant needle peaks resulting from air conditioning load, SMUD developed and adopted the "Load Management Business Plan" in 1987. Implementation of this plan improved the utility's load management programs with a continued focus on residential air conditioning units and new attention to commercial and industrial curtailable efforts, thermal energy storage incentives, and time of use rates.[R#3]

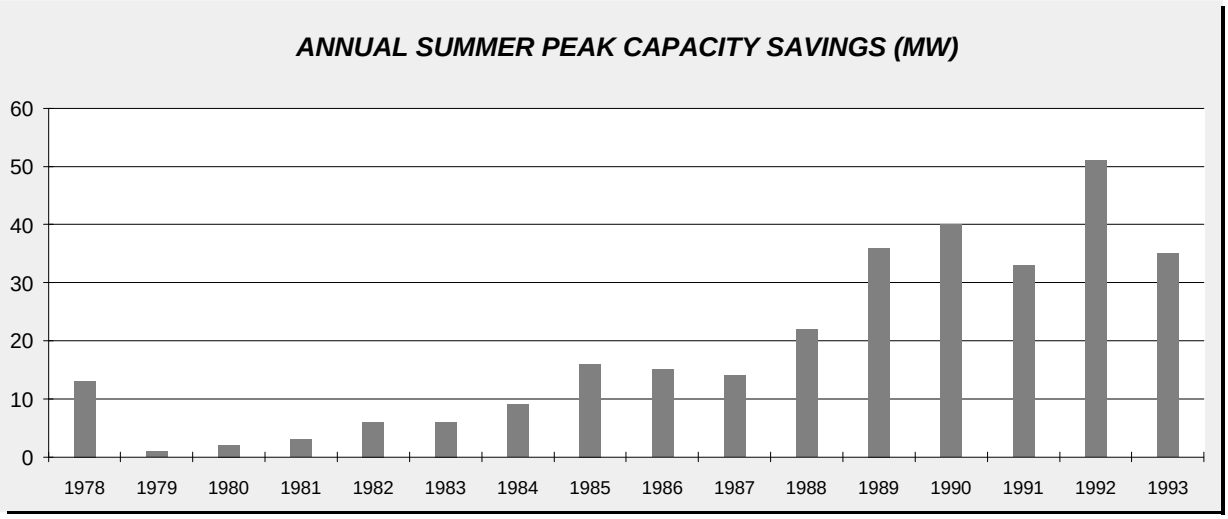
The utility entered a new and aggressive phase of conservation efforts in 1990 as a result of the premature closure of the Rancho Seco nuclear power plant (913 MW) and a changing corporate vision of the utility's role as a provider of energy. Since 1990 SMUD's expenditures on DSM have reflected its aggressive portfolio of programs. While the industry-wide average for DSM spending as a percentage of gross revenue was only 0.7 percent in 1990, SMUD's 1993 expenditures were 5.55 percent, one of the largest in the United States.[R#1,2]

To help meet the projected shortfall resulting from the loss of Rancho Seco, SMUD developed an energy efficiency goal, what it calls its "Conservation Power Plant," of 650 MW by the year 2000. Savings were identified in three major areas: Energy Efficiency Retrofit, New ☞

UTILITY DSM OVERVIEW	ANNUAL DSM EXPENDITURE (X1,000)	ANNUAL ENERGY SAVINGS (GWh)	ANNUAL SUMMER CAPACITY SAVINGS (MW)
1978	$3,608	negligible	13
1979	$4,501	"	1
1980	$4,758	"	2
1981	$7,189	"	3
1982	$6,772	"	6
1983	$6,561	"	6
1984	$7,548	"	9
1985	$8,503	"	16
1986	$7,155	"	15
1987	$6,903	"	14
1988	$8,839	"	22
1989	$8,432	"	36
1990	$10,000	9	40
1991	$38,317	51	33
1992	$34,562	113	51
1993	$32,717	96	35
Total	$196,365	269	302







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Construction, and Load Management, and the utility began design and implementation of various programs in these areas.

One of the most intriguing current programs is the Solar Domestic Hot Water (SDHW) program (see The Results Center Profile #66). Sacramento Municipal Utility District calculated that SDHW systems could provide substantial energy and capacity benefits to the utility by replacing existing electric water heating. The utility decided to design and implement a program that would capture these energy benefits while lowering the costs of systems and improving the SDHW market. To date more than 900 solar systems have been installed on rooftops throughout Sacramento and now SMUD is offering a parallel photovoltaic rooftop program, akin to the rooftop PV program in Saarbrucken, Germany (see Profile #78).

Most of the utility's programs target both capacity and energy savings, with the obvious exception of the load management programs. This focus is in direct contrast with SMUD's efforts prior to 1990 that were almost exclusively capacity oriented. As the attached charts show, energy savings from DSM efforts are negligible until 1990. However, the current portfolio of programs are providing substantial energy and capacity savings, a total of 96 GWh in 1993, and total available demand reduction of 302 MW by the end of 1993.[R#4]

SMUD continues to refine its DSM activities. The utility underwent a review by the Natural Resources Defense Council and the Conservation Law Foundation during 1992. This review resulted in recommendations that SMUD adopted to refine the cost-effectiveness screen to account for the benefits of reducing peak demand, to implement direct-installation programs for residential customers to improve participation, to encourage retrofit at time of replacement, and to expand and intensify evaluation efforts.[R#4] ■

SMUD DSM PROGRAMS

Residential Retrofit

Heat Pump
Solar Water Heating
Community Outreach Low Income
Direct Investment
Shade Tree

Load Management

Peak Corps
Pool & Spa

Equipment Efficiency

Refrigerator Program

Commercial / Industrial Retrofit

Small Commercial
Large Commercial / Industrial
DSM Bidding
Schools & Public Buildings
Multi-Family

New Construction

Residential
Commercial / Industrial
Thermal Energy Storage R/C/I

Education

Total School Energy Management

OVERVIEW

The Residential Peak Corps program provides peak clipping and load shifting through the remote cycling of central air conditioners during selected summer afternoons. The program currently offers three cycling options with the program participants receiving discounts on their June through September electric bills. Temperatures during the summer in Sacramento can often exceed 100°F, and on these days SMUD's system approaches or reaches peak demand. In order to reduce this demand SMUD typically cycles participating central air conditioners 10 to 16 days per summer. Heat waves often last for a few days so cycling may occur several days in a row. Cycling is limited to 2:00 - 9:30 p.m., Monday through Saturday, from June 1 through September 30. Cycling does not occur on Sundays or holidays. On a "typical" cycling day, cycling occurs for between 2 1/2 and 4 hours.[R#5]

The program is available to SMUD residents with central air conditioning (including heat pumps), who live in single-family homes, duplexes (both units are rentals), half-plexes (owners occupy one-half), and tri-plexes through six-plexes. Switches are installed on the outside of central air conditioners, typically located outside the house. Although apartment complexes are not currently eligible for participation, there are 48 apartment complexes participating as a result of previous pilot programs. Window or wall air conditioners and evaporative coolers do not qualify.[R#5]

The Residential Peak Corps program began as a pilot in 1978 and was implemented on a full-scale basis in 1979. The original goal of the program was to address SMUD's spike summer peak, which was a problem even in the late 1970s and early 1980s. Currently the program has 96,130 customers participating. While the Residential Peak Corps program is the subject of this profile, there is also a Commercial Peak Corps component.[R#5]

MARKETING

SMUD has used direct mail pieces throughout the life of the program as its primary marketing tool. During 1994, SMUD will send two to three direct mailings to potential Peak Corps participants. The mailings will target customers with deactivated cyclers and current participants who are eligible to upgrade their cycling option. (The direct mail pieces also promote other SMUD DSM programs as well, providing telephone numbers for customers interested in additional information.)

To personalize its direct mail marketing efforts, the utility has also created Elmo, a cartoon character who appears on certain direct mail pieces and the program newsletter, titled "peakspeak." Elmo was created when SMUD's new customer database was established and titled Energy Load Management On-line (ELMO).[R#5]

SMUD makes a concerted effort with its marketing pieces to be sure that customers understand the details of the program and exactly what will be happening to their air conditioners during cycling season. The utility even goes so far as to caution that the Peak Performer option is not for everyone. SMUD also sends participants a mailer just before cycling season reconfirming the option that has been selected.[R#5,6]

In addition to the direct mail efforts, SMUD plans to run five newspaper advertisements throughout the year. In addition, bill inserts, a radio solicitation, and trade shows will also be used to promote the program.[R#5]

Despite these marketing efforts, the greatest reason for increased participation in recent years was the passage of Rule 15 by SMUD in 1990. Under this rule, all newly-constructed homes with central air conditioning are automatically placed in the Peak Corps program unless and until the customer specifically requests to be removed. Approximately 33% of the program's new participants are the direct result of Rule 15. Rule 15 participants are initially placed on the Basic Saver option, but they can ☞

select a higher option if desired. Only about 22% of the new homeowners have requested to withdraw from the program.[R#4]

SMUD has several other methods for increasing participation. Peak Corps is tied into one of SMUD's financing programs for air conditioning. If a customer finances a new, qualifying, energy-efficient air conditioner through SMUD or receives a rebate, they automatically have a cycler installed on their new air conditioner and are placed on the Basic Saver option. SMUD's Residential Direct Investment program provides an energy audit and direct installation of energy conservation measures for qualifying customers. Customers participating in this program having central AC are required to have a cycler installed and are also placed on the Basic Saver option. In addition, when a tenant moves into a multi-family dwelling with a cycler present, the new tenant is automatically activated at the Basic Saver option. For tenants moving into single family dwellings where a cycler is present, the cycler is activated at the program option selected by the previous tenant. For customers signing up for the low income assistance rate having central AC, it is mandatory to participate in Peak Corps in order to receive the discounted rate.[R#6,9]

In addition, SMUD cross markets many of its DSM programs. For example, customers joining the Peak Corps program have historically been encouraged to get an energy audit. The Peak Corp newsletter promotes other SMUD conservation activities, including the Shade Tree program, as well as recommending improved insulation and whole house fans.[R#9]

DELIVERY

There are currently three cycling options available to residential customers. The Basic Saver option (also referred to as the 50% option) allows customers to save 12% on their electric bills, up to $12 per month, June through September. With this option air conditioners are cycled off up to 30 minutes each hour on cycling days. The Saver Plus option (also referred to as the 67% option) saves customers 15% on bills with a maximum of $15 monthly savings, with air conditioners cycled off up to 40 minutes each hour on cycling days. The Peak Performer option (also called the 100% option) saves customers 20% on their bills, up to $20 per month. Under this option air conditioners are cycled off up to 4 continuous hours per cycling day, a maximum of 12 days per summer.[R#5,6]

There are also approximately 22,000 customers still participating in the program who signed up for a previously available 33% cycling option, which cycles air conditioners 10 out of 30 minutes. While this option is no longer available to new participants, current participants who have selected a higher cycling option and wish to leave the program entirely are allowed to select the 33% option as a last resort. SMUD believes it is better to gain some peak demand savings than none at all. The 33% option was dropped because the peak savings were not very large and SMUD realized that customers would readily accept more stringent cycling options.[R#5,6]

Customers who signed up for the program between March 1994 and April 15, 1994 received a signing bonus of $10, $15, or $25 depending upon the cycling option selected. In addition, these customers are eligible for a bonus of an additional $10, $15, or $25 if they stay in the program through September. This bonus offer is only available to customers who have not been Peak Corps participants in the previous six months. Customers receive all bill discounts even if cycling does not occur.[R#5]

Once a customer contacts SMUD and requests to participate in the program, an installation form is generated and if necessary an appointment is set up to install the cycler on the customer's AC compressor unit. The air conditioner cyclers are installed by SMUD employees at no charge to the customer. The average installation requires one hour including travel, labor, and paperwork. Individual cyclers cost SMUD about $60 and labor costs per installation average $60. Once the installation is complete, a code is assigned depending on the cycling option selected and then sent out activating the cycler. If customers are home when the installation takes place, the installer explains the details of the program and answers questions, making sure the customer fully understands their

selected cycling option. If customers are not home a note is placed on the door, explaining program details and providing the Peak Corps number for additional questions. [R#5,6]

SMUD tries to have cycling equipment installed within 30 days of the customer signing up for the program. It is not always possible to stay within this time frame however, as much of the program marketing occurs during the fall and winter leading to customers signing up in bunches instead of being spread evenly throughout the year. As a general goal, SMUD tries to have all cycling equipment installed by June 1, the start of the cycling season.[R#5,6]

When air conditioning cycling is required (based on load forecasts), SMUD's energy operations group determines when the cycling is to begin as well as which options are to be used. When peak demand has dropped, the energy operations group determines when to discontinue cycling. Typically the lower three cycling options are used first, with the Peak Performer used as a last resort. Because the Peak Performer option can only be exercised 12 days per summer, the utility hesitates to use this option, especially early in the summer. Cycling is controlled from the SMUD energy management center through three antennas. Radio signals transmitted through the antennas cover all of SMUD's service area.[R#6]

In order to ensure customer satisfaction, SMUD provides customers the option of calling the utility and changing their cycling option or even dropping out of the program. Changes are guaranteed to occur within 24 hours if called in on weekdays. Customers who have dropped out of the program always have the option of rejoining the program as SMUD does not remove the cycling switches. The utility also provides free maintenance service on Peak Corps cyclers.[R#5]

Customers can find out when they are being cycled by either looking for a green flashing light on their air conditioner or by phoning SMUD. In addition, the Sacramento BeeLine (one of Sacramento's newspapers) provides a phone number which provides current Peak Corps cycling information. There were almost 5,500 calls to the BeeLine during the summer of 1993. Radio updates on Peak Corps also occur on weekdays around 7:30 a.m. and 4:45 p.m. on two local radio stations.[R#5]

The Peak Corps program manager has made improvements to the telephone system and increased phone staffing during evening hours on cycling days in order to answer customer calls quickly. Such services have led to a very high program retention rate, with 84% of volunteer participants remaining in the program and 78% of Rule 15 participants staying with the program.[R#4,6]

MEASURES INSTALLED

The program currently installs a dual relay cycler manufactured by RELM Communications. The dual relay gives SMUD the ability to cycle off the compressor as well as the indoor fan. (See The Results Center Profile #58 for a summary of load management communication system types.) [R#6]

STAFFING REQUIREMENTS

Mitzi Guthrie is the program manager for Residential Peak Corps, devoting 85% of her time to the Peak Corps program and 15% of her time to the Pool & Spa program. Ray Willey is the Load Management Supervisor, in charge of the load management program managers, and devotes 55% of his time to the program. Isaac Cotton is the Area Head for load management, overseeing all SMUD load management programs, and Peak Corps requires 50% of his time.[R#6,9]

In addition there are 10 clerical support staff who perform data entry as well as handle customer calls. There are currently 19 cycler installers as well as three senior technicians and one load management services technical supervisor who split their time between the Residential Peak Corps program and the commercial program.[R#6] ■

Monitoring and Evaluation

MONITORING

The Peak Corps program is monitored by SMUD using an MV 90 system which collects data from the field and converts it into a format that can be uploaded to SAS. SAS is a modular integrated application system of numerous software products that has the ability to generate list reports summarizing data. Currently SMUD has more than 260 recording meters in the field with plans for an additional 140 to be installed throughout 1994. These meters are used to determine the amount of load reduction provided by each cycling option.[R#6]

SMUD created a Peak Corps customer database in 1993 titled Energy Load Management On-line (ELMO). This database tracks details on each participant including cycling option selected, cycler number, cycler location, and participation status.[R#5,6]

SMUD provides monthly tracking reports on the Peak Corps program which contain participation and savings data. Additional program reports are produced on an as-needed basis.[R#5,6]

EVALUATION

In 1991 SMUD placed an increased emphasis on evaluation of all its DSM programs with the creation of a formal evaluation department. Previous Peak Corps program impacts were based on the results of a monitoring study conducted between 1985 and 1989. Following a large increase in participation and the addition of new cycling options, a new monitoring sample was assembled in 1991 which revealed the average savings per participant to be much smaller than had previously been estimated.[R#4,8]

The basis for the resulting changes in load reduction estimates appears to be in the composition of the monitoring samples and the population of program participants from which the samples were drawn. The 1985 sample was composed entirely of customers who had signed up for the only cycling option available (Original Peak Corps) at that time, a strategy where air conditioners are cycled off for 10 out of 30 minutes (33% strategy). By 1991, the program included two additional strategies: cycling 40 out of 60 minutes (67% strategy) and cycling off continuously for up to 4 hours (100% strategy). Participants from all three strategies were included in the 1991 sample.[R#4,8]

In comparing the average capacity savings from the 1985 and 1991 samples, the average AC load of the 1991 group was considerably smaller than the average load of the 1985 group, indicating better insulated houses, and more efficient and properly-sized air conditioners. Essentially, the more efficient homes of recent participants have a lower cooling load. Furthermore, customers who sign up for the more rigorous options are those who operate their air conditioners less intensively on the hottest days when cycling occurs. Customers signing up for the higher cycling options tend to use less energy than other SMUD customers, again reducing the potential savings delta on cycling days.[R#4,8]

As a result of these comparisons, the overall impact of the Peak Corps program was reduced greatly, with the estimated impact of the program at the 1992 summer peak decreasing from 127 MW to 88 MW.[R#4,8] ■

SAVINGS OVERVIEW	ANNUAL SUMMER PEAK CAPACITY SAVINGS (MW)	CUMULATIVE SUMMER PEAK CAPACITY SAVINGS (MW)
1979	0.5	0.5
1980	2.6	3.1
1981	1.2	4.3
1982	3.7	8.0
1983	3.7	11.7
1984	2.5	14.2
1985	4.4	18.6
1986	0.5	19.1
1987	4.8	23.9
1988	4.9	28.8
1989	16.3	45.1
1990	16.5	61.6
1991	11.9	73.5
1992	14.8	88.3
1993	12.1	100.4
Total	100.4	

DATA ALERT: Peak demand savings for the program are weather normalized annually, based on a 20 year forecast.[R#9] Total savings figures may have some degree of error due to the fact that savings are calculated at the end of the year and based on the cycling option selected by the customer at that time.[R#6]

The Peak Corp Residential program achieved incremental peak capacity savings of 12.1 MW during 1993, bringing the program total to 100.4 MW of peak capacity savings. SMUD's 1993 peak was 2,145 MW, occurring in August. The greatest annual incremental savings were achieved during 1990 with 16.5 MW of savings added. The lowest level of annual incremental savings (0.5 MW) was achieved in 1979, the first year of the program.[R#5,6]

SMUD describes the Peak Corp program as providing both peak clipping and load shifting services. Peak clipping can best be described as reducing the system peak without transferring electricity usage to another time, therefore resulting in net energy savings. Load shifting, on the other hand, means that while load is reduced for a specific period, the electricity saved during that period is consumed at another time, with no net energy savings achieved.

If SMUD participants do not increase the run time of their air conditioners before or after cycling, it is likely that some energy savings occur. However, generally following cycling, air conditioners have to run longer and harder to cool homes. Furthermore if participants turn up their air conditioners to compensate for the curtailment ☞

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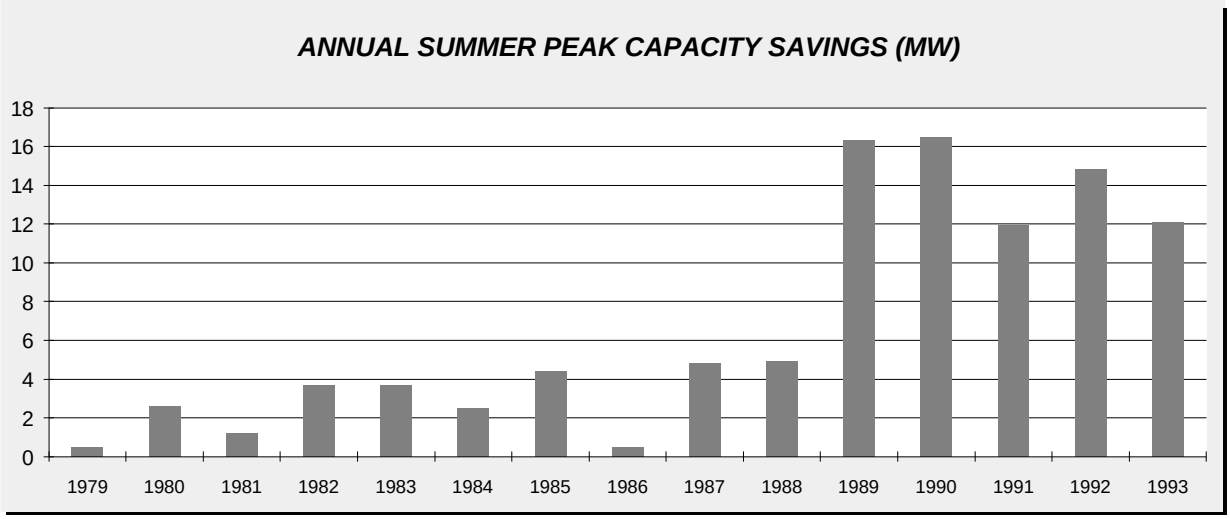
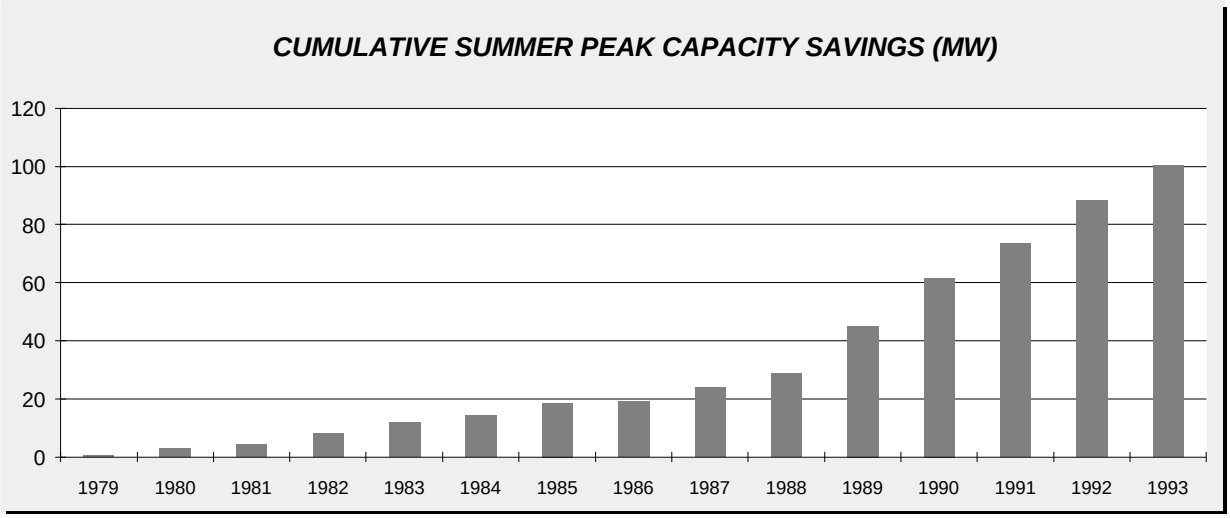
before and after cycling, then energy savings are definitely not occurring. Note that SMUD only tracks capacity savings, and not energy savings, indicating the program's relative emphasis.

PARTICIPATION RATES

Participants are defined as homes having installed, active cycler switches. A total of 11,294 participants were added in 1993 bringing the program total to 96,130. Peak Corps is SMUD's largest conservation program in terms of participation. With 96,130 participants and 213,622 residential SMUD customers having central air conditioning, the program has a participation rate of 45%. Through December 1993, 22,572 customers were participating under the Original (33%) option, 25,766 customers used the Basic Saver (50%) option, 13,778 customers exercised the Saver Plus (67%) option, and 34,014 customers were using the Peak Performer (100%) option.[R#5,6]

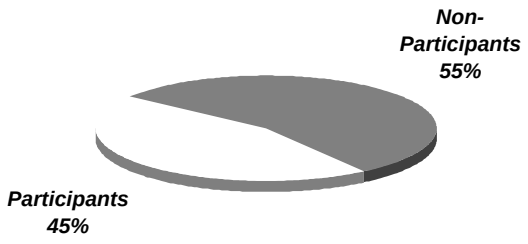
Throughout the course of the year some customers elect to change their cycling option, some selecting a more stringent option while others select a lesser cycling option. SMUD totals year-end participation and savings based on the cycling option the customer has selected at the end of the year. For example, if a customer had been on the Basic Saver option during the summer and then changes to the Peak Performer in November, that cus-





PROGRAM PARTICIPATION	ANNUAL PARTICIPATION	CUMULATIVE PARTICIPANTS	PARTICIPANTS' ANNUAL INCREMENTAL SUMMER PEAK DEMAND SAVINGS (kW)
1979-1985	NA	35,924	NA
1986	1,376	37,300	0.4
1987	8,707	46,007	0.6
1988	6,168	52,175	0.8
1989	5,860	58,035	2.8
1990	8,997	67,032	1.8
1991	6,715	73,747	1.8
1992	11,089	84,836	1.3
1993	11,294	96,130	1.1
Total	96,130		

tomer would be counted as a Peak Performer customer and savings for that customer would be the kW value assigned to Peak Performer customers, even though the actual savings for that customer were lower through the Basic Saver option. In general, there is not a great deal of



cycling option switching, and customers tend to select higher cycling options when switching instead of lesser cycling options, possibly leading to slightly over valued savings estimates.[R#6]

Annual incremental summer peak capacity savings per new participant (from 1986 through 1993) have ranged from a low of 0.4 kW for 1986 to a high of 2.8 kW in 1989. The average rated capacity of the central AC units is 4.0 kW. In terms of specific cycling strategies, SMUD assigns daily cycled savings of 0.69 kW to the 50% option, 0.88 to the 67% option, and 1.74 kW to the 100% option.[R#6,8]

FREE RIDERSHIP

Free ridership is not an issue for the Peak Corps program. It is highly unlikely that customers would cycle their air conditioners without any utility incentive, and a peak alert is not announced when cycling occurs, so customers would not know when to cycle voluntarily even if so inclined.[R#6]

PROJECTED SAVINGS

Currently SMUD estimates the Peak Corps program to have achieved a 45% penetration rate and believes that the program has a maximum potential penetration rate of around 55%. According to SMUD staff the single biggest barrier to a higher penetration rate is the simple fact that many people do not want to give up their air conditioning on hot days. Many SMUD customers have been receiving information soliciting program participation for the past 14 years and have not signed up. The utility hopes to achieve 127 MW of controllable load by the year 2000.[R#6] ■

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Cost of the Program

COSTS OVERVIEW	LABOR (x1000)	MATERIALS (x1000)	INCENTIVE (x1000)	TRAINING (x1000)	MKTG (x1000)	MON/EVAL (x1000)	PLANNING (x1000)	TOTAL COST (x1000)
1992	$1,509.8	$747.9	$55.7	$7.4	$408.8	$139.4	$49.2	$2,918.2
1993	$1,535.8	$761.6	$118.1	$4.5	$420.9	$141.5	$49.6	$3,031.9
Total	$3,045.5	$1,509.5	$173.8	$11.9	$829.7	$280.9	$98.8	$5,950.1

DATA ALERT: While SMUD tracked Peak Corps program costs for 1977 through 1982 and 1992 through 1993, Peak Corps costs for 1983 through 1991 were bundled with other SMUD load management programs and thus are not presented. [R#6]

COST OF THE PROGRAM

In 1993, Peak Corps program costs totaled $3,031,900, up slightly from 1992 expenditures of $2,918,200. SMUD's budget for the program in 1994 is $3,255,000.[R#6]

SMUD spent $72,351 on the program's planning and design in 1977, then a total of $125,153 during the pilot phase in 1978. In 1979, SMUD spent $653,387 during the first year of full-scale implementation, then $1,374,157 in 1980, $1,145,806 in 1981, and $1,606,223 in 1982.[R#6]

COST EFFECTIVENESS

In a 1992 study, SMUD found all cycling options offered at that time to be cost effective when compared to the avoided cost of a natural gas power plant. Only new customers selecting the 33% cycling option were judged not cost effective. SMUD has calculated a benefit/cost ratio of 0.73 for the 33% option (new customers), 1.05 for the 33% option (existing customers), 1.09 for 50% option customers, 1.04 for 67% option customers, and 1.64 for 100% option customers.[R#6,8]

Based on 1992 incremental savings of 14.8 MW and costs of $2,918,200, the program had a cost per kW of $197. The cost per kW increased to $251 in 1993, based on total costs of $3,031,900 and incremental savings of 12.1 MW.

COST PER PARTICIPANT

In 1993, the cost per new participant was $268, up slightly from $263 in 1992.

COST COMPONENTS

SMUD spent $1,535,800 on program labor in 1993, accounting for 51% of total program costs, and up slightly from 1992 labor expenses of $1,509,800. Costs for materials also increased from $747,900 in 1992 to $761,600 (about 25% of total costs) in 1993. Customer incentives more than doubled (in an attempt to increase participation) from $55,700 in 1992 to $118,100 in 1993, equal to 4% of program costs. Training costs decreased slightly from $7,400 in 1992 to $4,500 in 1993. Marketing costs increased from $408,800 in 1992 to $420,900 (14% of total costs) in 1993, while monitoring & evaluation remained fairly constant at $139,400 in 1992 and $141,500 in 1993, hovering around 5% of program costs. Planning costs were also steady, coming in at $49,200 in 1992 and $49,600 in 1993.[R#6] ■

LESSONS LEARNED

The Residential Peak Corps program has been the focus of SMUD's efforts to shave its summer peak with 96,130 program participants accounting for 100.4 MW of demand that can by cycled. The utility's historical needle peak in the summer was in fact the primary motivation for SMUD initially getting involved with conservation programs in the mid-1970s. Peak Corps has been successful to such a degree that SMUD is now branching out and looking at using similar strategies to address other peak demand issues occurring throughout the year.[R#7]

SMUD believes that a key to program success has been a strong emphasis on customer service. Providing additional phone staff on cycling days, the BeeLine, and radio ads all help to alert customers about cycling days as well as address any complaints or questions. Another key component of customer service is trying to provide customer education. Many customers have signed up for the Peak Corps program without fully understanding it, and then have been confused when their air conditioner was turned off. Educating customers in advance of cycling has greatly increased customer satisfaction.[R#4,7]

Customer service has helped maintain a high level of customer retention, 84% for volunteer participants and 78% for Rule 15 participants. Another reason customers stay in the program is the current split incentive set up where customers receive a bonus for signing up for the program and then also get a season end bonus for staying in the program through the entire summer.[R#7]

For several years SMUD was able to achieve satisfactory participation levels through reduced customer bills. As the saturation level of the program increased, it became more challenging to entice non-participants with the existing financial incentives. While customer incentives have been bumped up somewhat over the past few years, the join rate for the program was slowing. Passage of Rule 15 by SMUD has taken care of program participation challenges and is the primary reason for program growth.[R#9]

A major challenge to program cost effectiveness is the fact that the installers are full-time, year-round employees. While installations take place throughout the year, the vast majority occur between March and June each year. Hiring workers on a seasonal basis would likely improve program cost effectiveness.[R#9]

TRANSFERABILITY

The Residential Peak Corps program is highly transferable as its implementation and technology are very straight forward. SMUD's program targets a single end-use (residential AC) because air conditioning is the primary driver of summer peak, but many load management programs target multiple end-uses (see The Results Center Profiles #9, 56, 58).

For utilities interested in implementing a similar program, SMUD recommends limiting the number of cycling options available to customers. In fact, SMUD finds that with just three options customers still get confused. Similarly it is important to keep customers informed of any changes to the program and notify them each year as the cycling season approaches. Some customers mistakenly think they have to sign up for the program each year. SMUD emphasizes the importance of making sure that all customers understand all program details and the resulting household conditions that they may experience.[R#6] ■

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