U961

LESSONS LEARNED:

A Review of Utility Experience with Conservation and Load Management Programs for Commercial and Industrial Customers

Final Report

Prepared for:

NEW YORK STATE
ENERGY RESEARCH AND DEVELOPMENT AUTHORITY

Project Manager
David R. Wolcott

and

NEW YORK STATE ENERGY OFFICE

Project Manager
Peter Smith

and

NIAGARA MOHAWK POWER CORPORATION

Project Manager
Theresa Flaim

Prepared by:

AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY
Washington, D.C.

Principal Investigator
Steven Nadel

1064-EEED-AEP-88

Energy Authority
Report 90-8

April 1990

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

The author would like to acknowledge and thank a number of individuals and organizations who provided assistance during the course of the study. First and foremost, extensive assistance was provided by dozens of utilities who provided detailed information on their conservation and load management programs. Without their cooperation and help, preparation of this report would not have been possible.

Dave Wolcott of the New York State Energy Research and Development Authority, Peter Smith of the New York State Energy Office, Theresa Flaim of Niagara Mohawk Power Corp., and Howard Geller of the American Council for an Energy-Efficient Economy filled an important role in conceiving and overseeing the study.

The following individuals provided useful comments on a draft version of the report: Fred Avril and Paul Belnick of Long Island Lighting Company; John Berlin, Jim Gallagher and Peter Seidman of the New York Department of Public Service; Paul DeCotis and Harvey Tress of the New York State Energy Office; Joe Eto and Chuck Goldman of Lawrence Berkeley Laboratory; Fred Gordon of Pacific Energy Associates; John Hartnett and Steve Molodetz of Niagara Mohawk Power Corporation; Eric Hirst of Oak Ridge National Laboratory; Marty Morris of Rochester Gas and Electric; Peter Miller of the Environmental Defense Fund; David Moscovitz, independent consultant; John Spada of Consolidated Edison Company; and Rick Tempchin of the Edison Electric Institute.

Valuable production support was provided by Monica Burke, Ulrike Mengelberg, and Karen Smith of the American Council for an Energy-Efficient Economy.

Neither the individuals nor the organizations acknowledged here necessarily endorse the analysis or the conclusions expressed in this report. The author assumes full responsibility for all information presented herein.

EXECUTIVE SUMMARY

A. INTRODUCTION

This report examines utility experience with conservation and load management (C&LM) programs for commercial and industrial (C&I) customers in order to summarize the lessons learned from program experiences to date and what these teach us about how to operate successful programs in the future. This analysis was motivated by a desire to learn about programs which achieve high participation rates and high electricity savings while remaining cost effective. Also, we wanted to review the very latest experiences with innovative program approaches -- approaches that might prove useful to utilities as they scale up their C&LM activities.

This report is part of a multi-phase study on the potential for electricity conservation in New York State being prepared by the American Council for an Energy-Efficient Economy (ACEEE) for the New York State Energy Research and Development Authority (NYSERDA).

Specific objectives of this phase of the study are threefold:

(1). To disseminate information on utility C&LM experience to a nationwide audience.

(2). To review current New York State utility programs and make suggestions on how these programs can be improved.

(3). To collect data for the final phase of the ACEEE/NYSERDA project, which will examine the savings that are achievable if C&LM programs are "pushed to the limit" of current knowledge on how to structure and run cost-effective C&LM programs.

Chapters in this study address the following program areas:

Energy audit programs
Lighting programs
Heating, ventilating and air conditioning programs
Motor programs
General industrial programs
Storage cooling and thermal air conditioning programs
New construction programs
Miscellaneous measure programs
Multiple end-use programs

B. APPROACH AND CAVEATS

For this study, data on over 200 C&LM programs for C&I customers were collected and examined, representing 58 different private and public utilities. Data were collected on conservation programs (programs which reduce electricity use) as well as on storage cooling and heating programs (which reduce peak electric demand but have little impact on total electricity use). Other load management programs, such as interruptible rates, load control, and stand-by generation programs were not examined. Also, programs to promote cogeneration systems were not examined, although a few programs which promote both C&LM measures and cogeneration are included.

A particular focus of this report is on programs and program procedures which result in high net participation rates and/or high net electricity savings (net of what would have happened if the program were not offered). If demand-side resources are to play a major role in meeting future electricity needs, then programs will need to reach a substantial proportion of customers and will need to have a significant impact on the electricity consumption of the customers that are reached. If high participation is achieved but savings per customer are minimal, or if high savings per customer are achieved but participation is low, then the total savings achieved will be limited. For example, if a utility C&I rebate program reaches customers responsible for 20% of total energy sales and reduces energy use by these customers by 7%, then C&I energy use will be reduced by 1.4% (20% times 7%). While a reduction in C&I energy sales of this magnitude is significant, it will have little impact on a utility's long-term need for generating plants.

We realize that not all utilities are interested in maximizing savings from cost-effective C&LM programs. For some utilities, other goals may apply such as maximizing customer satisfaction or minimizing lost revenues (utility revenues lost when consumers reduce electricity use), free riders (customers who participate in a program but would have undertaken the same conservation actions even if the program were not offered) or the cost per kW or kWh saved. For these utilities, this report will provide some useful data and insights, but conclusions on how to increase participation and savings may not apply.

All data on programs examined in this report come from the individual utilities operating the programs. There is considerable variation among utilities in the way different types of data are defined and tracked. For example, some utilities track number of customers participating in a program while others track number of projects, where one customer may undertake more than one project. Due to these variations, comparisons between programs are subject to a considerable margin of error. Other limitations in the data include the following:

1. Savings figures are generally based on engineering estimates -- more sophisticated estimates of actual savings are rarely available.

2. Participation rates reported here include free riders. In the discussions, allowance is made for free riders, to the extent available data permits. On the other hand, reported participation rates generally assume that all C&I customers are eligible for a program. If some customers are not eligible for a program, participation rates (participating customers divided by eligible customers) will be higher than estimated in this report because the number of eligible customers is smaller than we estimated.

3. Cost per kWh and kW figures are only approximate -- they use simple analysis procedures, ignore customer costs, and sometimes rely on rough estimates of indirect costs.

Due to these limitations, figures reported in this study are most appropriate for scoping purposes, not for detailed cost-effectiveness determinations.

C. OVERALL RESULTS

Typical C&LM programs are reaching less than 5% of eligible C&I customers on a cumulative basis, are reducing energy use among participating customers by less than 10%, and are reducing utility peak demand by less than 1%. While C&LM programs as a whole are not having a dramatic impact, the most successful programs do considerably better. A few programs are reaching 70% or more of targeted customers, are reducing customer electricity use by 10-30% (depending on end-use and building type), and are reducing utility peak demand by up to 5%. Many of the most effective programs are pilot or small-scale programs for which large-scale operation has yet to be attempted. Nearly all of the programs surveyed, including most of the programs with high participation and savings, cost utilities less than $0.04 per kWh saved, even if allowance is made for free riders. Since these costs are less than the long-term avoided costs of most utilities, including all utilities in New York State, most of the programs examined are likely to be cost-effective for New York utilities, using the utility cost test (one of several commonly used cost-effectiveness tests, as discussed in chapter 1).

In general, the highest participation rates and highest savings (as a percent of the pre-program electricity use of participating customers) are achieved by comprehensive programs which combine regular personal contacts with eligible customers, comprehensive technical assistance, and financial incentives which pay the majority of the costs of measure installation. However, the high participation and savings achieved by comprehensive programs come at a price -- these programs typically cost approximately $0.03 per kWh saved. At this point in time, full-scale comprehensive programs are just starting up, so a determination of how well comprehensive programs scale-up to full-scale operation remains to be seen. Comprehensive programs may be particularly appropriate for serving small customers (who are the least likely to participate in other types of programs) and for new construction (where there is a one-time opportunity to capture substantial savings at only the marginal cost of efficient equipment over standard equipment).

Rebate programs are by far the most common type of C&LM program for C&I customers. The most successful rebate programs have served approximately 10% of C&I customers including approximately 25% of large customers (customers with peak demand greater than 100-500 kW). These results are typically achieved over a period of three to seven years. The most successful of these programs have reduced C&I electricity use by approximately 5% at costs to the utility of approximately $0.01 per kWh saved (this cost figure is not adjusted to exclude free riders). These programs have proven effective at promoting basic lighting and HVAC equipment improvements. Most rebate programs currently in operation have not been especially effective at promoting "system" improvements, i.e., efficiency improvements involving the interaction of multiple pieces of equipment. C&I rebate programs combine moderate participation levels and moderate savings to reduce utility peak demand and electricity sales by approximately 1% per year, in the most successful instances. There are limited indications that after several years of aggressive program promotion, participation levels from rebate programs may drop off. Further research is needed in this area.

Loan programs are only offered by a few utilities. Programs which offer the option of a rebate or low-interest loan show that most customers prefer rebates, although loans are useful for the minority of customers who lack cash to finance energy-saving investments.

Performance contracting programs are also offered by a few utilities. These programs generally rely on energy service companies (ESCo's) to recommend, install and finance C&LM measures. Left to their own devices, most ESCo's will choose to concentrate on the largest customers and the most lucrative energy-saving measures (particularly lighting and cogeneration). Limited side-by-side comparisons indicate that other program approaches will achieve greater participation than ESCo-based programs. Most utilities which offer or have offered performance contracting programs have either phased-out these programs or chosen to complement them with other types of programs. However, several performance contracting programs which include high incentives have achieved significant energy savings. These programs are generally more expensive than other types of utility-operated programs promoting the same measures.

Request for proposal (RFP) and bidding programs have only begun operation in the past year or so. Further experience is needed with these programs before definitive conclusions can drawn. Indications thus far are that these programs can achieve significant energy savings (up to 1.5% of utility peak demand after approximately two years). This has been achieved primarily by reaching large customers, either directly through the RFP process or indirectly through ESCo's who participate in the bid process. These programs cost less than utility avoided costs (bids prices are capped at avoided costs), although there is a tendency for bids to approach utility avoided costs.

Information-only programs generally have low participation and low savings. Programs which offer free energy audits and post-audit follow-up assistance are the most effective type of information program. These programs can achieve high participation rates (60-90%) and energy savings among participating customers of up to 6-8%.

D. FACTORS CONTRIBUTING TO SUCCESSFUL PROGRAMS

Regardless of program type, our analysis of program experience indicates that several program elements contribute to above-average participation and savings. The most important of these elements are the following:

Marketing which employs multiple approaches (e.g., direct mail, media, etc.) but emphasizes personal contacts (via phone and face-to-face) with the target audience. The most successful programs are those that develop a regular, personal relationship with the target audience, including post-installation follow-up contacts to verify that measures are working properly and to promote additional measures. Personal marketing has been successfully used by utilities for all but the very smallest customers. Besides improving program participation levels, personal contacts can increase customer-satisfaction as well.

Targeting of program approaches and marketing efforts to the different audiences. Program approaches and marketing efforts often need to be packaged differently for different decision-makers (e.g. customers, equipment dealers, architects, engineers, and developers) and for different types of investment decisions (e.g. new construction, remodeling, replacement of worn-out equipment, or retrofit of inefficient but functioning equipment). Target audiences should be involved in program planning so the final program design truly meets their needs.

Technical assistance to help the target audience identify and implement C&LM opportunities. For retrofit programs, technical assistance includes energy audits and advice on equipment and contractors. For new construction, technical assistance often includes computer modeling and education for the target audience on new technologies. The depth of technical assistance should be matched to the type of customer and to the other services offered. Small customers generally require simple analysis and extensive assistance implementing measures. Large customers often need less assistance. If no financial incentives are available, it is often not cost-effective to do detailed technical audits. If sufficient incentives and other services are available so customers are likely to implement audit recommendations, then detailed audits may be worthwhile.

Simple program procedures and materials. Customers and trade allies are generally busy and have little time to decipher complex program procedures or marketing materials. One-step application procedures, assistance in filling out forms, and simple and catchy marketing materials and forms increase the likelihood of program participation. Rebate programs for different measures should often be packaged together to minimize customer confusion. However, while programs should be kept simple from the customer perspective, it does not necessarily follow that program designs and procedures be simple from the utility perspective -- to achieve high participation, savings, and quality control usually requires the utility to prepare and implement detailed marketing, technical assistance and quality control procedures.

Financial incentives to catch customer attention and reduce the first cost of implementing C&LM measures. Data on the effect of different incentive levels are limited but show that providing free measures results in the highest participation rates. High incentives (approximately 50% or more of measure cost) appear to promote greater participation than moderate incentives (on the order of 1/3 of measure cost). However, moderate incentives may not achieve higher participation than low incentives.

Multiple measures for customers to choose from. When customers can choose from multiple measures, they are more likely to find appropriate measures and/or to implement more than one measure, thereby increasing savings. Many programs limit themselves to lamps and air conditioners. Inclusion of additional lighting, HVAC, and motor measures, as well as allowing customers to propose their own measures, tends to increase participation and savings.

Promote new technologies which are not widely adopted in the marketplace. In the typical program analyzed in this study, limited data indicates that approximately 30% of the participants were free riders. Free rider percentages are high when rebates are provided for technologies which are already being purchased by many customers (such as reduced wattage lamps and moderate efficiency air conditioners). To the extent programs promote technologies which are not widely adopted, free riders are reduced. Furthermore, by promoting advanced energy-saving technologies (e.g., reflectors and variable-speed drives) greater savings can be achieved than with first generation technologies alone. On the other hand, because end-users are generally unfamiliar with advanced technologies, initial participation rates may be lower for programs emphasizing these technologies and substantial marketing efforts may be required to promote these technologies.

Additional factors linked with high participation and savings are noted in the "Conclusions" section at the end of Chapters 2-10.

E. COMPARISON OF TECHNICAL SAVINGS POTENTIAL WITH SAVINGS ACTUALLY ACHIEVED BY PROGRAMS

Even though the most successful programs are achieving substantial energy savings, the savings achieved fall far short of the full technical potential which is cost-effective to end-users. The programs with the highest participation are only reaching 10 - 70% of eligible customers, and even among participating customers, the programs with the highest energy savings are achieving savings which are only 20-60% of the cost-effective technical potential (where cost-effective is defined to be equipment and installation costs less than $0.05 per kWh saved -- a price less than the average retail C&I electricity price and long-run avoided costs of all New York utilities).

While the gap between achieved and potential savings is large for the best programs, the gap is greater still when typical programs are examined instead of the best programs. Most programs primarily promote a limited number of lighting and HVAC improvements. If achieved savings are to approach potential savings, additional measures need to be promoted, particularly advanced lighting and motor technologies, and HVAC and industrial process <u>system</u> improvements.

Besides covering a wider range of measures, in order to increase savings, existing program approaches need improvement and new approaches need to be tried. In many cases, marketing efforts need to be expanded. Among the new program approaches, comprehensive programs show particular promise, assuming they can be scaled-up successfully from the pilot and limited-scale efforts now under way. Another option which is likely to increase savings is to offer utilities financial incentives for operating successful conservation programs. Making the least-cost strategy for society also the "most-profit" strategy for utilities (through reform of utility regulations) could go a long way towards convincing utilities to vigorously promote and finance C&LM efforts.

However, even improved utility programs cannot achieve all of the cost-effective savings that are technically achievable. Some customers will always choose not to participate in a program and many customers will not implement all cost-effective C&LM measures. Complementary programs and policies are needed to maximize overall energy savings. Examples of such programs and policies include equipment efficiency standards and building codes.

F. ADDITIONAL WORK NEEDED

In addition to work on new and improved program offerings, additional work is needed to document and evaluate existing programs. Information on the size of target populations (e.g., number of new buildings built in a year or number of motors in a utility service area) is rarely collected, making calculation of participation rates difficult if not impossible for many programs. Data on percentage savings are also rarely collected, making it difficult to determine the depth of savings that are achieved. Most savings data are based on engineering estimates. At a minimum, these data need to be adjusted to exclude savings achieved by free riders. Ideally, savings estimates should be based on analysis of electricity bills for a sample of projects implemented. Where possible, savings results should be broken down by end-use or measure. Likewise, most free rider estimates are based on customer self-reports -- a very unreliable indicator. Additional work to determine free rider shares based on statistical analyses of program participants and non-participants is needed.

G. IMPLICATIONS FOR NEW YORK STATE UTILITIES

All seven of New York's investor-owned utilities are presently offering pilot or full-scale C&LM programs for C&I customers. As of mid-1989, approximately 25 C&I programs were being offered by New York utilities. Approximately half of these programs are pilot programs while the other half are full-scale. Among the New York programs are several exemplary programs, including pilot audit programs operated by Con Edison and NYSEG, well-structured experimental studies conducted by Niagara Mohawk and NYSEG, and a steam air conditioning program operated by Con Edison.

While these programs are a good start, New York utilities are still in the process of "gearing up" their C&LM activities. Most utilities have either just begun major programs or are planning to begin these programs in 1990. In particular, as a result of a directive from the New York Public Service Commission, all seven utilities will offer lighting, space conditioning, audit, consumer information, demand management, and bidding programs in 1990.

Of the utilities that have begun full-scale programs, participation levels and savings achieved are generally low relative to the most successful programs discussed in this report. Low participation and savings levels are common during the start-up stage of a program. However, in order to improve the performance of their programs, New York utilities should study the lessons from nearly a decade of experience around the country. In particular, as they develop new programs and/or modify existing programs, New York utilities should consider:

* Expanding personal marketing efforts, particularly with large customers and trade allies. These efforts should strive to develop an on-going personal relationship with the target audiences.

* Involving target audiences in program planning, so that program procedures, packaging and marketing are designed to appeal to the targeted audiences.

* Developing a comprehensive list of measures eligible for incentives, including custom measures proposed by customers, and advanced energy-saving technologies such as electronic ballasts, lighting and motor controls, and fluorescent fixture reflectors.

* Expanding technical assistance services provided to customers.

* Considering innovative programs, such as comprehensive programs, particularly for new facilities and for existing small C&I customers.

Recent filings by New York utilities show important progress in these directions. Furthermore, recent steps by the N.Y. Department of Public Service to provide incentives to utilities who achieve cost-effective DSM savings, should lead to continued progress in these areas.

After nearly ten years of activity by utilities throughout the country, utility C&LM programs are leaving childhood and entering adolescence. Much has been learned about how to structure and promote programs, resulting in substantial energy and dollar savings. However, much remains to be learned if even half the technical potential for C&LM improvements are to be achieved. C&LM practitioners need to continue experimenting with new and improved programs as well as better documenting existing programs so that available "conservation resources" can be more fully exploited.

Chapter 1

INTRODUCTION AND APPROACH

A. BACKGROUND

This report examines utility experience with conservation and load management (C&LM) programs for commercial and industrial (C&I) customers in order to summarize the lessons learned from program experiences to date and what these teach us about how to operate successful programs in the future.

This report is part of a multi-phase study on the potential for electricity conservation in New York State being prepared by the American Council for an Energy-Efficient Economy (ACEEE) for the New York State Energy Research and Development Authority (NYSERDA). In the first phase of the study, ACEEE examined the technical potential for cost-effective C&LM measures in New York State. This study concluded that if all conservation measures which are cost-effective to end-users are implemented, current electricity use would be reduced by approximately 36% in the residential sector, 48% in the commercial sector and 13% in the industrial sector [1].

The analysis of the technical conservation potential is only the first step in planning comprehensive C&LM programs. The technical potential study examined the installed costs of conservation measures and did not include the cost of programs needed to promote these measures. Furthermore, the technical potential study deliberately ignored the very important and difficult issue of how to convince or encourage end-users to undertake all cost-effective conservation opportunities. As study after study has shown, there are many reasons end-users do not install conservation measures, even when it is cost-effective for them to do so [2].

This report is intended to address some of the limitations in the technical potential report by examining participation rates, costs, savings and other aspects of actual C&LM programs, both in New York

State and throughout the United States. In subsequent phases of the ACEEE study for NYSERDA, we will draw from the studies of technical potential and utility program experience to examine the savings that are achievable if C&LM programs are "pushed to the limit" of current knowledge on how to structure and run cost-effective C&LM programs.

In addition to disseminating information on utility C&LM experience to a nationwide audience and collecting data for subsequent phases of the ACEEE/NYSERDA project, this report has one additional objective: to review current New York State utility programs. New York State utilities have recently begun offering C&LM programs to their customers. This report reviews program efforts thus far and makes recommendations, based on the lessons learned nationwide, as to how New York programs could be modified and expanded. We hope that this information will aid New York utilities as they make the transition from pilot-scale to full-scale C&LM efforts.

A particular focus of this report is on programs and program procedures which result in high participation rates and/or high electricity savings. If demand-side resources (resources which reduce the demand for electricity, thereby reducing the amount of electric capacity and energy which are needed) are to play a significant role in helping to meet future electricity requirements, then programs will need to reach a substantial proportion of targeted customers <u>and</u> will need to have a significant impact on the electricity consumption of customers that are reached.

If high participation is achieved but savings per customer are minimal, or if high savings per customer are achieved but participation is low, then the total savings achieved will be limited. For example, if a utility C&I rebate program addressed at all end-uses reaches 20% of eligible customers and reduces energy use by these customers by 7%, then C&I energy use will be reduced by 1.4% (20% times 7%). While a reduction in C&I energy sales of this magnitude is significant, it will have little impact on a utility's long-term need for generating plants. New York State has set a goal for utility C&LM programs -- to reduce electricity use and demand by 15% in the year 2008 [3]. Scenarios for meeting this goal will likely require developing programs which collectively reach 50-70% of customers and achieve savings among participating customers of 20-30%. Similarly, New England Electric System (NEES -- a major private utility), recently released a long-range demand/supply plan which calls for peak demand reductions of nearly 14% by 2008 (14% of what demand would be in 2008 in C&LM programs were not offered) [4]. Without high participation <u>and</u> high savings per customer, achievement of the New York State and NEES goals will be impossible.

At times there may be tradeoffs between the goals of achieving high participation rates and achieving high savings per participating customer. At these times, it is important to bear in mind that the ultimate goal is to achieve long-term energy and demand savings. If high participation is achieved primarily by paying incentives to customers who would make changes anyway, then progress towards long-term goals will be minimal. Thus, achieving long-term C&LM goals requires high <u>net</u> participation and high <u>net</u> savings per customer (net of what would have happened if the program were not offered). Also, achievement of these goals does not necessarily require that a single program reach all customers and achieve high savings per customer. Most likely, the best way to achieve long-term goals will be through packages of programs which together reach most customers and which together assist these customers to undertake many cost-effective actions which they would not otherwise pursue.

We realize that not all utilities are interested in maximizing savings from cost-effective C&LM programs. For some utilities, other goals may apply such as maximizing customer satisfaction or minimizing lost revenues (utility revenues lost when consumers reduce electricity use), free riders (customers who participate in a program but would have undertaken the same conservation actions even if the program were not offered) or the cost per kW or kWh saved. For these utilities, this report will provide some useful data and insights, but conclusions on how to increase participation and savings may not apply.

B. METHODOLOGY

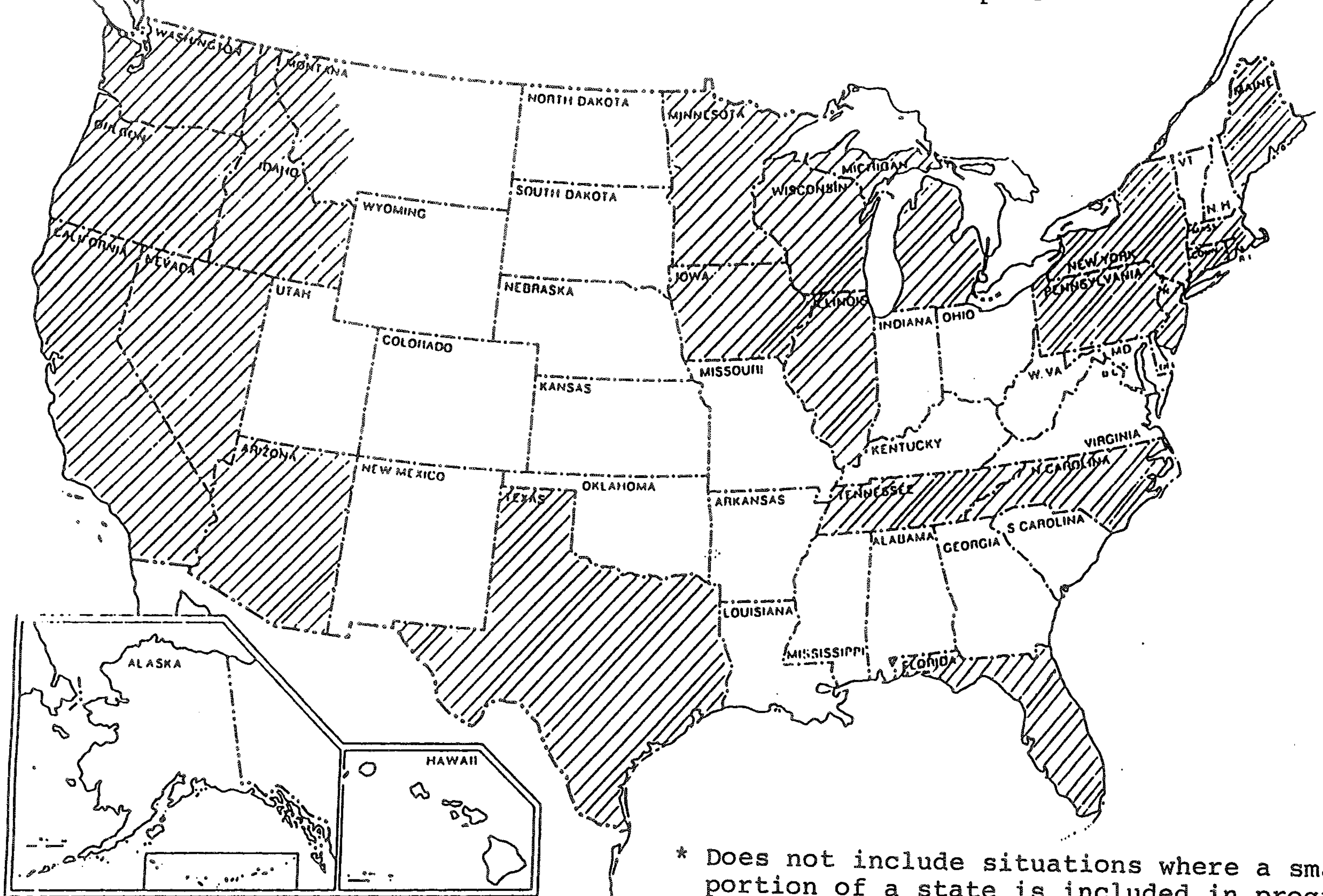
For this study, over 200 C&LM programs for C&I customers were examined. These programs are operated by 58 different utilities, including both public and private utilities. Figure 1-1 shows the states served by these programs. These programs range from energy audit programs to incentive programs designed to encourage industrial process improvements. Data was collected on conservation programs (programs which reduce electricity use) as well as on storage cooling and heating programs (which reduce peak electric demand but have little impact on total electricity use). Other load management programs, such as interruptible rates, load control, and stand-by generation programs were not examined. Also, programs to promote cogeneration systems were not examined, although a few programs which promote both C&LM measures and cogeneration are included.

Leads on C&LM programs were obtained from a variety of sources including prior reports on C&LM programs [5], magazines [6], and word-of-mouth suggestions obtained from dozens of people who were consulted during the research phase of this project. Data on individual programs were collected during 1989. In most cases the data summarizes program results through the end of 1988, although in some cases 1989 data are included and in other cases only data from 1987 or earlier years were available.

Detailed data on each program examined are contained in the Appendix to this report. Unless otherwise stated, all data come from the individual utilities operating the programs. Data were obtained from either published reports, from internal utility

Figure 1-1

States with C&LM Programs Featured in This Report *



* Does not include situations where a small portion of a state is included in programs offered by an out-of-state parent utility.

records supplied by utility staff, and/or from telephone conversations with utility staff.

Specific information collected on each program (as available) is as follows:

1. Utility.

2. Program name.

3. Program type (e.g. audit, lighting, HVAC, etc.).

4. Measures being promoted (general description). For a detailed description of the measures being promoted and specific incentive levels, the reader is referred to other publications [7].

5. Incentives (general description -- see note above).

6. Whether the program is a pilot or a full-scale program.

7. Start and end dates of the program. In most cases the programs are still ongoing.

8. Start and end dates of the detailed participation, savings, and cost information collected. In many cases detailed data is available for only part of the program's lifetime.

9. Number of customers eligible for the program. In some cases the program is targeted to a specific customer segment (e.g. industrial customers with a peak demand greater than 500 kW). In other cases all C&I customers are eligible. In these latter cases, the total number of C&I customers, as of the end of 1987, is used as the estimate of the target population [8]. Included in these figures are customers with more than one account at a single address, and minimal use customers such as billboards, water pumps, and storage sheds.

10. Number of customers participating in the program. Generally only customers who have completed projects are included, although where the only data available are for projects under contract, this information is noted and used. Customers with two meters are generally not counted twice. Customers who undertook multiple projects are only counted once.

11. Number of completed projects, meaning a particular measure at a particular facility. Customers who install multiple items of a particular measure (e.g. high efficiency motors) are only counted once. Customers who

receive rebates for two separate projects are counted twice.

12. Participation rate -- number of participating customers divided by number of eligible customers. If all C&I customers are eligible for a program, then the maximum participation rate will be approximately 50-60%, since typically 40-50% of C&I customers represent multiple accounts at the same address or minimal use accounts [9]. If the number of participating customers is unavailable, the number of completed projects is used to calculate participation rates and is so noted. Since some customers will undertake multiple projects, participation rates based on number of completed projects will be inflated. On average, across all the programs analyzed, the average participating customer completed 1.8 projects.

13. Estimated MW savings, both coincident with the system peak (i.e. adjusted to account for the proportion of load that is actually operating at the time of the system peak), and "absolute" savings (not adjusted for coincidence). For example, if a 60 Watt light bulb is replaced with a 15 Watt bulb, absolute savings are 45 Watts but, assuming 80% of lights are actually on at the time of system peak, coincident savings are only 36 Watts (45 * 80%). Unless otherwise stated, all savings figures are based on engineering estimates (see #15 below).

14. Estimated annual GWh savings for all measures completed under the program. Unless otherwise stated, all savings figures are based on engineering estimates (see #15 below).

15. Adjustments included in savings estimates. As previously noted, most savings estimates are based on engineering calculations made by the utility sponsoring the program. In a limited number of cases, savings estimates are based on billing analysis, submetering, or whole-building computer simulations. These are noted in the program listing. In addition, in some instances, engineering calculations are adjusted to:

   * Account for free riders;

   * Include air-conditioning savings resulting from reduced heat output of improved efficiency equipment;

   * Include transmission and distribution benefits of programs (the number of kWh saved at the power plant is approximately 8% greater than the kWh saved on the customer side of the meter because of line losses during power transmission from the power plant to the customer);

* Include reserve margin benefits of programs (saving a kW on the customer side of the meter reduces power plant requirements by an amount equal to the customer savings plus the utility's reserve margin percentage (an allowance for power plant downtime)).

These adjustments are all noted under the applicable programs.

16. Utility peak demand (for 1987) [10].

17. MW savings as a percent of peak demand. Coincident peak savings are used where available, otherwise "absolute" MW savings are used (see #13 above) and are so noted.

18. Program expenses, including direct expenses (incentives paid to customers), indirect expenses (marketing and staff expenses) and total expenses (the sum of direct and indirect expenses).

19. Average cost per kW -- program expenses divided by MW savings. Whenever possible, $/kW was calculated using total expenses and coincident peak savings. Where total expenses are not available, direct costs are used and are so noted. Where coincident peak savings are not available, "absolute" MW savings are used. [Note: Average cost per kWh saved was not collected from individual utilities since different utilities use different assumptions to calculate this figure and the assumptions used have a large effect on the result. Instead, ACEEE calculated cost per kWh using uniform assumptions. The methodology and assumptions used are discussed in section "C" below.]

20. Contact name and phone number.

21. Additional notes on the program, including additional descriptive information on the program, marketing methods used, findings of evaluation studies and other interesting results. In particular, in compiling this data, we tried to obtain information on free rider percentages and on savings as a percentage of pre-program electricity use by participating customers.

    Free riders are important because they contribute to program costs but do not provide any benefits. Nearly all programs have at least some free riders. While high free rider proportions can make programs very costly, if costs per participant are low and/or benefits per participant are high, even programs with a large number of free riders may be cost-effective. Estimates of free rider proportions need to be used with caution because of limitations in the quality of the data and because even small differences in program designs can have a large impact on the number of free riders. These issues are discussed extensively in Chapters 3 and 10

Information on percentage savings is useful because it provides information on the "depth" of savings achieved -- i.e. are substantial savings being achieved by each participant. As previously mentioned, for C&LM programs to have a large impact on future energy and capacity needs, substantial savings per participant will be needed. Programs with high percentage savings can provide insight into ways to maximize energy savings. Programs with low percentage savings can also be important, if they have high participation rates and/or if they are complemented by additional efforts to achieve additional savings among the same participants.

C. PROGRAM COST-EFFECTIVENESS

Detailed cost-effectiveness information on each program was not collected since there is a wide variation in the utility industry as to how benefit-cost ratios and levelized cost per kWh saved are calculated. Most of the programs discussed have been found to be cost-effective by the utilities running each program, based on their own cost-effectiveness methodology. In the next phase of the project for NYSERDA, ACEEE will examine the cost-effectiveness of prototypical programs using a sophisticated demand-side management screening model which calculates the benefit-cost ratio of programs from several different perspectives.

For purposes of this report, two rough cost-effectiveness analyses are employed. These are intended to provide a first-cut analysis of program cost-effectiveness from the utility perspective. The utility perspective considers a utility's costs and benefits for a program including rebate and other program costs and avoided energy and capacity benefits. The utility perspective does not consider costs paid by program participants nor does it consider the value of revenues lost by the utility due to reduced electricity sales. Detailed explanations of the utility perspective can be found in other publications [11].

In New York State, the Department of Public Service has recently determined that utilities should pay particular attention to the "total resource cost (TRC) perspective," stating that "programs which fail the TRC test should not be implemented on a large scale basis" [12]. This perspective differs from the utility perspective in that it includes monies paid by program participants for materials, installation and maintenance of measures (including credits for reducing customer costs, such as reduced maintenance costs) [13]. We use the utility perspective in this report because it relies on information (utility costs and savings) which are generally available). Data on customer costs are rarely collected by utilities and hence were not available for our analysis. For programs in which the utility pays all the costs of purchasing and installing measures, the utility perspective and the total resource perspective are often the same. Where the utility only pays a portion of measure costs, utility costs are less than total costs and the cost per kW or kWh will be less under the utility perspective than the total resource cost perspective.

The two rough cost-effectiveness measures used in this report are cost per kW saved and levelized cost per kWh saved. Cost per kW saved is calculated for each program for which cost and demand savings information is available. The calculation of cost per kW was discussed previously. Due to variances in the data used to calculate cost per kW, care should be used in comparing programs and comparing these results to long term capacity costs in New York State.

The discounted levelized long run avoided capacity cost for New York utilities is summarized in Table 1-1. The statewide average 20-year avoided capacity cost is $1,032/kW, assuming a 6% real discount rate [14]. Avoided capacity costs in New York range from a low of $746/kW for Central Hudson Gas & Electric to $1,236/kW for Long Island Lighting. These avoided capacity costs include only the cost of capacity and not potential savings from avoided operations and maintenance costs. Thus, if the cost per kW for a program is more than a utility's avoided capacity cost, but the program reduces operations and maintenance costs (by saving kWh in

Table 1-1

Long Run Levelized Avoided Costs for New York State Utilities (1989 $)

	Central Hudson G&E	Consolidated Edison	Long Island Lighting	NY State Electric & Gas	Niagara Mohawk	Orange & Rockland	Rochester Gas & Electric	Statewide Weighted Average*
5 Year (1989-1993):								
Energy ($/kWh) **	$0.0340	$0.0353	$0.0429	$0.0339	$0.0339	$0.0345	$0.0339	$0.0356
Capacity ($/kW) **	$221	$319	$446	$340	$305	$282	$328	$331
Total ($/kWh) ***	$0.0399	$0.0439	$0.0550	$0.0431	$0.0422	$0.0422	$0.0428	$0.0446
10 Year (1989-1998):								
Energy ($/kWh)	$0.0398	$0.0416	$0.0472	$0.0397	$0.0397	$0.0408	$0.0397	$0.0414
Capacity ($/kW)	$446	$619	$785	$656	$594	$554	$633	$631
Total ($/kWh)	$0.0466	$0.0512	$0.0594	$0.0499	$0.0489	$0.0494	$0.0495	$0.0512
15 Year (1989-2003):								
Energy ($/kWh)	$0.0426	$0.0448	$0.0497	$0.0426	$0.0426	$0.0438	$0.0426	$0.0443
Capacity ($/kW)	$616	$846	$1,042	$896	$814	$761	$866	$859
Total ($/kWh)	$0.0498	$0.0547	$0.0619	$0.0531	$0.0521	$0.0528	$0.0527	$0.0544
20 Year (1989-2008):								
Energy ($/kWh)	$0.0442	$0.0465	$0.0511	$0.0442	$0.0442	$0.0455	$0.0442	$0.0459
Capacity ($/kW)	$746	$1,019	$1,236	$1,078	$980	$918	$1,042	$1,032
Total ($/kWh)	$0.0516	$0.0566	$0.0634	$0.0549	$0.0539	$0.0546	$0.0546	$0.0562

* Weighted average of seven N.Y. utilities. Weighting based on 1988 Gwh sales of each utility.

** Avoided costs are discounted assuming a 10% nominal discount rate and are levelized assuming a 6% real discount rate.

*** The total cost is the avoided energy cost plus the levelized value of the annual capacity cost divided by 8760 hours/year.

Source:
Values calculated by Harvey Tress, New York State Energy Office based on "Order Adopting Long-Run Avoided Cost Updates (Case 88-E-093), July 13, 1989 (Albany: N.Y. Public Service Commission).

addition to kW), the program may still be cost-effective when the benefits of avoided capacity and energy are combined.

In addition to 20-year avoided capacity costs, Table 1-1 also includes 5, 10 and 15-year avoided capacity costs. These values are needed when examining the cost-effectiveness of programs with average measure lives of 5, 10 and 15 years (e.g. to estimate if a program with a 5-year measure life is likely to be cost-effective, compare its cost per kW to the 5-year avoided capacity costs for each utility).

The cost per kWh for each program is calculated (and included in summary tables) based on a series of simplifying assumptions including:

> Program cost is taken from the program database. These costs were incurred in varying years, but in order to simplify the analysis, no effort is made to adjust the costs to a common value. In cases where only direct program costs are available, total program costs are estimated by increasing direct costs by 36%, where 36% is the average ratio of indirect to direct costs for the 46 programs included in our study for which both direct and indirect cost information is available.
>
> Measure life is assumed to be 5 years for audit and lamp programs, 10 years for control, industrial and mixed measure programs, 15 years for major equipment replacement, and 20 years for new construction programs [15].
>
> Discount factor is based on measure life and a real 6% discount rate. This discount rate was chosen based on the current inflation rate (approximately 5%) and on overall utility return on investment requested and awarded in recent utility rate cases (average of 11.5%) [16].

These values were then inserted in the following formula:

$$\$/kWh = \frac{\text{Total Program Cost} * \text{Capital Recovery Factor}}{\text{Annual GWh Savings}}$$

The Capital Recovery Factor is given by the following formula:

$$CRF = ((1+D)^{L-1} * D) / (1+D)^{L} - 1),$$

where D is the discount rate and L the average measure life. If a C&LM program were financed with a loan, with an interest rate equal to the discount rate and a term equal to the measure life, then the annual payments due on the loan at the beginning of each year would be the same as the total program cost times the capital recovery factor. This approach to calculating levelized program costs is equivalent to the California Standard Practice Method used by the California and New York Public Service Commissions [17].

For comparison purposes, the weighted average avoided total costs (avoided energy costs plus capitalized avoided capacity costs) for New York State utilities, again assuming a 6% real discount rate are $0.0562/kWh (see Table 1-1). Avoided total costs for New York utilities range from a low of $0.0516 for Central Hudson Gas & Electric to a high of $0.0634 for Long Island Lighting. Except for these two utilities, avoided total costs for the other five investor owned utilities in New York are all between $0.054 and $0.057 per kWh.

These cost-effectiveness calculations are very rough and are intended for scoping purposes only. In the next phase of the project for NYSERDA, ACEEE will examine the cost-effectiveness of prototypical programs using detailed cost-effectiveness calculations with assumptions customized for each New York utility.

D. CAVEATS

The data on individual programs summarized in this report is subject to a number of significant limitations which should be kept in mind in using this report.

Most importantly, there are great variations in how utilities collect and report data. Hence extreme caution should be used in making direct comparisons between programs. For example, while most utilities do not adjust their savings estimates to account for free riders, a few utilities do subtract free riders from their savings estimates. Similarly, nearly all utilities include expenditures for customer incentives in their cost figures, most include marketing costs, some include staff costs, and a few even include company overhead costs. Additional examples of data reporting differences were discussed earlier in this chapter.

As an aid to signaling instances where data is not directly comparable, in the tables which summarize the results of each program, the most common distinctions between data types are noted in special columns within the relevant tables. For example, it is noted whether participation rates are based on the number of participating customers or the number of participating projects. Likewise, it is noted if costs per kW are for all program costs or for direct program costs only. Less common distinctions are mentioned in the notes column of each program description.

As a general rule of thumb, we estimate that where programs differ in a particular index by less than a factor of two, the differences are quite possibly due to data reporting differences, and not to substantive differences. Where programs differ by more than a factor of two for a particular index, there is a reasonable chance that substantive differences are involved.

Besides data reporting differences, there are a number of other data limitations, many of which were discussed earlier in this chapter. First, most of the savings estimates are based on engineering calculations -- statistical analyses of actual savings are rarely available. Actual savings in some cases can differ substantially from engineering estimates. Sometimes actual savings are higher than engineering estimates and other times they are lower than the estimates [18].

Second, data on participation rates are subject to a number of shortcomings. Participation rates reported here <u>include</u> free riders (although likely free rider proportions are reported for each program type, to the extent available data allows). While we would have liked to exclude free riders from data on all programs, good data on the number of free riders is rarely available. Where free rider proportions are high, actual net participation rates will be substantially lower. On the other hand, data on the eligible population for a program is often exaggerated because the eligible population is defined to be all C&I customers, including minimal use accounts and customers with more than one meter. When the eligible population is exaggerated, participation rates will tend to be low. Likewise, low participation rates do not necessarily mean than high participation cannot be achieved -- often participation is low because a program is just beginning or because budgets and/or marketing constraints limit the number of participants who can be reached or served.

Third, the cost-effectiveness measures used are only approximate -- they use simple analysis procedures, ignore customer costs, and sometimes rely on rough estimates of indirect costs. For these reasons the cost-effectiveness calculations are appropriate for scoping purposes, not detailed cost-effectiveness determinations.

Despite these limitations, we do attempt to make some general program comparisons in order to identify which programs appear to be successful and the likely reasons for their success. As was noted previously, for purposes of this report, success is defined as achieving high participation and high savings (net of free riders, to the extent available data allows this determination).

The purpose of this exercise is to provide information that utilities can use to improve their programs. The purpose of this exercise is <u>not</u> to flag poorly performing programs so that the program operators may be penalized. In fact we believe that penalties are usually counter-productive. First, due to data reporting differences or traditional difficulties during the start-up phase of a program, programs that initially may appear unsuccessful, may ultimately prove very successful. Second, utility C&LM programs are still in their infancy. Much remains to be learned; mistakes are to be expected, particularly mistakes that can only be identified with "20-20 hindsight." Finally, it is important that mistakes be well publicized, so that others can learn from the mistake, rather than repeating the mistake. To the extent that individuals or utilities are penalized for making honest mistakes, data on mistakes will not be released and all C&LM practitioners will suffer.

While we have made extensive efforts to include as many programs as possible in this report, many additional programs are being offered, either unbeknownst to us, or for which sufficient data could not be compiled in time for inclusion in this report. Omission of a particular program should in no way imply that the program is not worth considering. In particular, many programs which first began in 1988 or 1989 are not included because these programs are too new for word of them to reach us, or for any significant results to be available.

One final caution: for some utilities, the results of a particular program are listed more than once (i.e. under multiple end-use programs and again under the individual measures involved such as lighting and motors). As a result, aggregating data for different programs is likely to provide misleading results.

E. ORGANIZATION OF THIS REPORT

This report is divided into 12 chapters. The first ten chapters focus on programs serving different end-uses. Each chapter begins with general introductory information on the technical potential for energy savings and basic data on the programs analyzed. Descriptions of the different types of programs and how they are typically structured are then provided. Next, sections discuss program participation rates, energy savings, free riders, and program cost-effectiveness. Throughout these sections, programs and program components which have been particularly successful and the attributes contributing to their success are analyzed.

The final two chapters attempt to summarize the lessons taught by the over 200 programs examined. Chapter 11 summarizes general lessons, while Chapter 12 focuses on New York State. Program experience in New York State is analyzed and compared to typical and to successful programs. These comparisons take into account differences between New York and other regions of the country, and also take into account the fact that most New York State programs are still in the pilot or start-up stage. Based on these comparisons, recommendations for improving New York State programs are made.

F. NOTES

1. Miller, Eto and Geller, 1989, The Potential for Electricity Conservation in New York State (Washington, D.C.: American Council for an Energy-Efficient Economy), p. S-11.

2. See for example Hirst, Clinton, Geller and Kroner, Energy Efficiency in Buildings, Progress and Promise, 1986 (Washington, D.C.: American Council for an Energy-Efficient Economy).

3. Cotter, Jorling and Bradford, 1989, New York State Energy Plan (Albany, N.Y.: New York State Energy Office), p. 2.

4. Destribats, Alan, 1989, "Implementation, Evaluation and Incentives," paper presented at the Electric Council of New England, Demand Side Management National Conference, Boston, MA, November 17, 1989 (Westboro, MA: New England Electric).

5. The major reports examined were as follows: Consumer Energy Council of America Research Foundation and American Council for an Energy-Efficient Economy, 1987, A Compendium of Utility-Sponsored Energy Efficiency Rebate Programs, EM-5579 (Palo Alto, CA: Electric Power Research Institute); Kolb and Hubbard, 1988, A Review of Utility Conservation Programs for the Commercial Building Sector, ORNL/CON-220 (Oak Ridge, TN: Oak Ridge National Laboratory); Battelle-Columbus Division, 1989, 1987 Survey of Commercial-Sector Demand-Side Management Programs, CU-6294 (Palo Alto, CA: Electric Power Research Institute).

6. See particularly "Utility Rebate Guide", Energy User News, March, 1989, pp. 20-26.

7. See notes # 5 and 6.

8. Number of C&I customers was taken from Electrical World Directory of Electric Utilities, 1989, 97th Edition (New York: McGraw Hill).

9. New England Electric, in a study of 3768 small C&I accounts in 20 target communities, determined that 40% of the accounts represented customers using less than 500 kWh/month [Evaluation Report on Massachusetts Electric Company's Enterprise Plan, Executive Summary, 1988 (Westboro, MA: New England Electric), p. 2.3]. Phone calls and field visits indicated that 12% of the remaining sites either represented multiple accounts at the same address, were out-of-business, or used no energy for lighting. [Nadel, Steven, 1989, "Electricity Savings from a Small C&I Lighting Retrofit Program: Approaches and Results," in Energy Program Evaluation: Conservation and Resource Management, Proceedings of the August 23-25, 1989 Conference, (Argonne, IL: Argonne National Laboratory), pp. 107-112.] Thus out of the initial pool of accounts, only 53% (1-40%)*(1-12%) were truly eligible for the program. Similar results were found for a similar program operated by the Sacramento Municipal Utility District [Personal communication with Kathy Itow, SMUD, June, 1989].

10. Obtained from Electrical World Directory of Electric Utilities, 1989, 97th Edition (New York: McGraw Hill).

11. See for example Krause and Eto, 1988, Least-Cost Utility Planning Handbook for Public Utility Commissions, Volume 2 (Washington: National Association fo Regulatory Utility Commissioners).

12. New York Public Service Commission, 1989, "Order Concerning 1990 Demand Side Management Plans," issued Dec. 29, 1989, Case 28223 (Albany, N.Y.: N.Y. Department of Public Service), p. 32.

13. A fuller explanation of this perspective in referenced in note # 11.

14. The 6% real discount rate is based on the following calculation: 1 + 11.5% average overall utility return divided by 1 + 5% current inflation rate; where the average overall utility return is the average of 46 pending and authorized rate filings listed in the Aug. 31, 1989 issue of Public Utilities Fortnightly, p. 62) and the current inflation rate is based on changes in the consumer price index in 1987 (4.4%), 1988 (4.4%) and the first seven months of 1989 (5.5%), as calculated by the U.S. Labor Department.

15. Measure lives are based roughly on the values reported by Gordon, McRae and Rufo, "Use of Commercial Energy Efficiency Measure Service Life Estimates in Program and Resource Planning," in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings, p. 3.84-3.97. These lives range from a low of approximately five years for lamps to a high of approximately 20 years for measures built into new buildings. The majority of measures have lives of 10-15 years, but when lighting measures (which tend to dominate many multiple measure programs) are averaged in, we estimate that

the average life across all measures is approximately ten years. Industrial measures are assigned a 10 year life based on work by Fred Gordon which takes account of the fact that often industrial process lines are revamped before the end of the useful equipment lives (Gordon, Fred, Memo to Dave Wolcott of December 6, 1989 (Portland, OR: Pacific Energy Associates)). Energy audits are assigned a short measure life because many of measures involve operational changes that are sometimes forgotten. When Southern California Edison examined the persistence of measures installed under its audit program, it found that approximately half the measures were not in place after a period of approximately five years (ACEEE estimate based on the results of a 1986 Southern California Edison study on measure persistence relative to the sum of savings reported from 1980-1986).

16. See note # 14.

17. Based on an analysis by Dr. Harvey Tress, New York State Energy Office, February, 1990 (personal communication).

18. See for example, Nadel, Steven, and Malcolm Ticknor, 1989, "Electricity Savings from a C&I Lighting Retrofit Program: Approaches and Results" in <u>Energy Program Evaluation: Conservation and Resource Management, Proceedings of the August 23-25, 1989 Conference</u> (Argonne, IL: Argonne National Laboratory), pp. 107-112.

Chapter 2

AUDIT PROGRAMS

A. INTRODUCTION

Energy audits are used to identify potential energy-saving actions and measures that end-users can undertake. In addition, audits can be useful for motivating customers to implement energy conservation actions.

A total of 29 C&I energy audit programs were examined for this study. In addition, a number of incentive programs (discussed in other chapters of this report) have energy audit components. Summary information on each of the audit-only programs is contained in Table 2-1. This table first lists full-scale programs, then pilot programs. More detailed information can be found in the Appendix.

B. PROGRAM DESCRIPTION

The typical C&I energy audit program combines a non-engineering audit (detailed engineering assessments are not made) with limited marketing and post-audit follow-up efforts. The audit is typically either a computerized or walk-thru audit. Computerized audits produce detailed reports listing the costs and potential savings from standard energy-conserving retrofits. Calculations are based on data collected on-site, such as information on equipment types and quantities. Walk-thru audits usually do not include site-specific cost and savings calculations, but instead combine checklists with pre-printed sheets describing measure costs and savings for typical applications.

Only very limited data are available on the accuracy of computerized, non-engineering audits. Based on the limited data available, it appears that when the audits are conducted by well-trained staff and with good quality control procedures, the

able 2-1
ummary of Audit Program Results

tility	State	Program	Audit Free?	Time Period Start	Time Period End	Pilot or Full-Scale	Number Eligible	Number of Participating Customers	Cumm. Participation Rate	Estimated Savings Coin. MW	Estimated Savings Absolute MW	Estimated Savings GWh/yr	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute	% of Recommendations Implemented	Avg. Svgs/Customer (%)	Total Cost (1000s)	Utility Cost $/kW	Utility Cost $/kWh
ECo	MA	Comm'l Cons. Service	Y & N	1986	12/88	Full	~40,000	~1000	2.5%	3.04		11.52	2,477	0.12%	C			$650	$214	$0.013
en. Hudson	NY	C/I Audit Program	Yes	4/87	2/88	Full	27,904	162	0.6%		0.21	0.62	824	0.03%	A			$50	$238	$0.019
MP	ME	Energy Mgmnt Audits	Yes	1984	12/88	Full	43,686	1,975	4.5%			6.17	1,455							
uke Power	NC	Energy Surveys	Yes	1978	12/88	Full	454,015		~.6%/yr	875.4			12,691	6.90%	C					
lorida P&L	FL	C&I Energy Analysis	Yes	1/81	12/88	Full	324,915	7,516	2.3%	112.60		580.20	12,394	0.91%	C			$17,065	$152	$0.007
ILCO	NY	Comm. Energy Audit	Yes	1986	9/88	Full	95,871	1,927	2.0%	13.81		49.98	3,576	0.39%	C	39%		$811	$59	$0.004
adison G&E	WI	C/I Energy Audits	Y & N	1983	11/88	Full	13,973	1,568	11.2%				477					~$784		
SP	MN	C&I Audit Services	Y & N	1/87	12/87	Full	111,751	4,668	4.2%				5,543					$280		
U	CT/MA	EnergyCHECK	No	1/88	12/88	Full	99,254	1,805	1.8%	4.00		22.08	4,242	0.09%	C		4%	$617	$154	$0.007
G&E	CA	Energy Management	Yes	1/81	12/82	Full		5962			29.98	60.82	14,142	0.21%	A					
G&E	CA	Energy Management	Yes	1/83	12/85	Full	~475,000	54,967	11.6%		135.26	642.67	14,142	0.96%	A		4-8%	$30,106	$223	$0.011
ortland GE	OR	C/I Services	Y & N	1980	7/83	Full	64,247	1,700	2.6%				2,809							
SE&G	NJ	Conservation Survey	Y & N	10/84	12/88	Full	~220,000	8,423	3.8%				8,137							
eattle C.L	WA	Walk-Thru Survey	Yes	12/79	12/83	Full	25,900	449	1.7%			11.57	1,725				6%	$459		$0.009
eattle C.L	WA	Energy Mgmnt	Yes	1/84	12/88	Full	31,975	763	2.4%			30.56	1,725					$567		$0.004
eattle C.L	WA	Energy Mgmnt Partnership	Yes	12/79	12/83	Full	434	32	7.4%			6.90	1,725				2%	$234		$0.008
MUD	CA	Small Comm'l Audit	Yes	1982	1985	Full	22,000	2,245	10.2%	1.71		4.52	1,902	0.09%	C			$1,721	$662	$0.056
MUD	CA	Small Comm'l Audit	Yes	1986	1988	Full	~25,500	1,473	5.8%		2.18	8.97	1,902	0.11%	A			$546	$250	$0.014
MUD	CA	Large Comm'l Audit	Yes	1980	1985	Full	125	111	88.8%	6.36		39.20	1,902	0.33%	C	~50%	8%	$1,541	$242	$0.009
MUD	CA	Large Comm'l Audit	Yes	1986	1988	Full	~500	116	23.2%		8.46	31.17	1,902	0.44%	A			$1,053	$124	$0.008
nohomish	WA	Ind'l Energy Mgmnt Serv.	Yes	1/88	12/88	Full	~400	35	8.8%			0.76	1,156							
o. Cal. Ed	CA	Energy Mgmnt Surveys	Yes	1/88	12/88	Full	393,754	34,826	8.8%	51.30		248.38	14,775	0.35%	C			$8,916	$174	$0.008
nited Illm	CT	C&I Energy Audit	Yes	11/83	11/89	Full	28,860	2,100	7.3%		4.50	30.00	1,072	0.42%	A	24%	4-6%	$1,000	$222	$0.007
isc. P&L	WI	Comm'l Energy Eff. Serv.	Yes	1984	4/89	Full	~38,000	3,169	8.3%				1,634					$1,109		
isc. P&L	WI	Lg. C&I En. Mgmnt. Stud.	Y & N	1987	5/89	Full	~600	21	3.5%				1,634					~$600		
PA	WA/OR	Comm'l Audit	Yes	6/84	3/87	Pilot		3,800					16,680			8%		~$7,200		
ent. IL Lt	IL	ENER-Check	No	3/83	2/85	Pilot	19,353	177	0.9%				993					$175		
ent. IL PS	IL	Small Business En. Audit	No	1/84	12/87	Pilot	4,646	86	1.9%				1,632					$24		
on Ed	NY	Free C&I Audits	Yes		12/88	Pilot	~800	562	70.0%				9,386			~50%				
nterst.Pwr	IL	Comm'l/MF Energy Audit	No	1984	1985	Pilot	862	0	0.0%				822					$0.60		
SP	MN	Energy Checkup	No	1984	10/86	Pilot	111,751	553	0.5%			9.87	5,543			27%	5%	$711		$0.016
YSEG	NY	C/I Audits	Y & N	10/86		Pilot	1,474	413	28.0%	0.41		1.72	2,540	0.02%	C					

audits on average are good predictors of energy savings, although savings estimates for individual measures or individual buildings are subject to a considerable degree of inaccuracy [1].

A few utilities (e.g. Southern California Edison and the Bonneville Power Administration) have provided detailed engineering audits, primarily to large customers (peak demand above 200-500 kW).

Audits are generally conducted by either utility representatives or private firms. Approximately half of the utilities surveyed provide audits for free, the other half charge a nominal amount for the audit. A common arrangement is to provide free walk-thru audits but to charge for more detailed audits.

Most utilities market their audit programs through bill messages (messages printed directly on the bill), bill stuffers (brochures enclosed with bills), direct mail brochures, and referrals, such as in response to high bill complaints. Some utilities use more intensive marketing efforts including telemarketing or site visits to most eligible customers. Follow-up usually consists of delivery of the audit report, either in person or by mail. A few utilities provide more extensive follow-up services such as annual follow-up visits and assistance arranging measure installation. Many utilities offer financial incentives for implementation of audit recommendations.

C. PARTICIPATION

Customer response to the typical C&I audit program is generally limited. Most utilities surveyed reach approximately 1% of eligible customers each year. Only a few utilities have reached more than 10% of their eligible customers on a cumulative basis (see Table 2-1). A recent analysis by Xenergy, Inc. of commercial sector audit programs found that audit program participants tend to have the following characteristics:

* Medium to large businesses
* High level of profitability
* Significant energy expenses
* Owner-occupied facilities
* Customer intends to occupy the building for a long time
* Older buildings
* The firm pays its own energy bills
* Customer perceives that the building's load is controllable
* The firm has taken previous conservation actions [2].

A number of programs have had very high participation rates. For example:

* The Sacramento Municipal Utility District (SMUD) reached 89% of its large commercial customers (peak demand greater than 500 kW) and over 70% of its medium commercial customers (peak demand of 200-500 kW) during the 1980-1985 period [3]. Similar participation rates among large commercial customers were achieved by other California utilities during the same time period under a program ordered by the California Public Service Commission [4]. These programs provided free energy audits and were promoted by utility field representatives through personal contacts with all eligible customers.

* Consolidated Edison, in a pilot program, reported 70% participation for a program which provided free energy audits to medium-sized (150-500 kW) C&I customers. This program was promoted through repeated phone calls to targeted customers [5].

* Southern California Edison reports auditing 65% of its C&I customers during the 1981-1988 period [6]. This program provides free audits and is promoted through mailings and personal contacts by utility field representatives, including drop-in site visits to small C&I customers.

* In the small C&I area, Massachusetts Electric achieved a 60% participation rate among customers with peak demands less than 100 kW. This program provided free energy audits and offered free installation of cost-effective lighting improvements. Program promotion included telemarketing and drop-in site visits [7].

These programs all combined free energy audits with extensive personal marketing efforts. The importance of free audits and personal marketing was illustrated by an experimental study conducted by New York State Electric & Gas (NYSEG). In this study, two different marketing approaches: (1) personal contact by a utility representative and (2) phone prequalification followed by direct mail were compared. In addition, three different audit prices were compared: (1) free audit, (2) sliding scale audit fee, and (3) sliding-scale fee which is rebated if customer implements audit recommendations. Participation rates were greater for the free audit groups (average 50% participation) than for the sliding-scale fee groups (average 13-19% participation). Participation was higher for the personal marketing groups (average of 37%) than for the phone/mail groups (average of 9%). Among customers who were offered free audits through a personal contact, the participation rate was 65% (see Table 2-2). In fact, this study found that despite the high cost of personal contacts, the cost per audit "sold" with personal marketing ($52) was considerably lower than the cost per audit sold by direct mail marketing ($170) [8].

D. IMPLEMENTATION OF AUDIT RECOMMENDATIONS

Six studies have examined the degree to which audit recommendations are implemented by customers. Due to differences between programs in the number and type of measures recommended, comparisons of implementation rates between programs should be approached with caution. Recommendation implementation rates vary from a low of 8% to a high of approximately 50% (see Table 2-1). The low implementation rate was achieved by a Bonneville Power Administration pilot program which provided little post-audit follow-up assistance and no incentives. Bonneville attributes the low implementation rates in large part to the lack of concerted follow-up and to the lack of financial incentives [9]. United Illuminating (UI) had the second lowest measure adoption rate. UI provides assistance arranging for measure installation, but at the time their measure adoption survey was done, UI did not help fund measure installation (incentives are being added to the program in 1990) [10]. The other four programs for which implementation rates

Table 2-2

Participation Rates for NYSEG Commercial Audit Pilot Study

Audit Cost	Marketing Method: Personal Contact	Marketing Method: Phone Prequalification Followed by Direct Mail	Combined
Free audit	65% (356)	17% (159)	50% (515)
Sliding scale fee	18% (317)	5% (172)	13% (489)
Sliding scale fee but rebated if implement recommendations	25% (327)	4% (143)	19% (470)
Combined	37% (1000)	9% (474)	28% (1474)

Notes:

Numbers in parentheses are number of customers who were solicited in each treatment group.

Data from Xenergy, Inc., 1989, Final Report Commercial Audit Pilot (Draft), prepared for New York State Electric & Gas Corp. (Burlington, MA: Xenergy), p. 4-8.

are available achieved implementation rates of 27-50%. All of these programs provide rebates for selected conservation measures, providing circumstantial evidence that financial incentives improve measure implementation rates.

Within particular programs, implementation of audit recommendations is generally highest for low- and no-cost measures such as changing set-points on HVAC equipment and installing basic lighting improvements such as reduced wattage lamps [11]. A detailed statistical analysis on the Bonneville Power Administration program determined that medium-sized customers (electricity use of 4,000-83,000 kWh/month) had the highest implementation rates. Implementation rates were also found to be positively correlated with the amount of time spent on the audit (controlling for the impact of customer size). This study also found considerable variation in implementation rates among the different audit contractors [12]. The evaluators conclude that one possible explanation for these implementation rate differences between firms is that some contractors are better at selling conservation measures than others [13].

While incentives often help to improve implementation rates for audit recommendations, not all incentive programs achieve this effect. For example, Atlantic City Electric, Detroit Edison, Jersey Central Power and Light, and Public Service Gas and Electric have all offered incentive programs to promote implementation of recommendations from small C&I energy audits (basic data on these programs is included in Table 10-1). These programs either provide rebates towards the cost of measure implementation (typically 50% rebates are provided) or low-interest loans. In all of these programs, less than 4% of audit recipients have taken advantage of the financing.

These programs illustrate the difficulties of achieving measure implementation among small C&I customers. Unlike larger customers who have full-time maintenance staff, small C&I customers typically lack the expertise and time to implement conservation improvements. Furthermore, many small C&I customers are renters who do not own their facilities and hence are reluctant to make capital investments in facilities they do not own. To address these problems, a few utilities have provided free installation of measures to small C&I customers. 1263XExample, Boston Edison, in 1989, began offering free installation of cost-effective measures identified in an energy audit. Free measures include lamps, air conditioning tune-up, air conditioning cycling, clock thermostat, and hot water and weatherization packages [14]. Similarly, Northeast Utilities began offering $100 of free materials in 1989 [15]. Cost-effectiveness data is not presently available for either of these programs, although both programs pass their company's cost-effectiveness tests. Additional information on special programs for small C&I customers can be found in Chapters 3 and 10.

In addition to questions about how to structure audit programs for small C&I customers, there is also a debate about how extensive to make audits for large C&I customers (peak demand of approximately 200 kW or more). On the one hand, large customers, with sophisticated energy systems, and full-time maintenance staffs, often do not find simple non-engineering audits especially useful [16]. On the other hand, engineering audits are time-consuming and expensive.

Southern California Edison offered detailed engineering audits to its large commercial customers for several years. They found that the audits were difficult to deliver in a timely manner and that the cost per audit was high. After two years they stopped offering engineering audits and instead substituted very comprehensive non-engineering audits. In addition, Southern California Edison offered to jointly fund engineering audits. Few customers took advantage of this offer [17].

The Bonneville Power Administration, as part of its Commercial Audit Program, conducted sophisticated computer simulations for large customers (annual use of a million kWh or more). They found that implementation of audit recommendations was lower than for less sophisticated audits conducted on smaller buildings. The evaluators attribute this lower implementation rate to the complexity of the buildings and the audit recommendations [18].

E. SAVINGS ACHIEVED

Seven studies have examined the reduction in electricity use actually achieved by audited customers in comparison to a control group of unaudited customers. These studies have found that participants reduce their kWh use by an average of 2-8% (see Table 2-1). The highest savings were achieved by the Sacramento Municipal Utility Districts' Large Commercial Audit Program. This program includes annual site visits to all participating customers to determine which measures have been installed and to counsel the customer on the impacts of already implemented measures and the potential impacts of measures that have yet to be implemented. Interestingly, this program had the highest participation rate of any program examined in our study, indicating that it is possible to achieve high participation and savings with the same audit program. The second highest savings were achieved by Pacific Gas and Electric Company [19]. Their program combines energy audits, follow-up visits 6, 18 and 42 months after the audit, and extensive rebates for implementation of audit recommendations.

Periodic site visits are also part of several other successful C&I energy audit programs, including those operated by Southern California Edison and Duke Power. These programs have reduced their company's peak electricity demand by more than 3% (all other audit programs surveyed had a cumulative impact of less than 1% of their company's peak demand -- see Table 2-1). The Southern California Edison program combines audits with rebates for measure implementation. During the 1980-1986 period this program (listed in Table 10-1) saved an estimated 1,134 MW [20] (7.7% of the company's 1987 peak electricity demand). This savings estimate includes free riders (estimated to be approximately 50% by the utility) [21]. The Duke Power program combines audits with periodic follow-up visits. Large customers are revisited quarterly, medium customers annually, and small customers are revisited on a time available basis. No financial incentives for measure implementation are paid. Over the past 10 years, Duke Power estimates that this program has saved 875 MW [22] (6.9% of the company's 1987 peak electricity demand). Again, free riders are included in the savings estimate.

F. PROGRAM COST-EFFECTIVENESS

Most C&I energy audit programs have low utility costs per kW or kWh saved. In all but one of the 14 programs for which both cost and savings information is available, utility costs are less than $300/kW saved and/or less than $0.002/kWh saved (see Table 2-1). Most of these costs are not adjusted to eliminate free riders (to find which programs do make a free rider adjustment, see the Appendix). Even allowing for free rider proportions of 50%, these low costs per kW or kWh are substantially lower than the avoided costs of New York utilities, indicating it is likely that C&I energy audit programs will be cost-effective for most utilities (based on the utility perspective).

The one program with high costs per unit of energy saved, the Small Commercial Audit Program operated by SMUD during the 1982-85 period, included extensive start-up costs. Also, in the early years of this program, extensive analyses were sometimes provided for small customers, resulting in high audit costs per kWh saved. Beginning in 1984, in an effort to reduce audit costs while achieving significant energy savings, SMUD developed a "limited audit" which focuses on lighting, hot water and other low- and no-cost measures most likely to be implemented by small C&I customers. These audits are provided to all customers with peak demand of less than 50 kW. They are also sometimes used for customers with peak demand between 50 and 200 kW. During the 1986-1988 period, costs for SMUD's Small Commercial Audit Program were lowered to an average of $250/kW saved and $0.014/kWh saved (see Table 2-1).

G. CONCLUSIONS

C&I energy audit programs can achieve participation rates of 60% or more if:

(1) Audits are provided free of charge, and

(2) The program is personally marketed, via phone and/or site visits, to all eligible customers.

These results have been achieved by both pilot programs and full-scale programs. Achieving high participation levels with full-scale programs for which large numbers of customers are eligible takes many years. For example, it has taken Southern California Edison nine years to reach 65% of its eligible customers.

Energy savings of 4-8% per participating customer can be achieved at a cost to the utility of approximately $0.01-0.02/kWh saved, making it likely this type of program will be cost-effective for nearly all utilities (from the utility perspective). Factors linked with high implementation of audit recommendations include:

* Periodic post-audit contacts to reinforce the value of measures already implemented and to encourage implementation of additional measures.

* Financial incentives to help pay for measure implementation (for small C&I customers, free installation of cost-effective measures may be justified).

* Auditors who are well-trained and audit and presentation procedures which show attention to quality.

In order to keep program costs for small C&I customers to cost-effective levels, streamlined audits emphasizing low- and no-cost measures should be used. However, even though streamlined audits are used, auditor training and quality control procedures should be maintained. A knowledgeable auditor and an audit presentation which looks like a professional job can help assure customers that the audit recommendations are solid and worth implementing. For large customers, available data suggests that detailed engineering audits may not be worth the expense unless customers are seriously interested in implementing audit recommendations.

H. ADDITIONAL READING

Much has been written about C&I energy audit programs. Among the more useful documents for program planners and implementers are the following:

Cambridge Systematics, 1988, Evaluation of the Commercial Audit Program (Portland, OR: Bonneville Power Administration).

Sacramento Municipal Utility District, 1986, "Large Commercial Load Management 1985 Annual Report" and "Small Commercial Load Management 1985 Annual Report" (Sacramento, CA: Sacramento Municipal Utility District).

Xenergy, 1989, Final Report Commercial Audit Pilot (Draft), prepared for New York State Electric & Gas Corp. (Burlington, MA: Xenergy).

I. NOTES

1. See Train, Kenneth and Patrice Ignelzi, 1986, "The Economic Value of Energy-Saving Investments by Commercial and Industrial Firms" (Berkeley, CA: Cambridge Systematics). Also, Cambridge Systematics, 1988, Evaluation of the Commercial Audit Program, Final Report (Portland, OR: Bonneville Power Administration).

2. Xenergy, Inc., 1989, Final Report Commercial Audit Pilot (Draft), prepared for N.Y. State Electric & Gas Corp. (Burlington, MA: Xenergy), pp. 1-1 to 1-2.

3. Sacramento Municipal Utility District, 1986, "Large Commercial Load Management 1985 Annual Report" and "Small Commercial Load Management 1985 Annual Report" (Sacramento, CA: Sacramento Municipal Utility District).

4. Southern California Edison, 1984, 1983 Conservation/Load Management Results (Rosemead, CA: Southern California Edison), pp. 3-4. Also, Pacific Gas and Electric Co., 1984, Report on 1983 Energy Management and Conservation Activities (San Francisco: Pacific Gas and Electric), p. 9.

5. Brush, Pertusiello and Waintroob, 1988, "The Effect of Free Energy Audits for Con Edison's Mid-Size Commercial and Industrial Customers," in Managing the Shape of Tomorrow, proceedings of the May 3-5, 1988 Symposium on Demand-Side Management Sponsored by New York's Seven Investor-Owned Electric Utilities.

6. See note # 2, p. 2-4.

7. Nadel, Steven, 1988, "Utility Commercial/Industrial Incentive Programs: A Comparative Evaluation of Three Different Approaches Used by the New England Electric System" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. 6.153-6.165.

8. See note #2, p. 4-6 to 4-10.

9. Personal communication with Andy Eckman, BPA, September, 1989.

10. Personal communicatiion with Robert Mills, United Illuminating, December, 1989.

11. See detailed program descriptions (in the Appendix of this report) for audit programs operated by the following utilities: BPA, Con Ed, LILCO, NYSEG and PG&E.

12. Cambridge Systematics, 1988, Evaluation of the Commercial Audit Program, Final Report (Portland, OR: Bonneville Power Administration), pp. 5-1 to 5-2.

13. George, Lee and Train 1988, "The Impact of the Auditor on Conservation Implementation: An Evaluation of BPA's Commercial Audit Program," in Proceedings of the 1987 Conference Energy Conservation Program Evaluation: Practical Methods, Useful Results, Volume 1 (Argonne, IL: Argonne National Laboratory), pp. 97-116.

14. Personal communication with Patricia McCarthy, Boston Edison, July, 1989.

15. Connecticut Light and Power Co., 1989, Conservation and Load Management Programs Annual Report (Hartford, CT: Northeast Utilities), p. 35.

16. New England Electric, 1988, Evaluation Report on Massachusetts Electric Company's Enterprise Plan, Executive Summary (Westboro, MA: New England Electric), p. 1.5.

17. Southern California Edison, 1983, Conservation and Load Management, 1982 Program Results (Rosemead, CA: Southern California Edison), pp. 5-6.

18. See note #12, p. 5-9.

19. In a 1983 study prepared by the California Energy Commission (Improving Energy Efficiency in the Commercial Sector), savings from PG&E's program were estimated to be 9-16%. However, these savings estimates include savings from measures that customers would have implemented anyway, even if they did not receive an audit. Southern California Edison, which operates a program nearly identical to PG&E's, estimates that if savings are adjusted to eliminate free riders, the savings will be reduced by 50% (Personal communication with Mr. Bob Murphy, Southern California Edison, June, 1989). Applying this 50% adjustment to the California Energy Commission's original 9-16% savings estimate yields net savings of 4.5-8%.

20. Southern California Edison, 1986 Energy Management Results (Rosemead, CA: Southern California Edison), p. 3-10.

21. Train, Kenneth and Judi Strebel, 1986, "Net Savings from the 1983 Audit and Hardware Rebate Programs for Commercial and Industrial Customers, Volume I: Summary" (Rosemead, CA: Southern California Edison), p. 5.

22. Duke Power, 1989, Conservation and Load Management (Charlotte, NC: Duke Power), p. 35. Also, personal communication with Ken Hatley, Duke Power, August, 1989.

Chapter 3

LIGHTING PROGRAMS

A. INTRODUCTION

Lighting accounts for approximately 37% of U.S. commercial sector electricity use [1] and approximately 5-11% of industrial electricity use [2]. In New York State, lighting accounts for an estimated 33% of commercial sector electricity use and 7% of industrial sector electricity use [3]. Large, cost-effective reductions in lighting energy use are possible. Xenergy, in a study on lighting in C&I buildings in Rhode Island, estimated that there is a technical potential to reduce C&I lighting energy use by 42% [4]. ACEEE, in its recent study on "The Potential for Electricity Conservation in New York State" concluded that from a consumer perspective (i.e. based on consumer electricity prices, measure costs, and discount rates), cost-effective efficiency measures can reduce electricity used in the commercial sector for lighting by 72% and in the industrial sector by 37% [5].

For this study on utility experience with C&I C&LM programs, a total of 46 lighting programs were examined. Included in this figure are several comprehensive, multiple end-use programs for which breakdowns of results by end-use were available. A number of other multiple end-use programs address lighting and are described in Chapter 10. Also, many of the new construction programs discussed in Chapter 8 address lighting improvements. Summary information on each of the lighting programs is contained in Table 3-1. More detailed information on each program can be found in the Appendix.

B. PROGRAM TYPES

Utility lighting programs fall into three general categories: information-only programs, rebate programs, and direct installation programs.

Table 3-1
Summary of Lighting Program Results

Utility	Program	Program Type	Time Period Start	Time Period End	Pilot or Full-Scale	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects	Estimated Savings Coin. MW	Estimated Savings Absolt. MW	Estimated Savings GWh /yr	1987 Peak Demand	Svgs as % of Pk	Coincident or Total	Expenses (1000 $) Direct	Expenses (1000 $) Total	Util. Cost $/kW	Direct or Total?	Avg. Measure Life	Utility Cost $/kWh
Atlantic El.	Save-A-Watt Rebates	Rebate	1987	12/88	Full	48,331	224		0.5%	C		1.42	7.09	1,609	0.09%	A		$276	$194	T	10	$0.005
BECo	Efficient Lighting	Rebate	10/86	12/88	Full	78,020	234		0.3%	C	2.84		8.89	2,477	0.11%	C	$284	$698	$246	T	10	$0.010
BECo	Custom Lighting	Rebate	10/88	12/88	Full	78,020	8		0.0%	C	0.30		1.90	2,477	0.01%	C		$290	$982	T	15	$0.015
BECo	Lite Lights	Rebate	8/87	12/88	Full	78,020	123		0.2%	C	0.73		0.62	2,477	0.03%	C		$299	$412	T	5	$0.108
CMP	Lighting Rebate	Rebate	1986	12/88	Full	43,686	433	995	1.0%	C			31.16	1,455				$1,275			10	$0.005
Eastern Utl	Efficient Ltg Rebate	Rebate	11/87	12/88	Full	26,681	85		0.3%	C	0.37		1.29	713	0.05%	C		$98	$264	T	10	$0.010
Florida P&L	Lighting Incentive	Rebate	7/84	12/88	Full	324,915	2,258		0.7%	C	5.20		33.60	12,394	0.04%	C		$2,326	$447	T	5	$0.016
Gainesville	Comm'l Ltg Service	Install	10/86	12/88	Full	5,983	85		1.4%	C	0.31		0.98	270	0.12%	C	$46	$75	$242	T	5	$0.017
Jersey Cen.	Lighting Rebate	Rebate	7/82	12/88	Full	87,534						4.33		3,766	0.11%	A	$2,164		$500	D	10	
LA Dept W&P	Ltg Effic. Cash Rebates	Rebate	5/87	12/88	Full	182,907			~1%	C		5.81	21.20	4,922	0.12%	A		$1,635	$281	T	10	$0.010
LILCO	Dollars and Sense	Rebate	10/86	9/88	Full	95,871		585	0.6%	P	8.10		55.24	3,576	0.23%	C	$1,245		$154	D	10	$0.004
Madison.G&E	Comm'l Lighting	Rebate	12/87	11/88	Full	13,973	255		1.8%	C	2.37			477	0.50%	C	$415	$442	$186	T	10	
Met-Ed/GPU	High Efficiency Lighting	Rebate	1/87	12/88	Full	43,959	75 in '88		.2% in '88	C		2.76	7.84	1,673	0.16%	A		$275	$100	T	10	$0.004
NEES	RI Small C&I	Install	2/89	6/89	Full	~20000	372		1.9%	C	0.50	0.62	1.82	703	0.07%	C			~$200	T	5	$0.012
NEES	C&I Lighting Rebate	Rebate	7/87	12/88	Full	122,307	~4000	6,288	3.3%	C	15.08		59.20	3,798	0.40%	C	$6,333	$8,628	$572	T	10	$0.019
Nevada Pwr	High Efficiency Ltg	Rebate	1986	7/89	Full	32,927		355	1.1%	P		6.52		1,740	0.37%	A	$572		$88	D	10	
NSP	C&I Ltg Conservation	Rebate	1/86	12/87	Full	111,751		2,746	2.5%	P	10.82	12.02	52.28	5,543	0.20%	C	$1,487	$2,018	$186	T	10	$0.005
NU	Energy Saver Ltg Rebate	Rebate	1/88	12/88	Full	99,254	1,050	1,528	1.1%	C	8.97	9.76	42.85	4,242	0.21%	C	$1,094	$1,563	$174	T	10	$0.005
Or. & Rock.	Switching to Savings	Rebate			Full	20,902								892							10	
Or. & Rock.	C&I Efficient Ltg Info	Info	1987	1987	Full	18,000	120 responses		0.7%	C				892			$0	$28			10	
Palo Alto	Partners Elec. Incentive	Rebate	1985	7/89	Full	2,409		271	11.2%	P		2.85	10.93	182	1.56%	A	$505		$177	D	10	$0.008
PG&E	Lighting Conversion	Rebate	1983	1983	Full	~25,000		2,145	8.6%	P				14,142			$1,368				10	
Puget P&L	Comm'l Conserv. Financ'g	Rebate	1980	12/88	Full	69,236		588	0.8%	P			61.80	3,528			$9,576	$12,209			10	$0.025
Puget P&L	Outdoor Ltg Systems	Rebate	1/80	12/88	Full	69,236		1,850	2.7%	P			64.65	3,528			$11,798				15	$0.024
RISE	C&I Conservation	Install	2/89	6/89	Full	11,847	381		3.2%	C		1.26		~1050	0.12%	A		$350	$278	T	5	
Salt R Proj	Lighting Incentive	Rebate	6/88	2/89	Full	38,760		25	0.1%	P		0.31		2,785	0.01%	A					10	
Seattle C.L	Lighting Survey	Info	1979	12/83	Full		111						5.64	1,725				$30			5	$0.001
Sierra Pacf	Comprehensive Ltg Effic.	Rebate	4/87	12/88	Full	29,502		116	0.4%	P		2.00		813	0.25%	A	$142	$513	$257	T	10	
SMUD	Comm'l Lamp Installation	Install	7/86	12/88	Full	20,000	7,339		36.7%	C		2.24	6.88	1,902	0.12%	A	~$320	~$850	$379	T	5	$0.028
Snohomish	Comm'l Energy Effic. Ltg	Install	4/88	12/88	Full	15,759	729		4.6%	C			0.21	1,156							5	
So. Cal. Ed	Lighten Your En. Overhd.	Rebate	10/86	2/87	Full	233,000	888		0.4%	C		1.06	3.90	14,775	0.01%	A	$169		$159	D	5	$0.013

Table 3-1
Summary of Lighting Program Results

Utility	Program	Program Type	Time Period Start	Time Period End	Pilot or Full-Scale	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects	Estimated Savings Coin. MW	Estimated Savings Absolt. MW	Estimated Savings GWh /yr	1987 Peak Demand	Svgs as % of Pk	Coincident or Total	Expenses (1000 $) Direct	Expenses (1000 $) Total	Util. Cost $/kW	Direct or Total?	Avg. Measure Life	Utility Cost $/kWh
So. Cal. Ed	Hardware Rebate	Rebate	1/82	12/84	Full	393,754						35.98	200.7	14,775	0.24%	A	$3,842		$107	D	10	$0.003
Texas Util.	Efficient Lighting	Rebate	1983	1988	Full	242,647		6,185	2.5%	P	171.89			16,680	1.03%	C					10	
Wisc. Elec.	Smart Money	Rebate	6/87	3/89	Full	81,750	3,299	6,577	4.0%	C		46.39	222.8	3,810	1.22%	A	$25,555		$551	D	10	$0.020
Austin	Sm. Comm'l Relamping	Install	1987	1988	Pilot		121				0.16		0.41	1,391	0.01%	C	$49		$316	D	5	$0.037
Bangr Hydro	Comm'l Ltg Efficiency	Rebate	3/86	6/89	Pilot	10,383	~200	310	1.9%	C		0.92	4.25	262	0.35%	A	$182		$197	D	10	$0.007
Clark PUD	Industrial Ltg Incentive	Install	11/85	1/88	Pilot	207	24		11.6%	C		0.75	3.24	649	0.12%	A	$691	$900	$1,197	T	15	$0.027
Comm Ed	Sm. C&I Ltg Audit/Grant	Rebate	4/87	1988	Pilot	500	19		3.8%	C				15,683							5	
Con Ed	Free C&I Ltg Audits	Rebate	1987	12/88	Pilot		135							9,386							5	
NEES	Enterprise Zone - Sm C&I	Install	8/85	12/86	Pilot	2,263	775		34.2%	C	1.89		5.94	2,502	0.08%	C	$1,500	$2,200	$1,166	T	10	$0.048
NEES	Narragansett Ltg Rebate	Rebate	7/86	6/87	Pilot	18,000	431		2.4%	C	1.20		5.40	703	0.17%	C		$400	$333	T	10	$0.009
NiMo	Expermnt on Low-Cost Ltg	Multiple	1988	1988	Pilot									5,403							10	
NiMo	Fluor. Ltg Reb. Expermnt	Multiple	1988	1989	Pilot	4,094	154		3.8%	C				5,403							5	
Rochestr G&E	Comm'l Ltg Pilot	Rebate	3/89	7/89	Pilot	30	6		20.0%	C				1,205							5	
Seattle C.L	Lighting Incentive	Rebate	12/80	10/83	Pilot		358						12.21	1,725				$439			5	$0.008
SMUD	Lighting Incentive	Rebate	6/84	12/84	Pilot	1,421	101		7.1%	C		0.50		1,902	0.03%	A	$39	$148	$294	T	5	

Notes:

Measure life is a conservative ACEEE estimate. See Chapter 1 for description of methodology employed.
Methodology for calculating $/kWh discussed in Chapter 1.

Information programs typically involve mailing an educational brochure to customers which espouses the benefits of efficient lighting. For example, Niagara Mohawk conducted an experimental program in which targeted customers were mailed a brochure describing the benefits and economics of using reduced-wattage fluorescent lamps (e.g. substituting "energy-saving" 34 Watt lamps for standard 40 Watt lamps). Another type of information-only program is lighting audits. For example, Seattle City Light operated a program which provided a free walk-through lighting survey to C&I customers.

Rebate programs are the most common type of utility lighting program -- over 70% of the lighting programs evaluated for this study are rebate programs. In a typical rebate program, targeted customers are mailed a brochure listing eligible measures and rebate amounts. For example, rebates of $.50/lamp might be offered for reduced-wattage fluorescent lamps. A few utilities offer rebates based on energy savings instead of specific measures. For example, a rebate of $100/kW saved might be offered. For a project that replaced a 40 Watt lamp with a 34 Watt lamp, the rebate will be $0.60 (0.06 kW * $100/kW). The rebates offered typically cover 20-50% of the cost of qualifying measures.

Many programs only offer rebates for reduced-wattage fluorescent lamps (so called "energy-saver" lamps). Other products commonly covered by rebates are efficient fluorescent ballasts (primarily magnetic ballasts), compact fluorescent lamps, and high-intensity discharge lamps. A few utilities offer rebates for other products, such as reflectors, electronic ballasts, and lighting controls. These latter measures are not widely used at present, and offer the potential for dramatic energy savings (see Table 3-2).

Most rebate programs are promoted primarily through direct mail offers. Many utilities also try to encourage participation through personal contacts with lighting dealers and with large customers. Some utilities require an inspection before a customer can request a rebate. The purpose of the inspection is to reduce free riders

Table 3-2

Savings Potential and Cost Effectiveness of Energy-Efficient Lighting Technologies

Technology	Savings potential (a) (%)	Savings potential (a) (kWh/yr)	Unit cost (b) ($)	Simple payback (c) (yrs)
Compact fluorescent replacing incandescent	60-75	125-200	12-20	0.8-2.3
Energy-saving fluorescent lamp (d)	10-15	17-21	0.6-1.2	0.4-1.0
T-8 lamp and ballast (e)	20-25	70-90	7-13	1.1-2.6
High-efficiency magnetic ballast (e)	10	30-40	4-6	1.4-2.8
Electronic ballast (e)	20-25	70-90	15-30	2.3-4.7
Optical reflector (f)	30-50	150-300	35-60	1.6-5.6
Daylighting controls (g)	25-50	2.2-4.4	0.5-1.5	1.6-9.6
Occupancy sensors (g)	20-50	1.7-4.4	0.3-0.6	1.0-5.0

Notes:

(a) Lighting electricity savings assuming lights in a commercial building are used 3500 hours/yr.
(b) Cost includes installation for add-on retrofit measures. In cases, where a high-efficiency product replaces a standard product, the incremental equipment cost is given.
(c) Based on the 1986 national average commercial sector electricity price of $0.071/kWh.
(d) Based on a 48" fluorescent tube, the most common type.
(e) Based on a ballast that operates two 48" fluorescent lamps, the most common circuit design.
(f) Based on removal of one or two 48" lamps from a fixture originally containing three or four lamps.
(g) The electricity savings potential and unit cost values are provided per square foot of floor area, assuming installation in a large office building.

Source: American Council for an Energy-Efficient Economy based on information obtained from research reports, lighting equipment manufacturers and lighting distributors.

by limiting rebates to customers who are not yet using eligible products. Most utilities pay the rebate directly to the customer, although a few utilities have experimented with paying rebates to lighting dealers.

Direct installation programs pay all or most of the cost of lighting equipment purchase and installation. The most common type of direct installation program combines a lighting audit with utility purchase and installation of reduced-wattage fluorescent and compact fluorescent lamps. These programs are most commonly directed at small C&I customers. Most programs concentrate on fluorescent lamps, although one program also included high-efficiency fluorescent ballasts and high-intensity discharge fixtures. Variations on the direct installation type program include programs operated by Clarke County, Oregon and Gainesville, Florida. In the Clarke County program, lighting sales representatives performed audits, lighting contractors installed the equipment, and the utility paid most of the cost of the installation [6]. In Gainesville, the utility provides the audit, materials and installation, but the customer pays for the work, over a period of years, through a special charge on his or her electric bill [7].

C. PARTICIPATION

Customer response to utility lighting programs has varied widely, from programs with no participants to programs in which over 30% of the targeted customers install lighting retrofits (see Table 3-1). Participation rates vary according to the program type, the quality and intensity of the promotion effort, and a variety of other factors.

Information Programs

Information programs appear to have the lowest participation rates (3% or less of targeted customers purchase efficient lighting products), although this finding should be treated with caution since only limited participation data on information-only programs is available. For example, Orange and Rockland mailed an informational brochure on lighting efficiency improvements to 18,000 customers. Less than 1% responded by sending in a tear-out card to request additional information [8]. Orange and Rockland has since replaced this program with a rebate program.

Niagara Mohawk conducted an experiment in which a group of customers was mailed informational brochures and another group was mailed an identical brochure that also contained a rebate offer. Special efforts were made to target the lighting decision-maker at each firm. All customers were mailed three copies of the brochure. In a survey conducted at the end of the six-month experiment, 3% of the information-only group reported that they had switched to high-efficiency fluorescent lamps in the last six months, while 5.6% of customers receiving the rebate offer reported the same switch [9].

Rebate Programs

Rebate programs generally have medium to low participation rates. Participation rates vary from less than one percent to approximately 20%. Among the programs included in our study, the average participation rate is approximately 3%.

The highest participation rates have been achieved in small, experimental studies in which extensive personal marketing efforts were employed. For example, Niagara Mohawk, as part of the experimental study discussed above, offered identical rebates to two groups of customers -- one which received the offer through the mail (specially targeted to the lighting decision-maker) and one which received the offer during a visit from a utility representative. Response of the in-person solicitation group (21% of targeted customers) was substantially higher than response of the mail solicitation group (approximately 3%), although part of this difference is due to the fact that the in-person group was more likely than the mail group to use efficient lamps before the program [10]. Early results from a Rochester Gas and Electric experimental study are similar. Of 30 customers who received a free lighting audit and were offered a rebate, 20% applied for the rebate [11].

Full-scale lighting rebate programs have had participation levels up to approximately 10% of eligible customers, although most programs have had participation levels of less than 3%. Participation levels among large customers may approach 20% in the most successful programs.

The City of Palo Alto and Pacific Gas and Electric (PG&E) have achieved participation rates approaching 12% and 9% respectively for the lighting components of their comprehensive, multiple end-use rebate programs. Both of these participation rates are based on the number of rebates paid, and not the number of different customers receiving rebates (one customer can receive more than one rebate). Thus, the actual participation rate is probably somewhat lower than the figures noted above.

The PG&E program is particularly notable because these results, which apply to customers using over 100 MWh/year, were achieved in only one year. In subsequent years lighting measures were combined with other measures and end-use breakdowns are not available. Overall, from 1983 to 1986, the multiple end-use PG&E program had a participation rate of approximately 7%, including approximately 40% for customers with peak demands in excess of 50 kW. These figures are based on rebates granted and have not been adjusted to eliminate customers who applied for more than one rebate. Approximately half the rebates were for lighting measures [12]. After adjusting to eliminate multi-rebate recipients and non-lighting rebates, we estimate that the PG&E program, over a period of four years, funded lighting improvements for approximately 5% of small customers and 12-21% of large customers [13]. Beginning in 1987, rebate levels were reduced, marketing efforts scaled-back, and annual participation levels fell by approximately 50% [14].

The Palo Alto program, which has been in operation for 4 1/2 years, has also been more successful among large customers than small customers. Approximately 75% of the rebates have gone to large customers (peak demand of 200 kW or more), despite the fact that eligible small customers outnumber eligible large customers by more than a factor of five to one [15]. Among large customers, the participation rate is probably in the neighborhood of 12-21% for the lighting components of their program [16].

Both the Palo Alto and PG&E programs have emphasized extensive marketing of the rebate programs with a particular emphasis on developing a personal relationship with customers, especially large customers. Both have assigned representatives to work on a regular basis with individual customers. In addition, both have operated a successful energy audit program (see Chapter 2) which they use to promote rebates. Other marketing methods employed by both utilities include mailings to all eligible customers and extensive outreach to lighting dealers to enlist their support for the program. Both programs offer rebates for a wide variety of lighting measures including lamps, ballasts, fixture conversions, reflectors and lighting controls. Both feature simple, easy-to-understand applications.

The Palo Alto lighting program has resulted in peak demand savings totaling approximately 1.5% of the entire utility's peak demand (see Table 3-1). Peak demand data on PG&E's program is not available. Other utilities whose lighting programs have reduced peak demand by approximately 1% are Wisconsin Electric and Texas Utilities.

Wisconsin Electric operates a comprehensive multiple end-use rebate program similar to those operated by Palo Alto and PG&E. Begun in 1987, this program has achieved a participation rate of 4% in less than two years. In addition to using many of the marketing approaches employed by the California utilities, Wisconsin Electric, in the spring of 1989, began distributing simplified rebate applications through lighting dealers. These simplified applications require no pre-inspection. The intent of this effort is to encourage lighting dealers to promote rebates when customers come in to purchase equipment. In the first five months of the program, over 1,000 lighting rebates were granted. This represents over 1% of eligible customers, and likely a higher proportion of customers who purchased lamps (efficient or inefficient) during this period [17].

Detailed participation information is not available on the Texas Utilities program. The marketing of this program emphasizes regular personal contacts with customers and lighting dealers. Savings from this program include a considerable number of free riders because the utility includes savings achieved by customers who install lighting improvements without utility involvement. In 1987 Texas Utilities phased out its rebates (although not its information efforts) because most customers were purchasing qualifying products (reduced wattage fluorescent lamps), leading the utility to decide that rebates were no longer needed [18].

Another rebate program with above-average participation that is worth noting is the New England Electric System (NEES) C&I Lighting Rebate Program. This program is unique in that rebates are paid directly to lighting dealers instead of customers. By paying rebates to dealers, the utility reasons, dealers will have a strong incentive to promote the program. Another interesting feature of the program is that rebate levels are higher than many other utility programs. For example, in 1988, rebates for compact fluorescent lamps and high-intensity discharge (HID) fixtures were $300/kW saved. These rebates were high enough for lighting dealers to give free compact fluorescent bulbs to customers (and still make a profit) and to pay over 50% of the cost of many HID conversions. As a result of these high rebates, many dealers hired extra staff just to promote the NEES program. In less than two years the program has reached 3.3% of eligible customers and has reduced the utility's peak demand by 0.4%. Over half of the savings achieved are a result of installations of compact fluorescent lamps. In 1989 the rebates for compact fluorescents were scaled-back slightly and rebates for HID fixture conversions were increased to $400/kW [19].

Results have been more limited with energy-saving lamps and ballasts. In 1987-1988, rebate levels for these products were only sufficient to pay the incremental cost of efficient products compared to standard products. The incentive only induced a limited number of lighting dealers to devote special efforts towards promoting these products. Furthermore, since the program did not require pre-inspections for products which already had substantial market penetration, an estimated 65% of program participants were free riders (based on customer and dealer surveys), primarily customers who have previously used efficient lamps and ballasts and needed to replace their worn-out equipment.

In 1989, in order to reduce free riders and increase the number participants, NEES required pre-inspections for all projects and increased the rebate levels. In order to increase installation of multiple measures in the same fixture and increase use of advanced lighting products such as reflectors and electronic ballasts, NEES began paying rebates for packages of measures, with higher rebates for packages which include electronic ballasts. Preliminary data for 1989 indicate that reflector/lamp/ballast rebates alone account for approximately 10 MW of coincident peak savings (over 0.2% of the utilities peak demand) [20].

In 1990, NEES is modifying its lighting rebate program yet again. Lighting rebates are being merged with a multiple end-use customer rebate program. In order to sustain dealer interest in the program, even though rebates will be paid to customers, rebates are being increased to $600/kW saved. Also, procedures have been set up to allow customers to assign their rebate checks to dealers or other third parties [21].

A final program that is worth mentioning is the Energy Saver program operated by Northeast Utilities. This program has had only moderate participation (1.1% in their best year) but incorporates a number of interesting features. First, the program provides modest incentives for dealers. These incentives are in the form of points that dealers can redeem for gifts. Preliminary results from an evaluation of the dealer incentives indicates that the incentives increased dealer interest and satisfaction with the program, but that the incentives had only a limited impact on participation [22]. Second, the program has recently been revised to emphasize measures with very high efficiency. Rebates for standard reduced wattage fluorescent lamps and ballasts (e.g., 34 Watt four-foot tubes and energy-saving magnetic ballasts) are no longer available since these provide only modest savings and already had substantial market penetration in the NU service territory. Rebates now emphasize electronic ballasts and T-8 lamps (the highest efficiency fluorescent lamp presently on the market) [23].

From the preceding discussion, it appears that the factor most heavily linked with high participation rates is developing a regular, personal relationship with the customer. Also important are a program design which customers can understand, a good working relationship with lighting dealers, and a comprehensive program which promotes a variety of lighting improvements.

The impact of rebate levels on participation is not entirely clear. The results of the NEES program discussed above indicate that high rebate levels improve program participation. This conclusion is supported by the findings of an experimental study conducted by the Sacramento Municipal Utility District (SMUD). In this study, SMUD offered 40% rebates on reduced-wattage lamps (approximately $1/lamp) to one group of small C&I customers and 60% rebates (approximately $1.50/lamp) to another group. Participation rates were 7% for the high rebate group and 4% for the low rebate group.

This difference was not tested for statistical significance [24]. On the other hand, a study conducted by Niagara Mohawk indicates that low rebate levels do not hurt participation rates. In the Niagara Mohawk study, one group was offered $0.40 rebates on reduced-wattage lamps and a second group was offered $0.80 rebates. Participation was 2.6% with the low rebate and 3.2% with the high rebate. This difference was not statistically significant [25].

Direct Installation Programs

Direct installation programs generally have the highest participation rates. Of the eight direct installation programs examined for this study, participation rates ranged from a low of 1.4% to more than 30% (see Table 3-1). The average participation rate was approximately 13%.

The two lighting programs with the highest participation rates are programs operated by SMUD and NEES. The SMUD Commercial Lamp Installation Program (CLIP) reached 37% of all eligible customers. When minimal-use customers (e.g. billboards, water pumps) are factored out, the participation rate climbs to approximately 55%. The participation rate could have been higher, but the program was terminated due to utility-wide budget cutbacks and increasing marketing costs per customer served. SMUD estimates that if the program had continued, a participation rate of 68-70% could have been achieved (excluding minimal-use customers). This program provided up to 100 free reduced-wattage fluorescent lamps to small C&I customers (peak demand less than 50 kW). Customers received free lamps and installation. In the last year of the program, up to 50 energy-saving incandescent or compact fluorescent lamps were installed in customer facilities. Marketing emphasized door-to-door solicitations by energy auditors who determined eligibility and prepared work-orders [26].

The NEES Enterprise Zone Small C&I Program was a pilot program which provided free energy audits to 60% of eligible customers, and free lighting installations to 34% of eligible customers. Most of the customers who received audits but did not receive installations did not have sufficient operating hours (approximately 45-50 hours per week) to meet the program's cost-effectiveness test. As with the SMUD program, the NEES program was terminated before all eligible customers could be reached (the program was terminiated because staff were needed to start other full-scale programs). The NEES program provided free equipment and installation for the following measures: reduced wattage fluorescent lamps, high efficiency fluorescent ballasts, compact fluorescent lamps, and HID fixture conversions. Marketing emphasized telemarketing and door-to-door canvassing. In addition, the program included extensive publicity and mailings in the targeted communities. Program managers strived to reach all eligible customers at least four times. Market research showed them that four contacts were typically needed for customers to feel enough comfort about the program that they would agree to participate. In 1990 NEES plans to offer a full-scale version of this program. Under the full-scale version, product offerings will be expanded to include reflectors, electronic ballasts and occupancy sensors [27].

Direct installation programs have also been offered by the City of Austin, the Clarke Public Utility District, the City of Gainesville, Rhode Islanders Saving Energy and the Snohomish Public Utility District. These programs are all either pilot programs and/or they are still in the start-up phase, and hence participation rates have been lower than the SMUD and NEES programs, although better than most rebate programs (see Table 3-1).

The Austin and Clarke programs both provide important evidence that even with direct installation, personal marketing is necessary. In Austin, program participants were solicited by mail and in person. Participation rates for the mail group were 4% and for the in-person solicitation group approximately 50% [28]. The Clark program also used both mail and personal solicitation. Personal solicitation accounted for 75% of program participants, mail solicitation for only 25% of program participants [29].

The moderate participation rates in some of these programs raises the question of why some pilot programs have high participation rates (e.g. the NEES Enterprize Zone program) and others have lower participation rates? From our analysis of the programs in question, it appears that participation rates for pilot programs vary with the intensity of the marketing effort and the number of customers that are targeted. High participation programs tend to target a limited number of customers and to heavily market these customers. Lower participation programs tend to target a larger number of customers and/or to limit the amount of marketing done (in order to limit the workload to manageable levels and/or to allow time to work bugs out of the program).

D. FREE RIDERS

Free riders can be a significant factor in C&I lighting program design and cost-effectiveness. Of the lighting programs examined for this project, eight report estimates of free rider percentages. These are summarized in Table 3-3. All of these estimates are based on self-reports by rebate recipients. In addition, a few of the estimates are based in part on reports by dealers and/or regional sales information for covered products. Free rider estimates based on self-reports by rebate recipients should be used with caution, as the results depend on how respondents are questioned, are based on imperfect respondent recall, and can be biased by respondents who try to give the "correct" answer instead of the "true" answer [30].

To illustrate the problems with free rider estimates, let us look at NEES's evaluation of the Narragansett Lighting Rebate Program. For this evaluation, two lines of questioning were used in customer surveys. First, customers were asked how much influence the rebate had on their purchase decision. In response to this question, 6% of the participants reported the rebate was of no influence in

Table 3-3

Free Rider Percentages for Selected C&I Lighting Programs

Utility	Program	Predominant Measures	Percent of Participants Who are Free Riders*
Bangor Hydro	Commercial Lighting Efficiency	Fluorescent lamps including compact fluorescents	43-85%
Central Maine Power	Lighting Rebate	Fluorescent lamps	45%
New England Electric	Enterprise Zone Small C&I	Fluorescent lamps & ballasts, compact fluorescent lamps	12%
New England Electric	Narragansett Lighting Rebate	Fluorescent lamps & compact fluorescents	6-23%
New England Electric	C&I Lighting Rebate	Fluorescent lamps Fluorescent ballasts Compact fluorescents HID retrofits Reflectors	65% 20% 5% 10% 17%
Northern States Power	C&I Lighting Conservation	Fluorescent lamps & ballasts	30%
Pacific Gas & Electric	Lighting Conversion	Fluorescent lamps	63%
Wisconsin Electric	Smart Money	Fluorescent ballasts & HID fixture conversions	30-50%

* With the exception of the NEES C&I Lighting Rebate Program, all figures are program averages for all measures receiving rebates. Free rider figures for individual measures are likely to vary from the overall average. Also, all free rider estimates for fluorescent lamps and ballasts are for programs which promote reduced-wattage, "energy-saving" lamps and efficient magnetic ballasts. To our knowledge, free rider estimates for advanced lamps and ballasts (e.g. electronic ballasts and T-8 lamps) have not been compiled.

Sources: Utility evaluation reports as summarized in the Appendix.

their decision to install energy-efficient lighting equipment, while an additional 17% reported the rebate was "somewhat influential." The remaining 77% reported the rebate was "very influential." Second, customers were asked if they would have purchased the same equipment if the rebate was not available. The majority of respondents (72%) said they would have purchased the equipment anyway. Paradoxically, of the 72% who said they would have purchased the same equipment without the rebate, 62% said the rebate was very influential in their purchase decision! Based on the first question, free riders are estimated at 6-23%; based on the second question, free riders are 72%. Based on this survey, and on other market research it had conducted, the utility elected to rely on the first estimate, concluding that the second estimate was biased by good intentions (e.g. "I had planned to buy efficient lamps someday") and by respondents reluctant to admit that their decision was motivated by a cash rebate [31].

Despite the limitations to free rider estimates, a number of interesting trends and findings emerge from this data:

(1). Measures which presently do not have high market saturations (e.g. reflectors and compact fluorescent lamps) appear to have a low percentage of free riders (less than 20%). Similar results can be expected for other measures which are not widely used at present such as T-8 lamps, occupancy sensors and daylight dimming systems.

(2). The one direct installation program in our sample had a low percentage of free riders (12%).

(3). Rebate programs which emphasize use of reduced wattage fluorescent lamps generally have a high free rider proportion (45% or greater). This is not surprising since these lamps account for approximately 30-33% of fluorescent lamp sales in the U.S. [32] Most of these programs do not require a pre-inspection to verify that customers are not presently using reduced wattage lamps. The one program which does require a pre-inspection reports that only 6-23% of participants were free riders.

(4). Ballast rebate programs appear to vary in free rider proportion from a low of 20% to a high of 30-50%. Nearly all of the free riders for these programs are customers purchasing energy-efficient magnetic ballasts [33]. In January, 1990, a new Federal ballast efficiency law went into effect which mandates that most ballasts sold be at least as efficient as energy-efficient magnetic ballasts. As a result, utilities are generally no longer providing rebates for energy-efficient magnetic ballasts and are instead offering rebates for very high efficiency hybrid and electronic ballasts. Since these very high efficiency products currently have a very low market share, low free rider shares can be expected in the future.

(5). Free rider estimates for HID fixture conversions vary from 10% to 30-50%. The low free rider estimate is for a program which pays a very high rebate for HID conversions. This rebate is so high that lighting dealers are actively soliciting customers for the program, including providing free lighting analyses and designs [34]. The high free rider estimate is for a program with a relatively low rebate for HID conversions.

E. SAVINGS ACHIEVED

While many utilities track the cumulative savings achieved by lighting programs, to our knowledge only three (NEES, Austin and the Clark Public Utility District) have examined the savings achieved as a percentage of the pre-program electricity use or peak load of participating customers. This information is useful because it indicates the depth of the savings being achieved (i.e., are participants implementing a limited number of improvements or are they undertaking comprehensive lighting retrofits?).

NEES has examined the energy savings from its direct installation program for small C&I customers and from a pilot customer rebate program it offered for a one-year period. Savings from the direct installation program averaged 9-13% of participating customer pre-program electricity use while savings for the customer rebate program averaged 2.6% [35]. Since NEES estimates that approximately 40% of customer electricity use is for lighting, savings from the direct installation program amount to approximately 22-32% of lighting energy use while savings from the rebate program are approximately 6-7% of lighting energy use. As was discussed above, the direct installation program included multiple measures installed throughout customer facilities. The program did not include use of reflectors, T-8 lamps, electronic ballasts, or lighting controls. Thus, additional lighting savings are possible beyond those achieved in this program. The NEES customer rebate program only applied to lamp replacements. While some customers replaced lamps throughout their facility, many customers replaced only some lamps (a cap on the total rebate per customer limited whole building replacements) [36].

The City of Austin estimates that its Small Commercial Relamping Program reduced customer lighting use by 15-20%. This program was a direct installation program which replaced all lamps in a facility for which reduced wattage fluorescent lamps or compact fluorescent lamps were appropriate [37].

Clark County examined changes in lighting load among participants in an industrial lighting incentive program. The program involved HID fixture conversions in which the utility, working with contractors, arranged measure installation and paid for nearly 90% of the project costs. Among program participants, an average lighting load reduction of 50% was achieved [38].

While data on the percentage energy savings achieved by other programs is not available, some indirect inferences can be drawn. Most rebate programs encourage only lamp replacements. Hence savings similar to the NEES pilot lighting rebate program can be expected (2-3% of total electricity use and 6-7% of lighting use). Programs that provide incentives for additional measures such as ballast and fixture replacements, reflectors, lighting controls, etc., will likely achieve higher savings. Most direct installation programs involve only lamp replacements, hence savings similar to those achieved by Austin (15-20% of lighting energy use) and lower than those achieved by the NEES direct installation program (9-13% of total electricity use and 20-35% of lighting energy use) can be expected from currently operating programs. As programs start including more measures than included in the NEES program, higher savings are likely (NEES for example is now planning a program that would include reflectors, electronic ballasts, T-8 lamps and occupancy sensors).

F. PROGRAM COST-EFFECTIVENESS

Most C&I lighting programs have low costs to the utility per kW and kWh saved (see Table 3-1). Most programs cost the utility approximately $100-600/kW saved (median of $260) and approximately $0.005-0.03/kWh saved (median of $0.013). Most of these figures are not adjusted for the influence of free riders (see the Appendix to see which programs adjust savings estimates to exclude free riders). All programs examined cost the utility less than $1,200/kW saved, and with one exception, less than $0.05/kwh (the one exception is a program in the start-up phase with high start-up costs and low participation thus far).

In general, direct installation programs cost the utility more per unit of electricity saved than rebate programs. This is the price for the higher participation rates and higher savings achieved by direct installation programs. On the other hand, because the utility generally pays all the costs in a direct installation program, for these programs the cost to the utility is generally the same as the total resource cost.

Direct installation programs range in cost from $200-1,197/kW saved and from $0.012-0.048/kWh saved. The highest costs are for programs which offer comprehensive, multi-measure retrofits while the lower costs are for programs which only finance lamp replacements.

While comprehensive direct installation programs have relatively high costs, they also achieve economies of scale through bulk purchases of materials and through efficient training and scheduling of installers. Due to these economies of scale, the cost to the utility for materials and labor is generally less than what it would cost individual customers to do the work on their own [39]. Economies of scale are likely to increase as programs increase in size (for example discounts on equipment prices are directly proportional to the quantity purchased). Also, as additional experience is gained, some costs can be cut. For example, in NEES's pilot direct installation program, a full energy audit was conducted. NEES's current program involves a less expensive lighting-only audit.

Since current program costs are less than long-run utility-avoided costs in New York State (see Table 1-1), all the direct installation programs examined are likely to be cost-effective for New York State utilities from both utility and total resource cost perspectives [40]. Free riders appear to be low for direct installation programs (see Table 3-3), so free riders are unlikely to have a significant impact on the cost-effectiveness of direct installation programs. As program costs drop, program net benefits are likely to increase.

Rebate programs, with two exceptions, cost utilities less than $600/kW saved and $0.03/kWh saved (the two exceptions are the aforementioned start-up program and a custom measure program which emphasizes fixture replacements with long measure lives). The more expensive programs tend to be comprehensive, multi-measure programs and/or programs which emphasize personal marketing approaches. Most rebate programs cost utilities less than $0.02/kWh saved, meaning that even if free riders average 30-50% (a level common with first generation lighting improvements, but not with advanced lighting improvements), most programs will cost utilities less than $0.03/kWh saved. Since program costs are substantially less than utility avoided costs in New York, it is highly likely that most, if not all, of the rebate programs will be cost-effective for New York utilities from the utility perspective. Since data on costs incurred by participating customers is not available, the cost-effectiveness of rebate programs from the total resource cost perspective cannot be assessed.

Insufficient information is available on the cost-effectiveness of information programs to draw any conclusions.

G. CONCLUSIONS

The highest participation rates and savings per customer are achieved by direct installation programs. These programs cost utilities more per unit of electricity saved but even comprehensive direct installation programs cost less (from both the utility and total resource cost perspectives) than the long-run avoided costs of New York State utilities (approximately $.05/kWh saved). Furthermore, costs for these programs are already beginning to drop as economies of scale contribute to reduced equipment costs and program experience allows streamlining of audits and other program procedures. With direct installation programs, participation rates of at least 30%, and probably as high as 70% can be achieved. Savings of 10% or more (of total customer electricity use) can be achieved with small and medium-sized customers (peak demand less than 500 kW). This works out to reductions in lighting electricity use of 25-30% or more [41].

Rebate programs have lower costs (to the utility) and lower participation rates than direct installation programs but higher participation rates than information-only programs. With rebate programs, participation rates of 5-10% of small customers, and up to 25% for large customers appear possible. Typical savings per customer are 2-3% of total electricity use (approximately 6-7% of lighting energy use) but higher savings are possible for programs that promote many types of lighting equipment, including high-efficiency lamps, ballasts, fixtures, and controls. Nearly all rebate programs cost utilities less than $0.03/kWh saved, even when free riders are excluded from savings estimates.

Regardless of program type, programs with the highest participation rates and highest savings are those that:

* Use in-person marketing to develop an on-going relationship with targeted customers.

* Reach customers through multiple marketing approaches.

* Develop good working relationships with lighting distributors, and use distributors to help promote the program.

* Are easy for customers to understand and participate in.

* Promote a range of measures and not just energy-saving lamps.

* Minimize free riders by concentrating rebates on products with low market penetration, and/or requiring a pre-inspection before authorizing rebates for products with a high market penetration.

The impact of incentive levels on participation rates has not been fully resolved because only limited side-by-side comparison data are available. Clearly, programs that pay 100% of measure cost have the highest participation rates. Programs that pay over 50% of measure costs appear to have higher participation rates than programs with lower incentives. However, even at these rebate levels, incentive levels have less of an impact on participation rate than the marketing approaches used. Once incentives drop below 50%, available data suggest that incentive levels have little or no impact on participation rates. Programs that pay some incentive appear to have higher participation than information-only programs.

Nearly all current lighting programs suffer from a major shortcoming in our estimation: they do not encourage the best products. Most programs encourage first-generation lighting technologies (e.g. reduced-wattage fluorescent lamps and efficient magnetic ballasts) that result in only moderate energy savings and that already have a high market share (hence free rider proportions are high). Only a limited number of programs encourage advanced lighting products such as electronic ballasts, reflectors, T-8 lamps and lighting controls which produce far greater electricity savings (30% or more in some cases -- see Table 3-2) and, due to their current low market share, are likely to have very few free riders.

H. ADDITIONAL READING

Many reports have been written on C&I lighting programs. Among the most useful for program planners and implementers are the following:

Clinton, Jeanne, and Andrew Goett, 1989, "High Efficiency Fluorescent Lighting Program: An Experiment with Marketing Techniques to Reach Commercial and Small Industrial Customers" in Energy Conservation Program Evaluation: Conservation and Resource Management, Proceedings of the August 23-25, 1989 Conference (Argonne, IL: Argonne National Laboratory), pp. 93-98.

Gandhi, Sunita and Florentin Krause, "Program Design and Success: A Preliminary Overview of Utility Lighting Programs" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings, p. 6.45.

Nadel, Steven, 1988, "Utility Commercial/Industrial Lighting Incentive Programs: A Comparative Evaluation of Three Different Approaches Used by the New England Electric System" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. 6.153-6.165.

Nadel, Steven and Malcolm Ticknor, 1989, "Electricity Savings from a Small C&I Lighting Retrofit Program: Approaches and Results" in Energy Program Evaluation: Conservation and Resource Management, Proceedings of the August 23-25, 1989 Conference (Argonne, IL: Argonne National Laboratory), pp. 107-112.

Neos Corp, 1989, Final Report, Operating a Commercial Lamp Installation Program (Sacramento: Western Area Power Administration), p. 15.

Sacramento Municipal Utility District, 1984, Evaluation of the 1984 Lighting Incentive Program for Nonresidential Customers (Sacramento, CA: Sacramento Municipal Utility District).

Wolfe, Patrick and Larry McAllister, 1989, "The Industrial Lighting Incentive Program: Process and Impact Evaluation" in Energy Program Evaluation: Conservation and Resource Management, Proceedings of the August 23-25, 1989 Conference (Argonne, IL: Argonne National Laboratory), pp. 99-105.

I. NOTES

1. Geller, Howard, 1988, "Commercial Building Equipment Efficiency: A State-of-the-Art Review" prepared for Office of Technology Assessment (Washington, D.C.: American Council for an Energy-Efficient Economy), Table 2.

2. Miller, Eto and Geller, 1989, The Potential for Electricity Conservation in New York State (Washington, D.C.: American Council for an Energy-Efficient Economy), p. 31.

3. See note # 2, pp. 28 and 31..

4. Xenergy, Inc., 1988, A Statewide, Least-Cost Plan for Rhode Island, Final Report on the Initial Work of the Rhode Island Least-Cost Planning Committee (Draft), prepared for Rhode Island Governor's Office of Energy Assistance (Burlington, MA: Xenergy), p. 3-8.

5. See note # 2, pp. S-6 S-7, 28 and 31.

6. The Gainesville program involves installation of reduced-wattage fluorescent lamps, compact fluorescent lamps, new lenses for fluorescent fixtures, and HID fixture conversions (Personal communication with Jerry Donaldson, Gainesville Regional Utilities, June, 1989).

7. The City of Taunton, Massachusetts is planning a more comprehensive program which, in addition to many of the products supplied through the Gainesville program will include electronic ballasts, reflectors, high-intensity discharge fixture conversions, and lighting controls (Personal communication with Joe Desmond, Taunton Light Department, July, 1989).

8. Orange and Rockland, 1988, End-Use Conservation Plan Results: 1987 (Pearl River, N.Y.: Orange and Rockland), pp. 31-32.

9. Clinton, Jeanne, and Andrew Goett, 1989, "High Efficiency Fluorescent Lighting Program: An Experiment with Marketing Techniques to Reach Commercial and Small Industrial Customers" in Energy Conservation Program Evaluation: Conservation and Resource Management, Proceedings of the August 23-25, 1989 Conference (Argonne, IL: Argonne National Laboratory), pp. 93-98. In the post-program customer survey, 9.2% of the information-only customers reported that the brochure resulted in a change to high efficiency lamps, substantially higher than the 3% of information-only customers who reported they switched to high efficiency lamps. The authors of the study postulate that 3% of the respondents have already switched lamps but an additional 6% of respondents plan to switch in the future. Presently there are no plans for an additional follow-up survey to determine if customers who intend to switch to high efficiency lamps actually do switch.

10. Ibid. The in-person solicitation was made to medium-to-large size customers while the mail solicitation was made to customers of all sizes. The study found that large customers were more likely to participate than small customers. In part, large customers were more likely to participate than small customers because large customers were more likely to use qualifying products before the program began than small

customers (66% vs. 37-44%). However, the study found that even when differences in customer size and prior use of qualifying products are taken into account, the in-person rebate offer clearly had a higher acceptance rate than the mail offer.

11. Personal communication with Martin Morse, Rochester Gas and Electric, September, 1989.

12. Personal communication with Robin Calhoun, formerly with PG&E, March, 1988. Also, Barakat, Howard and Chamberlin, 1988, Demand-side Management Program Analysis, Volume III: Commercial/Industrial Sector Report (Woodbury, N.Y.: Long Island Lighting Company), p. 130.

13. The references cited in the preceding note report that 5-10% of small customers were reached. We estimate that the actual participation rate is at the low end of this range after allowing for customers who received multiple rebates or who received rebates for non-lighting measures. Among large customers, we estimate that the average participant received 1.5-2 rebates (a PG&E survey found that in 1983 alone, the average rebate recipient received 1.5 rebates), and that of participating customers, 60-80% installed lighting measures (since lighting measures account for half of the rebates, it is likely that the majority of the multi-rebate recipients installed at least one lighting measure and thus that lighting measures represent a higher proportion of the customer base than of the total number of rebates granted).

14. Based on data provided by Philip Quadrini and Diane Calden, PG&E.

15. Database printout supplied by Jane Siguenza, City of Palo Alto, August 2, 1989.

16. Through July, 1989, 304 rebates had been granted to large customers (Ibid.) Palo Alto has approximately 750 large customers (Gandhi, Sunita and Florentin Krause, "Program Design and Success: A Preliminary Overview of Utility Lighting Programs" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings, p. 6.45). Thus rebates granted are 40% of the large customer base. Applying the same adjustment factors used in note # 12 yields a 12-21% participation rate.

17. Personal communication with Frank Byrne, Wisconsin Electric, August, 1989.

18. Personal communication with C.C. Benson, Texas Utilities, June, 1989.

19. Personal communication with John Eastman, Michael Horton and Dean White, New England Power Service Company.

20. Ibid.

21. Ibid.

22. Personal communication with Kathy Thayer, Northeast Utilities, July, 1989.

23. Letter from Sharon Stepling, Northeast Utilities, dated February 17, 1989.

24. Sacramento Municipal Utility District, 1984, Evaluation of the 1984 Lighting Incentive Program for Nonresidential Customers (Sacramento, CA: Sacramento Municipal Utility District).

25. See note # 9.

26. Based on data supplied by Kathy Itow, SMUD, June, 1989. Also, Neos Corp., 1989, Final Report, Operating a Commercial Lamp Installation Program (Sacramento: Western Area Power Administration).

27. Nadel, Steven, 1988, "Utility Commercial/Industrial Lighting Incentive Programs: A Comparative Evaluation of Three Different Approaches Used by the New England Electric System" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. 6.153-6.165. Also, personal communications with John Oinonen, Don Robinson and Mike Horton, New England Electric.

28. Personal communication with Alfred Cobos, City of Austin, July, 1989.

29. Wolfe, Patrick and Larry McAllister, 1989, "The Industrial Lighting Incentive Program: Process and Impact Evaluation" in Energy Program Evaluation: Conservation and Resource Management, Proceedings of the August 23-25, 1989 Conference (Argonne, IL: Argonne National Laboratory), pp. 99-105.

30. For a discussion of some of these issues see McRae, George and Koved, 1988, "What are the Net Impacts of Residential Rebate Programs? in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings (Washington, D.C: American Council for an Energy-Efficient Economy), pp. 9.71-9.83.

31. Based on data supplied by Malcolm Ticknor, New England Electric.

32. Lovins, et. al., 1988, The State of the Art: Lighting (Snowmass, CO: Rocky Mountain Institute), p. 122.

33. Personal communication with Michael Horton, New England Electric.

34. Ibid.

35. The 13% and 2.6% savings figures come from Nadel, Steven, 1988, "Utility Commercial/Industrial Lighting Incentive Programs: A Comparative Evaluation of Three Different Approaches Used by the New England Electric System" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. 6.153-6.165. The 9% savings figure comes from Nadel, Steven, and Malcolm Ticknor, 1989, "Electricity Savings from a Small C&I Lighting Retrofit Program: Approaches and Results" in Energy Program Evaluation: Conservation and Resource Management, Proceedings of the August 23-25, 1989 Conference (Argonne, IL: Argonne National Laboratory), pp. 107-112. The 13% figure is only for small commercial customers (peak demand less than 100 kW) while the 9% figure includes both small and medium-sized customers (peak demand less than approximately 500 kW). Among program participants, medium customers used a smaller proportion of total electricity use for lighting than small customers, thus savings, as a proportion of total electricity use, were less for medium customers than for small customers. In addition to examining savings from the direct installation and customer rebate programs, the first paper also examined savings from NEES's dealer rebate program. Savings were found to be very low (0.2%), primarily due to the fact that the program was still in its start-up phase at the time the analysis was done.

36. New England Electric, 1988, Narragansett Electric Company Energy Efficient Lighting Rebate Program, Final Report (Westboro, MA: New England Electric). Also, personal communication with Bob O'Brien.

37. Cobos, Alfredo, 1988, "Memorandum: Report for the Small Commercial Relamping Program" (Austin: City of Austin).

38. See note #29.

39. Large discounts from list price can usually be achieved in direct installation programs due to the large quantities of materials purchased. For example, the City of Sacramento originally purchased lamps by the trailer load through the State of California purchasing agent at a steeply discounted price. Later, a local lighting distributor agreed to meet or beat the state price (Neos Corp, 1989, Final Report, Operating a Commercial Lamp Installation Program (Sacramento: Western Area Power Administration), p. 15). Savings on labor costs can also be achieved since: (a) semi-skilled labor can be used to install bulbs, leaving skilled labor such as electricians to install ballasts and controls; (b) installation staff becomes expert at lighting installations since they do nothing but lighting work; and (c) the steady work generated by a direct installation program allows close scheduling of installations, minimizing travel and down time.

40. One possible exception to this statement is that the most expensive direct installation program (operated by NEES) may not be cost-effective for Central Hudson Gas & Electric (the utility with the lowest avoided costs in New York State (see Table 1-1). However, NEES has since reduced costs for its small C&I direct installation programs, hence it is likely that even this program will now be cost-effective for Central Hudson.

41. Assuming lighting accounts for 35-40% of commercial electricity use -- see notes # 1 and 2.

Chapter 4

HEATING, VENTILATING AND AIR CONDITIONING PROGRAMS

A. INTRODUCTION

Heating, ventilating and air conditioning (HVAC) accounts for approximately half of commercial sector electricity consumption, both in the U.S. [1], and in New York State [2]. The HVAC proportion of commercial energy use in New York varies from a low of 48.6% for New York State Electric and Gas (an upstate utility) to 58.4% for Consolidated Edison (a downstate utility) [3]. HVAC end-uses account for a much smaller share of industrial energy use. Substantial energy and demand savings are possible from HVAC system improvements. In its study on "The Potential for Electricity Conservation in New York State," ACEEE concluded that from a consumer perspective (i.e. based on consumer electricity prices, measure costs, and discount rates), cost-effective efficiency measures can reduce commercial sector electricity use for HVAC systems by approximately 50%. Most of these savings are achieved by only four measures: variable supply air temperatures, conversion of constant-volume air handling systems to variable-volume operation, installation of variable-speed drives on fan motors, and re-sizing of air-conditioning units at the time of unit replacement [4].

For the present study, a total of 21 utility HVAC programs were examined. Nearly all of these programs are full-scale programs; only one (San Diego Gas and Electric's Coil Cleaning Rebate Program) was operated as a pilot program. Most of these programs are rebate programs directed specifically at high-efficiency air conditioners, chillers and heat pumps. A few of these programs are comprehensive multiple end-use programs for which results by end-use were available. In addition to these programs, a number of other multiple end-use programs (discussed in Chapter 10) are offered which promote HVAC energy and demand savings. Storage cooling and thermal air conditioning programs, which are a type of

HVAC program, are discussed separately in Chapter 7. Summary information on each of the HVAC programs can be found in Table 4-1. Additional information on each program is contained in the Appendix.

B. PROGRAM TYPES

Most of the HVAC programs presently offered by utilities provide rebates for air conditioners and heat pumps which exceed minimum efficiency requirements. These programs are designed to increase the efficiency of new equipment at the time of building construction or equipment replacement.

Most of these programs cover standard packaged central air conditioning and heat pump systems (which are commonly used to condition small- and medium-sized spaces -- up to approximately 50 tons of cooling requirements). Some programs also provide rebates for room air conditioners and heat pumps and/or for large "chiller"systems (used primarily to cool large buildings such as hospitals and multi-story office towers). While chillers are few in number (representing less than 10% of commercial air conditioning units sold), due to the large cooling capacity per unit, chillers account for approximately half of the commercial cooling capacity installed each year [5].

Some utilities provide a set rebate per unit purchased. Many utilities vary the rebate with the size of the system. For example, a rebate of $100/ton may be offered (where "ton" is a unit of the cooling capacity of a system). Some programs vary the rebate with the efficiency. For example, a small rebate is offered for moderately efficient systems and a higher rebate for high efficiency systems.

Besides HVAC equipment rebate programs, a few utilities offer programs directed at HVAC maintenance and controls. For example, San Diego Gas and Electric offered a program to encourage chemical cleaning of air conditioner condenser coils. The City of Palo

Table 4-1
Summary of HVAC Program Results

Utility	State	Program	Pkgd A/C?	Room A/C?	Heat Pumps?	Chillers?	Other?	Time Period Start	Time Period End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?
Denton	TX	Appliance Rebate	X	X	X			1987	6/89	2,953		~16	0.5%	P
Eastern Utl	MA/RI	Efficient A/C	X					5/88	12/88	26,681	109		0.4%	C
Jersey Cen.	NJ	A/C Rebate	X	X	X			8/83	11/88	87,534	378 in '88		.4% in '88	C
LA Dept W&P	CA	Heat Pump Cash Rebates			X			5/87	12/88	182,907		2,881	1.6%	P
LILCO	NY	Dollars and Sense	X	X				10/86	9/88	95,871		272	0.3%	P
Madison G&E	WI	Cool Investments	X		X		X	12/87	11/88	13,973	15		0.1%	C
Met-Ed/GPU	PA	Energy Mgmnt Controller					X	1/87	12/88	43,959				
Met-Ed/GPU	PA	Heat Pump			X			1/88	12/88	43,959	28		0.1%	C
NSP	MN	Rftop A/C & Condens Unit	X					10/86	12/87	111,751	30	96	0.0%	C
NSP	MN	Chiller Effic. Improve.				X		4/85	12/87		44			
Palo Alto	CA	Partners Elec Incentive	X			X	X	1985	7/89	2,409		10	0.4%	P
Puget P&L	WA	Comm'l Cons. Financing	X	X	X	X	X	1980	12/88	69,236		381	0.6%	P
SDG&E	CA	Coil Cleaning Rebate					X	5/86	7/86		461			
So. Cal. Ed	CA	Hardware Rebate	X		X	X	X	1/82	12/84	393,754				
So. Cal. Ed	CA	Keep Your Cool	X	X	X		X	3/84	10/84	393,754		3,790	1.0%	P
So. Cal. Ed	CA	A Refreshing Proposal	X		X	X	X	3/87	9/87		892			
So. Cal. Ed	CA	Its a Breeze	X		X			5/86	10/86	393,754		~2500	0.6%	P
Texas Util.	TX	Exist Non-Res Eff. Equip	X		X			1981	1988	242,647		26,215	10.8%	P
Texas Util.	TX	Efficient Room Unit		X				1981	1988	242,647		<6000	<2%	P
Texas Util.	TX	Geothermal Heat Pump					X	1/88	12/88	242,647		0	0.0%	P
Wisc. Elec.	WI	Smart Money	X	X	X	X	X	6/87	3/89	81,750	342	681	0.4%	C
W. TX Util.	TX	Energy Saving Plan	X	X	X			1987	1988	31,868		1,059	3.3%	P

Summary of HVAC Program Results

Utility	State	Program	Estimated Savings Coin. MW	Estimated Savings Absolt. MW	Estimated Savings GWh /yr	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute	Expenses (Thousands of Dollars) Direct	Expenses (Thousands of Dollars) Indirect	Expenses (Thousands of Dollars) Total	Util. Cost $/kW	Direct or Total?	Avg. Measure Life	Utility Cost $/kWh
Denton	TX	Appliance Rebate				173			$42						
Eastern Utl	MA/RI	Efficient A/C	0.06		0.05	713	0.01%	C			$48	$818	T	15	$0.100
Jersey Cen.	NJ	A/C Rebate	0.62		0.62	3,766	0.02%	C	$744			$1,200	D	15	$0.159
LA Dept W&P	CA	Heat Pump Cash Rebates				4,922						$1,094	T	15	
LILCO	NY	Dollars and Sense	1.07		1.26	3,576	0.03%	C	$325			$304	D	15	$0.034
Madison G&E	WI	Cool Investments	0.28			477	0.06%	C	$65	$23	$88	$316	T	15	
Met-Ed/GPU	PA	Energy Mgmnt Controller	1.49		0.49	1,673	0.09%	C			$34	$23	T	10	$0.009
Met-Ed/GPU	PA	Heat Pump	0.04			1,673	0.00%	C			$33	$817	T	15	
NSP	MN	Rftop A/C & Condens Unit	0.10			5,543	0.00%	C	$18	$56	$74	$771	T	15	
NSP	MN	Chiller Effic. Improve.	~1.38		1.82	5,543	0.02%	C	$312	$131	$443	$320	T	15	$0.024
Palo Alto	CA	Partners Elec Incentive		0.23	0.94	182	0.13%	A	$53			$230	D	10	$0.010
Puget P&L	WA	Comm'l Cons. Financing			55.03	3,528			$7,740	$2,129	$9,869			10	$0.023
SDG&E	CA	Coil Cleaning Rebate				2,374			$61						
So. Cal. Ed	CA	Hardware Rebate		15.75	140.14	14,775	0.11%	A	$3,106			$197	D	15	$0.003
So. Cal. Ed	CA	Keep Your Cool		7.20	5.67	14,775	0.05%	A	$2,769			$385	D	15	$0.065
So. Cal. Ed	CA	A Refreshing Proposal		2.60	2.20	14,775	0.02%	A	$592			$228	D	15	$0.036
So. Cal. Ed	CA	Its a Breeze				14,775			~1,200						
Texas Util.	TX	Exist Non-Res Eff. Equip	34.20			16,680	0.21%	C							
Texas Util.	TX	Efficient Room Unit				16,680									
Texas Util.	TX	Geothermal Heat Pump	0.00			16,680	0.00%								
Wisc. Elec.	WI	Smart Money		2.88	2.49	3,810	0.08%	A	$574			$200	D	10	$0.040
W. TX Util.	TX	Energy Saving Plan			1.59	1,077			$162					15	$0.013

Note: For a description of the methodology used to estimate measure life and $/kWh, see Chapter 1.

Alto, Consolidated Edison, and Metropolitan Edison all offer incentives for energy management and other controls which shift energy use off-peak. The Snohomish Public Utility District and Pacific Gas and Electric, among other companies, provide rebates for clock thermostats purchased by small C&I customers. New England Electric provides specific incentives for variable-speed drives, economizer controls, and optimal start controls.

In addition to these measure-specific programs, a number of utilities offer programs in which incentives are provided for customized measures proposed by customers. Examples of such projects in the HVAC area include variable-speed drives, energy management control systems, and variable air volume conversions. Some of these programs are briefly discussed in this chapter. Many more of these programs are discussed in Chapter 10.

C. PARTICIPATION

HVAC Equipment Rebate Programs

Since most HVAC equipment has a life of at least ten years, and many pieces of equipment last 20 years or more [6], only a small percentage of customers are purchasing equipment in a given year. In this type of market, a program has to operate for ten years or more to achieve a high participation rate. Given this situation, participation rates for HVAC programs can be expected to be lower than for audit and lighting programs. However, even with this limitation, the range of market penetration rates actually achieved by HVAC programs (0-11%) is disappointingly low (see Table 4-1). All but four programs have cumulative participation rates less than 1% of eligible customers. Most utilities have reduced their peak demand by less than 0.1% as a result of their HVAC programs.

Despite this generally dismal situation, a few programs have achieved moderate participation rates. The highest participation rate (11%) has been achieved by Texas Utilities' Existing Non-Residential Efficient Equipment Program. This program has been in operation for nine years and has reached approximately 1.2% of eligible customers each year. This program provides incentives for packaged air conditioners and heat pumps (packaged units are used by an overwhelming majority of C&I customers). Texas Utilities offers a fixed rebate per unit, regardless of unit size, based on the premise that receiving an incentive is more important to customers than the amount of the incentive. Program marketing emphasizes development of a close working relationship with HVAC contractors and dealers. In addition, promotional materials are sent to, and personal contacts made with, building owners and operators [7].

Several other utilities operate similar programs which have achieved participation rates of approximately 1%/year or more (see Table 4-1). These programs include ones operated by West Texas Utilities (3.3% participation over two years), Southern California Edison (1% participation over eight months), the Los Angeles Department of Water and Power (1.6% participation in 1 1/2 years), and Eastern Utility Associates (0.4% participation during the first seven months).

The West Texas Utilities program is promoted through a variety of mediums including television, radio, print media and personal contacts with builders, dealers, and building owners. Utility staff provide free heat-loss and duct layout analyses to encourage proper sizing and design of qualifying systems [8].

Southern California Edison ran a number of special short-term programs to promote high-efficiency cooling equipment during 7-8 month periods. These programs were marketed under catchy names such as "Keep Your Cool," and "It's a Breeze." These programs were promoted by direct mail to dealers and eligible customers. Small C&I customers were especially targeted. During one of these programs, dealers were offered points, redeemable for merchandise, for every complying unit they sold. Approximately 400 dealers participated -- a much higher response rate than for a similar program offered to motor dealers [9].

The Los Angeles program claims to be reaching 80% of the new equipment market with its program. This program is heavily promoted to builders, both by the utility and by heat pump contractors who use the rebate as a marketing tool [10]. In part, the high participation rate is due to the fact that qualifying efficiency levels are very low. This issue is discussed further in section E below.

Eastern Utilities recently began a program which provides rebates to dealers instead of to customers. The program has proven very popular with contractors and so far has exceeded participation goals set for it [11].

Programs offered by Northern States Power (NSP) are also worthy of mention. NSP offers two HVAC programs -- one for chillers (large units) and one for packaged systems (small units). NSP estimates that their chiller rebate program provides rebates for 70% of annual centrifugal chiller sales (centrifugal chillers are generally used in the largest buildings). The eligibility level for the program (energy use of 0.62 kW/ton or less) is substantially lower than building code requirements. The program is primarily promoted through personal contacts with owners and engineers. Manufacturer's representatives have also been active in promoting the program. NSP is considering expanding the program to other types of chillers [12].

The NSP packaged system program originally offered rebates of $10/ton for units exceeding minimum efficiency requirements. The program was promoted through a low-key marketing effort. In 1988, rebates were increased to $20-65/ton (the rebate level increases as efficiency increases) and a stepped-up marketing effort, emphasizing personal contacts with HVAC contractors, builders and owners of multiple buildings. In addition to increasing the rebate, NSP now splits the rebate (50-50) between the installing contractor and the building owner. Since these changes were instituted, participation has increased significantly [13].

Comprehensive Multiple End-Use Programs

Only limited data on participation in the HVAC portions of multiple end-use programs are available. While a number of utilities offer these programs, we were able to acquire end-use data for only four utilities (City of Palo Alto, Puget Power and Light, Southern California Edison, and Wisconsin Electric -- see Table 4-1). The HVAC portions of these programs have had participation rates ranging from 0.4% to 0.6% of eligible customers. While these participation rates are low, savings as a proportion of utility peak demand are generally higher for these programs than for programs which just provide HVAC equipment rebates. For example, Palo Alto's HVAC rebates have reduced the utility's peak demand by 0.13%, Southern California Edison's by 0.11%, and Wisconsin Electric's by 0.08%. Most HVAC equipment-only programs have reduced utility peak demand by 0.06% or less. While savings of 0.08-0.13% are small, they do represent an improvement over equipment-only programs. Likely reasons for the increased impact are twofold. First, the comprehensive programs generally fund more measures than the equipment-only programs, either by offering rebates for more items or by offering rebates for custom items proposed by customers. Second, as is discussed in Chapters 2 and 10, the comprehensive programs are more likely to attract large customers, where substantial demand savings can be achieved per customer. Third, marketing efforts for comprehensive programs are generally more extensive than marketing efforts devoted to end-use specific programs.

Maintenance and Control Programs

Only pilot maintenance programs have been conducted for which participation rates are not available. Control programs are often combined with HVAC equipment programs. Separate data for controls are not available. Likewise, information on control-only programs is so limited that no conclusions can be drawn.

D. SAVINGS

Information on customer savings as a proportion of pre-program electricity use is extremely limited. Essentially no information is available for control programs and comprehensive programs. In the case of equipment rebate programs, only "ballpark" estimates can be made based on engineering calculations. For example, the typical rebate program for small packaged air conditioners and heat pumps provided rebates for products with Seasonal Energy Efficiency Ratios (SEER) of 10.0 or more. A typical rebated unit will have a slightly higher SEER, say 10.25. In 1988, average air conditioner and heat pump cooling SEER was 9.1 [14]. Thus, a typical rebated unit saves 11% ((10.25-9.1)/10.25). Similarly, the typical centrifugal chiller rebate program provides incentives for water-cooled models using approximately 0.62 kW/ton. The typical new unit sold today uses approximately 0.70 kW/ton [15]. Thus a typical rebated unit will save 11% ((0.70-0.62)/0.70). With both packaged and chiller units, higher savings are possible as the efficiency of rebated equipment increases.

For air conditioner maintenance programs, in our research we found only one study on energy savings. This study, which was conducted by New England Electric on a small sample of units, found weighted average compressor demand savings of 9.8% from cleaning of condenser coils and other annual maintenance items. Savings on individual units ranged from 6.8-16.7% -- which was the range that other studies led them to expect [16].

E. FREE RIDERS

Only one of the programs we examined supplied data on the proportion of free riders among program participants. Long Island Lighting (LILCo) estimates that 35% of the 1988 participants in its commercial air conditioning rebates were free riders. This estimate is based on a survey of rebate recipients [17]. The LILCo program in 1988 covered packaged HVAC equipment and had qualifying efficiency levels, which while similar to those offered by many other utilities, require only modest improvements above prevailing construction practice [18].

Analysis of rebate eligibility criteria and national sales data leads us to believe that free riders are likely to represent a significant proportion of the participants for many other programs.

The three programs with the highest participation rates are those operated by Texas Utilities, West Texas Utilities, and the Los Angeles Department of Water and Power. The first two programs provide rebates on small packaged systems with an SEER of 10.0 or greater. In 1988, nationwide, 14% of small packaged air conditioners and heat pumps had SEERs of 10.0 or more [19]. In a hot, humid climate such as Texas, high SEER units are likely to represent a somewhat higher proportion of sales. The Los Angeles program provides rebates on heat pumps with an SEER of 8.3 or more. In 1988, the average SEER of small packaged heat pumps was 9.13 [20]. Thus the vast majority of heat pumps sold today qualify for the Los Angeles program [21].

While free rider shares for some programs may exceed 20%, these shares can easily be reduced if qualifying efficiency levels are raised. Generally, the higher the qualifying efficiency level, the higher the savings per unit and the lower the number of free riders. But, as qualifying efficiency levels rise, so do equipment costs, generally causing participation rates to decline. Good program design involves a careful balancing of qualifying efficiency levels in an effort to maximize cost-effective energy savings net of free riders.

F. PROGRAM COST-EFFECTIVENESS

The HVAC programs examined in our study ranged widely in cost to the utility, varying from \$23-1,200/kW saved and from \$0.003-0.159/kWh. Cost estimates for most programs include free riders. Median costs to the utility are \$318/kW and \$0.029/kWh. Costs per unit of energy saved might be expected to vary with local climate (e.g. lower costs per kW or kWh in warm regions). This tendency is illustrated by our data -- the median utility cost per kWh for six sunbelt programs is $0.018 while the median for six northern state programs is $0.028.

The HVAC equipment rebate programs ranged in utility cost from $0.013-0.159/kWh (median of $.036), the comprehensive multiple end-use programs from $0.003-0.04 (median of $0.016). Thus it appears that comprehensive programs may be less expensive per kWh saved. This conclusion should be used with caution, as the sample sizes are small and costs per kWh are very dependent on assumptions of average measure life (assumed for this analysis to be 15 years for most equipment and 10 years for multiple measure programs [22]). The one control program for which cost and savings information is available cost the utility $23/kW and $0.009/kWh. While it is difficult to draw conclusions from only one program, these low costs indicate that further investigation of controls programs is justified.

Three programs have costs per kwh of more than $0.05. Likely explanations for these high costs are low savings per unit in the Jersey Central program (we suspect an error was made and savings were underestimated) [23], substantial start-up costs in the Eastern Edison program (as participation increases, start-up costs will be spread over more participants and costs per kWh will drop), and very high rebate levels in the Southern California Edison "Keep Your Cool" program [24]. Except for these three programs, all the HVAC programs examined have costs of $0.04/kWh or less. Since all New York utilities have 15-year total avoided costs above $0.04/kWh (where 15 years is the approximate average life of HVAC equipment), all but the three most expensive programs are likely to be cost-effective, from the utility perspective, for New York utilities. Data on customer costs are available for none of the programs examined, hence the cost-effectiveness of HVAC programs from the total resource cost perspective cannot be assessed.

G. CONCLUSIONS

HVAC equipment rebate programs can be useful to promote high efficiency equipment at the time new equipment is purchased. When equipment is being purchased, high efficiency equipment can often be purchased for a small additional cost.

* Operators of these programs report reaching as much as 70-80% of the new equipment market.

* Typical energy savings of approximately 10% of electricity used for air conditioning can be expected given the efficiency guidelines currently being used by the typical utility (greater savings are possible with higher efficiency equipment).

* The most successful of these programs are promoted primarily through personal contacts with trade allies such as HVAC contractors and dealers, and mechanical engineers.

* Programs offering incentives to dealers (either money or gifts) report good dealer response.

* Free riders appear to account for approximately 20-40% of the participants in typical programs. These proportions can be lowered if minimum qualifying efficiency requirements are raised.

* The typical HVAC rebate program costs the utility less than $0.04/kWh saved (assuming a 10-15 year equipment life), making these programs less expensive to the utility than long-term avoided costs for New York State utilities.

Most HVAC programs overlook the vast majority of potential HVAC savings. Only half the programs offer rebates for chillers, despite the fact that chillers account for approximately half of all air conditioning capacity in the commercial sector.

Even more importantly, HVAC equipment selection represents only a small proportion of the energy savings available from HVAC systems. Large additional savings are available from HVAC retrofit measures including resetting supply air temperature, converting systems to variable air volume operation, installing variable-speed drives on fans, pumps and other equipment, installing economizers and improving HVAC maintenance and control. Some of these measures (e.g. improved maintenance and control, including reset, economizer and variable speed controls) may be appropriate for all buildings, including those in which equipment is not being replaced. Large additional savings are also available at the time of equipment replacement including re-sizing equipment and buying new equipment with the above-listed retrofit measures already incorporated (when these measures are incorporated in new equipment, costs are often lower).

Only limited programs have been offered in the areas of HVAC retrofit and new system optimization -- primarily from multiple end-use programs which pay incentives for custom measures proposed by customers. Data on the HVAC components of these programs are limited, but it appears that these programs achieve significant savings and often cost less per kWh saved than equipment-only programs.

Overall, energy savings from HVAC programs are disappointing relative to the substantial potential savings available. Clearly, additional work is needed to develop enhanced programs to capture additional HVAC savings. This issue is discussed further in Chapters 10 and 11.

Current HVAC equipment rebate programs can be improved by adding additional services and incentives for customers installing new equipment. Among the measures that should be encouraged are proper equipment sizing, installation of improved supply air temperature controls, and use of variable air volume and variable-speed equipment.

H. NOTES

1. Geller, Howard, "Commercial Building Equipment Efficiency: A State-of-the-Art Review," 1988 (Washington, D.C.: American Council for an Energy-Efficient Economy), Table 2.

2. Miller, Eto, and Geller, 1989, The Potential for Electricity Conservation in New York State (Washington, D.C: American Council for an Energy-Efficient Economy), p. 28.

3. Ibid., p. 49 and 65.

4. Ibid., pp. S-5, 28.

5. Harris, Katsenelenbogen and Bluestein, 1986, Status of the Space Cooling Equipment Market in the Commercial Sector, GRI-86/0085 (Chicago, IL: Gas Research Institute), p. 2-18 to 2-19.

6. Gordon, McRae, Rufo and Baylon, 1988, "Use of Commercial Energy Efficiency Service Life Estimates in Program and Resource Planning" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. 3.83-3.97.

7. Personal communication with C.C. Benson, June, 1989. The premise that rebate amount does not affect rebate level is based on market research in the residential sector -- equivalent research on the commercial sector has not been conducted.

8. Personal communication with Carl Piel, West Texas Utilities, July, 1989.

9. Personal communication with Bruce Mayo, Southern California Edison, June, 1989. Also, Southern California Edison, 1984 Conservation/Load Management Results, 1986 Energy Management Results, and 1987/88 Demand Side Management Annual Report (Rosemead, CA: Southern California Edison).

10. Personal communication with Art Bruce, Los Angeles Department of Water and Power, July, 1989.

11. Personal communication with Carol White, Eastern Utilities, August, 1989.

12. Northern States Power, 1988, Conservation Improvement Program Annual Report and Evaluation (Minneapolis: Northern States Power), Section VII.

13. Ibid., Section XX. Also, personal communication with Randy Gunn, Northern States Power, July, 1989.

14. Personal communication with David Martz, Air Conditioning and Refrigeration Institute, Arlington, VA, September, 1989.

15. Personal communication with Michael Kaplan, Kaplan Engineering, Lake Oswego, Oregon, January, 1989. This number is based on an informal survey he made of engineers and manufacturers representatives.

16. New England Electric, 1988, Six Month Evaluation of New England Electric Partners in Energy Planning Programs (Westboro, MA: New England Electric), p. 9.3.

17. Applied Energy Group, 1989, Evaluation of LILCo's 1988 Electric Conservation and Load Management Plan, Volume 1 (Woodbury, N.Y.: Long Island Lighting), Chapter 7, p. 8.

18. For example, LILCo's minimum qualifying efficiency level for single-phase central air conditioners is an SEER of 10.0. In New York State, minimum efficiency standards in force since 1984 have required an SEER of at least 9.5. Similarly, LILCo requires an EER of 8.4 or greater for three-phase packaged air conditioners. In late 1988, Mike Kaplan of Kaplan Engineering, Portland, OR estimated that the average EER in neighboring Massachusetts was at least 8.2 and perhaps as high as 8.6 (personal communication).

19. See note #14.

20. Ibid.

21. A major goal of the Los Angeles program is to increase sales of heat pumps relative to other types of heating systems. Promoting high efficiency units appears to be a secondary goal of the program.

22. See Chapter 1 for an explanation of the basis for these estimates.

23. The Jersey Central program reports very low savings per unit rebated (.18 kW/unit) -- far lower than the other programs of its type (over 1 kW/unit for the Texas Utilities, West Texas Utilities and Southern California Edison programs). We suspect that errors were made in calculating the Jersey Central savings estimates.

24. Rebates for this program were $200-400/ton. Other programs of its type provide rebates of approximately $10-200/ton (see the Appendix).

Chapter 5

MOTOR PROGRAMS

A. INTRODUCTION

Electricity used to power motors in the commercial and industrial sectors accounts for approximately half of total U.S. electricity use [1]. Motors are most heavily used in the industrial sector, but motor energy use in the commercial sector (primarily for power fans, pumps and compressors) is also substantial. In New York State, motors are estimated to account for 78% of industrial sector electricity use [2]. Motor energy-use can be reduced significantly -- according to one recent estimate, potential savings from motor efficiency improvements total 28-60% [3]. In New York State, just two measures (high-efficiency motors and adjustable-speed drives), when applied in applications where the cost of conserved energy to the consumer is less than $0.05/kWh, can reduce industrial sector electricity use by 13% [4].

For this project, 15 motor improvement programs were analyzed. All of these programs provide rebates for energy-efficient motors. Most of these programs concentrate their efforts on upgrading the efficiency of new motor purchases and on encouraging customers with burned-out motors not to repair the old motor, but to instead purchase new high-efficiency motors. Most of the programs offer rebates which cover most of the incremental cost of an efficient motor compared to a standard motor. Some utilities provide rebates on a per horsepower basis, others list specific rebate levels for each standard horsepower rating. All utilities specify minimum qualifying efficiencies for each standard horsepower rating. A few utilities vary minimum efficiencies depending on motor speed (1200, 1800 or 3600 RPM) or enclosure type (enclosed or open). Most programs are promoted through direct mail brochures and personal contacts with trade allies and eligible customers, particularly large industrial customers.

Besides motor rebate programs, two utilities (the City of Palo Alto and Bangor Hydro) provide rebates for reducing motor system size and another (New England Electric) provides rebates for adjustable-speed drives.

In addition to pre-calculated rebates, a number of utilities provide rebates for custom measures proposed by C&I customers. These programs include multiple end-use programs (discussed in Chapter 10) and industrial process programs (discussed in Chapter 6). Information on motor-only programs is summarized in Table 5-1. Additional details can be found in the Appendix.

B. PARTICIPATION

Participation rates (number of participating customers divided by number of eligible customers) for motor programs are generally less than 3%, although one small pilot program had a 33% participation rate. However, use of these figures can be misleading because motor program participation rates are very sensitive to the number of eligible customers. For example, the program with the highest participation rate (a pilot program operated by Niagara Mohawk) was offered to only 24 specially targeted customers. Given the special targeting (three-shift customers thought likely to be interested in the program), it is not surprising that this program had an above-average participation rate. Likewise, the British Columbia (BC) Hydro program estimates that it is currently providing rebates for 15% of all motor sales in its territory [5], but its gross participation level is very low (0.1%) since all C&I customers are eligible (including "Mom and Pop" stores) but most motor rebates have been requested by a limited number of very large customers. Despite these difficulties in interpreting motor program participation data, an examination of participation data yields an obvious conclusion -- that participation levels in most programs have been low. Most program managers are disappointed in the participation levels of their programs. With the exception of Niagara Mohawk's pilot program, no program has yet reached 5% of eligible customers (see Table 5-1). Likewise, all programs are

Table 5-1
Summary of Motor Program Results

Utility	State	Program	Time Period Start	Time Period End	Pilot or Full-Scale	Number Eligible	Number of Participants: Custo-mers	Number of Participants: Proj-ects	Cumm. Parti-cipa-tion Rate	Custo-mers or Proj-ects?	Estimated Savings: Coin. MW	Estimated Savings: Absolute MW	Estimated Savings: GWh	1987 Peak Demand	Svgs as % of Pk	Coin-ciden or Abso-lute	Expenses (1000s of $): Direct	Expenses (1000s of $): Total	Util. Costs $/kW	Direct or Total	Utility Costs $/kWh
BC Hydro	BC	High-Effic. Motor Rebate	7/88	6/89	Full	142,779	95	126	0.1%	C	0.57		3.75	6,830	0.01%	C	$210	$320	$566	T	$0.008
Jersey Cen.	NJ	Motor Rebate	6/87	12/88	Full	28,000								3,766			$43				
NEES	MA/RI	Lg. C&I Custom	1/88	6/89	Full	1890	23		1.2%	C	0.28			3798	0.01%	C	$112		$401	D	
NEES	MA/RI	Energy Initiative	6/89	8/89	Full	~6000	10	12	0.2%	C	0.09			3798	0.00%	C	$74		$822	D	
NSP	MN	C&I Motor Efficiency	1/87	12/87	Full	111,751	54		0.0%	C	0.14	0.21	0.86	5,543	0.00%	C	$25	$103	$744	T	$0.012
Palo Alto	CA	Partners Elec. Incentive	1985	7/89	Full	2,409		10	0.4%	P		0.16	0.77	182	0.09%	A	$29		$185	D	$0.005
PG&E	CA	Energy- Efficient Motor	1983	1983	Full	~25,000		431	1.7%	P				14,142			$1,273				
So. Cal. Ed	CA	A Rewarding Connect'n	11/86	9/87	Full	70,000	177		0.3%	C		0.52	5.20	14,775	0.00%	A	$41		$79	D	$0.001
So. Cal. Ed	CA	Hardware Rebate	1/82	12/84	Full	393,754						6.62	49.99	14,775	0.04%	A	$1,011		$153	D	$0.003
Wisc. Elec.	WI	Smart Money	6/87	3/89	Full	81,750	64	128	0.1%	C		0.27	1.66	3,810	0.01%	A	$81		$307	D	$0.006
Bangr Hydro	ME	C/I Motor Efficiency	4/86	12/88	Pilot	~1750	24	97	1.4%	C		0.08	0.34	262	0.03%	A	$20	$23	$305	T	$0.007
CMP	ME	Motor Rebate	1986	12/88	Pilot	43,686	232	320	0.5%	C			1.69	1,455							
Met-Ed/GPU	PA	High Efficiency Motor	1/87	12/87	Pilot	43,959						0.22	0.77	1,673	0.01%	A		$27	$122	T	$0.003
Nevada Pwr	NV	En. Eff. Elec. Motor Reb	4/89	6/89	Pilot	32,927	5		0.0%	C				1,740							
NiMo	NY	Motor Rebate Pilot	5/86	12/86	Pilot	24	8		33.3%	C				5,403			$117	$144			

Note:

$/kWh assumes a 15 year average motor life and a 6% real discount rate. For an explanation of these assumptions, see Chapter 1.

only reaching a minority of annual motor sales. As mentioned previously, BC Hydro estimates it is currently reaching 15% of motor sales. Southern California Edison estimated it reached only 3% of motor sales during a year-long period of aggressive promotion [6].

While participation rates thus far have been low, a number of programs with above-average participation levels provide some insights into how higher participation rates can be achieved in the future.

As previously mentioned, the Niagara Mohawk pilot program had a 33% participation rate. This program encouraged customers to replace functional, standard efficiency motors with high operating hours with high-efficiency motors. This program featured targeting of customers most likely to participate (large customers with long operating hours), personal approaches to all targeted customers, a free computer assessment of costs and savings, and high rebate levels ($25 per horsepower -- sufficient to pay over half the cost of a new motor in many applications [7]). Of the customers that did not participate, the majority were concerned about disruptions to production processes caused by the downtime required to change motors.

Pacific Gas and Electric (PG&E) achieved a 1.7% participation rate in less than one year with its Energy-Efficient Motor program targeted at medium and large C&I customers (annual electricity use greater than 100 MWh). A substantial number of additional customers were reached in subsequent years through a multiple end-use rebate program (motor participation figures are not available for this program). This program was promoted through mailings and extensive personal contacts with eligible customers and motor dealers.

As previously mentioned, BC Hydro estimates it is reaching 15% of motor sales in its service territory after one year of operation.

This relatively high participation level has been reached despite industrial electricity prices which average less than $0.02/kWh. Their goal is to reach 50% of the motor market in the province. The BC Hydro program is a combined education and incentive program. As part of the program the utility has developed an educational booklet for customers, computer software for dealers and large customers to use to estimate energy savings, a list of all dealers in the province supplying efficient motors, and a database of all motors sold in the province broken down by features and ranked from most to least efficient. In this program rebates increase as motor efficiency increases above a base qualifying efficiency level. Program marketing emphasizes personal contacts between field representatives and large customers, consulting engineers, and motor suppliers. Seminars and trade shows have also been sponsored. Many motor suppliers are actively promoting the program including providing information and application forms to customers [8].

A pilot program similar to BC Hydro's was recently offered by Ontario Hydro. Marketing of this program includes an educational booklet for customers, a free computer program for estimating energy savings, and prepared marketing materials (e.g. a notebook of marketing information including flip-charts) which are given by the utility to motor dealers for the dealers to use with their customers. Participation information is not presently available. Ontario Hydro is planning to expand its program systemwide in the near future [9].

New England Electric has run several multiple end-use rebate programs over the past several years. The Large C&I Custom Programs provided rebates to medium and large C&I customers. Participation was just over 1% after 1 1/2 years. Most of these rebates were through a few motor dealers who used the rebate program as a cornerstone of their marketing efforts. The utility was disappointed in the participation they were getting, so in June, 1989, they dramatically increased rebate levels for high-efficiency motors (rebates now are often adequate to pay the full cost of a new, high-efficiency motor), added generous rebates for adjustable-speed drives, simplified the rebate structure and application procedure, and held training seminars on the new program for motor dealers. With these changes the utility is not just targeting motors for new and replacement applications (when an old motor burns-out and needs to be replaced), but it is also actively pursuing retrofit applications (removing functioning, inefficient motors). After two months, the new program's monthly participation rate is approximately four times greater than the old program [10].

Several utilities (Nevada Power, Northern States Power and Southern California Edison) have run programs which provide rebates directly to dealers in addition to rebates paid to customers. Dealer rebates are intended to help cover dealer stocking, marketing and paperwork costs. The rebates offered dealers are generally low ($10/motor, $0.50/horsepower, and points toward gifts respectively), and have had little impact on program participation. Program operators all recommended higher rebates to dealers [11].

In addition to dealer rebates, Northern States Power (NSP) has tried another novel rebate approach. The NSP formula provides higher rebates ($7/horsepower) for new motors which are replacing functioning motors and lower rebates ($2/horsepower) for new motors which are not replacing functioning motors. Participation in both of these programs has been low, although the utility hopes that improved marketing will increase participation [12]. Another possible explanation for the low participation is low rebate levels -- the NSP rebate for replacement motors is less than what many utilities are paying for new, non-replacement motors (see the Appendix).

A few programs have promoted motor efficiency improvements besides new motors. The City of Palo Alto offered incentives for motor downsizing. Few customers took advantage of these incentives [13].

New England Electric recently began offering incentives for adjustable-speed drives. The rebates are sufficient to pay the full cost of an adjustable-speed drive for many applications. After two months, only one customer has participated. Simplifications to program technical procedures are now being investigated [14]. Other utilities offer rebates for adjustable-speed drives as part of custom measure or industrial process programs. Specific information on the number of customers installing adjustable-speed drives is generally not available.

C. SAVINGS

Niagara Mohawk has monitored the electricity savings of nine high efficiency motors installed through its Motor Rebate Pilot Program. The average motor reduced electricity use by 13.7% and reduced its peak demand by 5.4% [15]. Given the small sample size, these figures should be used with caution. Energy savings can also be estimated with engineering calculations, based on the ratio of efficiency for a basecase motor and the efficiency of a new high-efficiency motor. Percent savings vary with motor size (as motor size increases, the efficiency of standard-efficiency motors now on the market begins to approach the efficiency of high-efficiency motors now on the market), and also with whether the basecase is a new or old standard efficiency motor (new standard efficiency motors tend to be higher efficiency than old motors). Assuming the comparison is with new standard efficiency motors, savings range from approximately 15% for one horsepower motors to 0.5% for 250 horsepower motors. For 25 horsepower motors, savings of approximately 4.5% can be expected [16]. Average savings, weighted according to the distribution of motors and efficiencies in the existing national population, have been estimated at approximately 5% [17]. When the comparison is between new high efficiency motors and old standard efficiency motors, additional savings of approximately 2% are likely if the old motor has not been damaged [18]. Still greater savings are likely if the old motor is damaged. The <u>additional</u> savings from replacing a damaged motor have been estimated by one source at 1.8-3.4% [19]. Thus, average savings from installing new high-efficiency motors range from 5% to approximately 10%, depending on the efficiency of the motor that is being replaced or supplanted.

D. FREE RIDERS

New England Electric estimates that high-efficiency motors represent 10% of the installed motors in their territory and 25-35% of new motor sales [20]. Areas with lower electricity prices generally have a lower share of high-efficiency motors. For example, BC Hydro estimates that before their program began, high-efficiency motors represented 5% of motor sales in their service territory [21].

Five utilities have estimated the free rider proportion in their motor rebate programs based on customer surveys. As was noted in previous chapters, since these estimates are based on self-reports by rebate recipients, the estimates are not very reliable and should be used with caution. Results are as follows:

Utility	Free Rider Proportion
Bangor Hydro	67-88%
BC Hydro	3
Central Maine Power	37
Northern States Power	40
Wisconsin Electric	30-50

With the exception of the BC Hydro program, all of these programs are low participation programs in which free riders can be expected to dominate (since free riders can be expected to apply for a program, for the free rider proportion to be low, a substantial number of non-free riders must also apply). Thus, ignoring the high and low estimates, in low participation programs, 30-50% of the participants are likely to be free riders. As participation increases, free riders will decline, eventually approaching a floor defined by the penetration of high efficiency motors in the marketplace (approximately 5-10% for when working motors are being replaced, and 5-35% for when a new motor would have been purchased even if a rebate was not available).

E. PROGRAM COST-EFFECTIVENESS

Motor rebate programs are generally inexpensive to the utility per unit of energy saved. Costs per kW saved range from $79-822 (median of $354), while costs per kWh saved range from $0.001-0.012 (median of $0.0055). At these costs, even if costs are adjusted to account for free riders, motor rebate programs should be cost-effective for most utilities in North America (based on the utility cost perspective) including all of the utilities in New York State. Data on customer costs were not collected by any of programs studied, so the cost-effectiveness from the total resource perspective cannot be determined.

At least one program (the one operated by NEES) pays rebates substantially higher than those paid by other utilities. Rebate levels were raised only recently, so detailed cost and savings information is not presently available. Based on projections made by the utility during the planning of the program, and based on its avoided costs, NEES has found this program to be cost-effective from both the utility and total resource cost perspectives [22].

F. CONCLUSIONS

Motor rebate programs are the predominant type of utility motor program. Most programs have had very low participation rates. Reasons for low participation are numerous, but, according to a recent analysis by New England Electric, include the following factors [23]:

1. Bad customer early experiences with high efficiency motors due to improper sizing and installation.

2. Unfamiliarity of customers and dealers with the substantial operating cost savings which are available with high efficiency motors.

3. Multiple decision-makers on motor purchase decisions and difficultly reaching the right decision-maker.

4. Customer hesitancy to shut down production lines to replace an operating motor.

5. A tendency by many customers to speed up motor replacements, by replacing burned-out motors with identical motors. Also, to speed up replacements, and cut capital costs, many customers rewind burned out motors instead of replacing them.

6. Low rebate levels which cover only a portion of the cost of new, high-efficiency motors.

To date, the most effective programs have reached approximately 15% of new motor sales and less than 5% of eligible customers. The most successful programs feature regular personal contacts with motor dealers, consulting engineers, and large customers. In addition, educational materials and programs for customers, and seminars and marketing materials for dealers can be important promotional aids.

Several utilities have experimented with paying rebates to dealers. The rebates have been small and ineffective.

There is limited evidence that high rebates increase participation levels. A new program just started by New England Electric, which provides rebates approximately double those provided by other utilities, will provide important information on whether high rebates increase program participation.

Savings for high-efficiency motors vary from 0.5-15%. Average savings of approximately 5-10% can be expected relative to the existing motor stock. Free riders account for 30-50% of program participants in programs with low participation. As participation increases, free rider proportions of 5-35% can be expected (near the low end when working motors are replaced, and higher when new motors would be purchased in the absence of a rebate program).

Motor rebate programs have low costs to the utility per kW or kWh saved. Median program costs are $356/kW and $0.0055/kWh. Even allowing for free riders, motor rebate programs should be cost-effective for nearly all utilities in North America (based on the utility cost perspective). Furthermore, there is some evidence that programs based on high rebate levels (approximately double the level paid by the average program) may be cost-effective as well.

High-efficiency motors represent only one of many opportunities to improve motor system efficiency. A few programs promote adjustable-speed drives. These can produce savings of 20-30% in many applications [24]. Utilities need to focus additional efforts on promoting adjustable-speed drives -- the savings available are significantly greater than the savings available from high-efficiency motors [25]. Additional measures to improve motor system efficiency should also be pursued, including improved matching of motors to the load, improved belts, improved regulation of motor power supply, and improved fans and pumps [26]. In order to tap these savings opportunities, new innovative program approaches will be needed. While some of these measures may be appropriate for retrofit applications, the primary time to pursue many of these measures will be when existing equipment is being replaced.

G. ADDITIONAL READING

Only limited information has been published on motor efficiency programs. Among the more useful are the following publications:

BC Hydro, "High-Efficiency Motor Rebate," information packet (Vancouver, B.C.: BC Hydro).

Lovins, Amory, 1989, The State of the Art: Drivepower (Snowmass, CO: Rocky Mountain Institute).

Northern States Power, 1987, Conservation Improvement Program Annual Report and Evaluation (Minneapolis: Northern States Power).

Ontario Hydro, Marketing High Efficiency Motors (Ottawa, Canada: Ontario Hydro).

Stout, Timothy and William Gilmore, 1989, "Motor Incentive Programs: Promoting Premium Efficiency Motors", paper presented at the ECNE National Conference on Demand-Side Management, November 16-17, 1989, Boston, MA (Westboro, MA: New England Electric).

H. NOTES

1. Baldwin, Samuel, 1989, "Energy-Efficient Electric Motor Drive Systems" in Johansson, Bodlund and Williams, eds., Electricity: Efficient End-Use and New Generation Technologies and Their Planning Implications (Lund, Sweden: Lund University Press), p. 22.

2. Miller, Eto, and Geller, 1989, The Potential for Electricity Conservation in New York State (Washington, D.C.: American Council for an Energy-Efficient Economy), p. 29.

3. Lovins, Amory, 1989, The State of the Art: Drivepower (Snowmass, CO: Rocky Mountain Institute), p. 404.

4. See note #2, p. S-6 and 29.

5. Personal communication with Owen Stevens, BC Hydro, July, 1989.

6. Personal communication with Bruce Mayo, Southern California Edison, June, 1989.

7. This finding is based on motor retrofit costs reported in Seton, Johnson and Odell, Inc., 1987, Report on Lost Conservation Opportunities in the Industrial Sector (Portland, OR: Bonneville Power Administration), p. 39.

8. Personal communications with Derick Henriques and Owen Stevens, BC Hydro, June and July, 1989.

9. Personal communication with, and marketing material supplied by, Jim Patterson, Ontario Hydro, July, 1989.

10. Stout, Timothy and William Gilmore, 1989, "Motor Incentive Programs: Promoting Premium Efficiency Motors", paper presented at the ECNE National Conference on Demand-Side Management, November 16-17, 1989, Boston, MA (Westboro, MA: New England Electric).

11. Personal communications with Bob Tyre, Nevada Power; Randy Gunn, Northern States Power, and Bruce Mayo, Southern California Edison, June and July, 1989.

12. Northern States Power, 1988, Conservation Improvement Program Annual Report and Evaluation (Minneapolis: Northern States Power).

13. Personal communication with John Davies, February, 1989.

14. Personal communication with Tim Stout, New England Electric, September, 1989.

15. Niagara Mohawk, "Niagara Mohawk Power Corporation Motor Retrofit Program, An Industrial Customer Rebate Demonstration, Project No. CIP-17," (Syracuse, N.Y.: Niagara Mohawk).

16. Average efficiency values for new standard and high efficiency motors are from Stout, Timothy and William Gilmore, 1989, "Motor Incentive Programs: Promoting Premium Efficiency Motors", paper presented at the ECNE National Conference on Demand-Side Management, November 16-17, 1989, Boston, MA.

17. Lovins, Amory, 1989, The State of the Art: Drivepower (Snowmass, CO: Rocky Mountain Institute), p. 84.

18. Ibid., pp. 83-84, p. 96.

19. Ibid., p. 397.

20. See note #10.

21. Personal communication with Derick Henriques, BC Hydro, June, 1989.

22. See note #14.

23. See note #10.

24. Impact of Advanced Semiconductor Systems on Utilities and Industry, EPRI EM-2112, 1981 (Palo Alto, CA: Electric Power Research Institute).

25. See note #4.

26. The many opportunities available to improve motor system efficiency are discussed in depth in Lovins, Amory, 1989, The State of the Art: Drivepower (Snowmass, CO: Rocky Mountain Institute).

Chapter 6

GENERAL INDUSTRIAL PROGRAMS

A. INTRODUCTION

Nationwide, the industrial sector accounts for 35% of annual electricity use [1]. In New York State, 21% of annual electricity use is in the industrial sector [2]. In the industrial sector, C&LM opportunities are often very industry-, process- and plant-specific. Analyses of potential electricity savings in the industrial sector deal with this problem by focusing on the most common end-uses (e.g. motors, lighting, process heat, refrigeration, etc.). In New England, potential industrial conservation savings have been estimated at 15-19% [3]. In its study on conservation in New York State, ACEEE estimates a conservation potential of 16% from measures with a cost to consumers of less than $.05 per kWh saved [4].

For this study of utility program experience with C&LM programs, 17 general industrial programs were examined. Included in this figure are several programs, which while predominantly industrial in nature, are also open to the commercial sector. In addition to these programs, there are many predominantly commercial sector multiple end-use programs (discussed in Chapter 10) which are also open to the industrial sector. Basic information on the industrial programs is summarized in Table 6-1. Additional details can be found in the Appendix.

B. PROGRAM TYPES

Unlike lighting, HVAC, and motor programs, where most programs are rebate programs, in the industrial program area, many diverse approaches are being used by utilities, including technical assistance, rebates, grants, loans, shared savings, requests for proposals, and bidding.

Table 6-1
Summary of Industrial Program Results

Utility	State	Program	Program Type	Comm'l or Ind'l	Time Period Start	Time Period End	Pilot or Full-Scale	Number Eligible	Number of Participants Custo-mers	Number of Participants Proj-ects	Cumm. Partici-pation Rate	Customers or Projects?
BPA	WA/OR	Alum Smelter Cons/Modern	RFP	I	6/86	7/89	F	10	9		90.0%	C
BPA	WA/OR	Energy $avings Plan	Incentive	I	12/87	9/88	F	~3000	19		0.6%	C
BPA	WA/OR	Design Wise	TA	I			F					
NU	CT/MA	Customer Initiated	Incentive	C&I			F					
Palo Alto	CA	Partners Elec. Incentive	Incentive	C&I	1985	7/89	F	2,409		11	0.5%	P
Puget P&L	WA	Comm'l Cons. Financing	Grant or loan	C&I	1980	12/88	F	69,236		66	0.1%	P
Snohomish	WA	Ind'l Energy Mgmnt Serv.	TA	I	1/88	12/88	F	~400	35		8.8%	C
So. Cal Ed	CA	Hardware Rebate	Incentive	C&I	1/82	12/84	F	393,754				
So. Cal Ed	CA	Joint Funded Feas. Stud.	TA	C&I	1983	12/86	F			95		
TVA	TN+	Indust'l Energy Services	TA & Loan	I	~1980	9/86	F	6,500	317		4.9%	C
Wisc Elec	WI	Smart Money	Rebate or loan	C&I	6/87	3/89	F	81,750	47	94	0.1%	C
BPA	WA/OR	Sponsor- Designed	RFP	I	1984	1989	P	~800	14		1.8%	C
BPA	WA/OR	Industrial Test Program	TA	I	1984	1986	P		25			
CMP	ME	Shared Savings	Shared svgs	C&I	9/86	12/88	P	45	1		2.2%	C
CMP	ME	Efficiency Buy-Back	RFP	C,I&R	9/86	2/89	P	255	4		1.6%	C
CMP	ME	Power Partners	Bid	C&I	1987	2/89	P					
NEES	MA	Enterprise Zone - Lg C&I	Shared svgs	C&I	8/85	5/87	P	113	8		7.1%	C
PG&E	CA	Industrial Load Shaping	Incentive	I	1986	12/87	P		5			

Utility	State	Program	Estimated Savings Coin. MW	Estimated Savings Absolute MW	Estimated Savings GWh	1987 Peak Demand	Svgs as % of Pk	Coin-cident or Abso-lute	Expenses (Thousands of Dollars) Direct	Expenses Indirect	Expenses Total	Util. Costs $/kW	Direct or Total	Utility Direct Costs $/kWh
BPA	WA/OR	Alum Smelter Cons/Modern		69.00	604.44	16,680	0.41%	A	$30,222			$438	D	0.0087
BPA	WA/OR	Energy $avings Plan		7.82	68.51	16,680	0.05%	A	$1,864			$238	D	0.0047
BPA	WA/OR	Design Wise				16,680								
NU	CT/MA	Customer Initiated				4,242								
Palo Alto	CA	Partners Elec. Incentive		0.82	7.56	182	0.45%	A	$201			$246	D	0.0046
Puget P&L	WA	Comm'l Cons. Financing			23.88	3,528			$1,061	$292	$1,353			0.0072
Snohomish	WA	Ind'l Energy Mgmnt Serv.			0.76	1,156								
So. Cal Ed	CA	Hardware Rebate		0.75	7.33	14,775	0.01%	A	$79			$105	D	0.0018
So. Cal Ed	CA	Joint Funded Feas. Stud.				14,775			$596					
TVA	TN+	Indust'l Energy Services				19,772								
Wisc Elec	WI	Smart Money		3.03	20.11	3,810	0.08%	A	$2,532			$837	D	0.0219
BPA	WA/OR	Sponsor- Designed		28.30		16,680	0.17%	A			$4,800	$170	T	
BPA	WA/OR	Industrial Test Program				16,680								
CMP	ME	Shared Savings	5.50		12.10	1,455	0.38%	C	$650			$118	D	0.0093
CMP	ME	Efficiency Buy-Back			15.00	1,455								
CMP	ME	Power Partners		16.41	86.92	1,455	1.13%	A						
NEES	MA	Enterprise Zone - Lg C&I	6.60	6.60	50.00	2,502	0.26%	C	~$17,650	~$350	~$18,000	$2,727	T	0.0461
PG&E	CA	Industrial Load Shaping	4.00			14,142	0.03%	C			$5,089	$1,272	T	

NOTE:
$/kWh assumes a 10 year average measure life and a 6% real discount rate. For an explanation, see Chapter 1.

Technical assistance programs provide free or subsidized analyses on energy-saving opportunities in industrial facilities. Some programs provide further technical assistance in implementing study recommendations. For example, the Snohomish Public Utility District provides on-site technical analyses to industrial customers on facility and process C&LM opportunities. In addition, specialized information is compiled and made available to the most common industries in their service area. Southern California Edison has a program where it will pay half the cost of a detailed technical analysis prepared by independent engineers. The Bonneville Power Administration (BPA) Design Wise program provides engineering reviews of new construction and expansion plans. Site visits to discuss electrotechnologies are also part of the program. This program is unique in that it concentrates on new facilities and process lines. Most programs are limited to existing facilities and production lines.

A number of utilities offer financial incentives for industrial process improvements. Incentives are typically paid per kW or kWh of savings. Some utilities pay a set proportion of the measure cost. For example, Puget Power & Light pays 50-80% of the measure cost, where the incentive varies with the type of measure being funded. In a few cases (BPA's Sponsor-Designed Program and Northeast Utilities' Customer Initiated Program), the customer share of measure costs is capped at a three-year simple payback and the utility pays all additional costs, up to the utility's cost-effectiveness limit. Several utilities offer loans instead of grants. Wisconsin Electric and Puget Power and Light both give customers a choice of a grant or a zero interest loan. The Tennessee Valley Authority (TVA) only offers loans; the interest rate is based on TVA's cost of borrowing and administration, and is typically just below the prime interest rate.

Several utilities offer less conventional program structures. Central Maine Power (CMP) and BPA have both issued Requests for Proposals (RFPs) asking customers to submit proposed projects and subsidy requests. Winning proposals are selected based on the quality of the proposed project, when the proposal is submitted (first come, first served), and in the CMP case, the amount of subsidy requested. CMP also offers another program, Power Partners, where large customers and energy service companies' submit bids on how much saved energy they can "supply" and at what cost. Winning bids are selected based on project quality and the amount bid. Several utilities (CMP and New England Electric) have offered shared savings programs where the utility or independent energy service companies finance and install energy-saving measures in exchange for the customer sharing the money saved with the financing organization.

C. PARTICIPATION

Most industrial C&LM programs offered to date are either small-scale programs or are just getting going. Thus, only limited participation data are available.

BPA's Aluminum Smelter Conservation/Modernization program is a special program to fund conservation improvements among the ten large aluminum smelters in their service territory. The aluminum industry is under intense pressure from foreign competition and is very interested in cost-cutting measures. Electricity is a major cost of doing business for the aluminum industry. All eligible customers participated in the planning and design of the program. Once the program plan was finalized, all eligible customers but one elected to participate. This program features only modest incentives ($0.005/kWh saved over a 10 year period). Engineering analyses are all done by the aluminum companies' in-house staff [5].

New England Electric System (NEES) reached 7% of eligible customers with its Enterprise Zone Large C&I Program. This program was a pilot shared savings program available to 113 customers with peak demand of 100 kW or greater. All eligible customers were contacted by utility representatives and over 80% expressed interest in the program. However, energy service companies were only interested in working with 13 customers (12% of the targeted customer base), primarily very large firms with cogeneration opportunities. Financial incentives were very high in this program ($.07/kWh saved for up to 10 years) [6].

The Snohomish Public Utility District has reached nearly 9% of its industrial customers with its Industrial Energy Management Service Program. The above average participation rate is attributable to the small number of targeted customers and one-on-one marketing efforts by utility field representatives.

TVA has operated a technical assistance and loan program since 1980. Over this period, approximately 5% of eligible customers have participated. However, program marketing, which is based on personal contacts with eligible customers, concentrates on large customers (monthly use of 100 MWh or more). Among this target group, participation has been approximately 10% [7].

CMP has run three programs (a bidding, an RFP and a shared-savings program) which together have reached a number of very large customers. While the participation rates (number reached as a percent of the number eligible) are generally low, a number of large customers have participated, allowing the total savings, as a percentage of the utility's peak demand to approach 2%. CMP has found that each of these three programs serves a different market niche. The bidding program generally offers the highest incentives but requires going through a complex bidding process. This program has received the greatest customer interest of late. The RFP program provides a straightforward way to get a moderate subsidy. This program has received moderate customer interest. The shared savings program appeals to customers who have difficultly obtaining financing on their own. Only a small number of customers have been interested in this program. [8]

All other industrial programs have reached less than 5% of eligible customers. Some of these other programs teach some interesting lessons.

BPA conducted a pilot industrial audit program which was designed to investigate industrial energy audit procedures on a sample of 25 industrial customers. While capturing energy savings was not the primary objective of the program, BPA did collect data on adoption of audit recommendations. Only a small proportion of the recommendations were adopted. A process evaluation on the program attributes the low adoption rates to: (1) measure simple payback periods which exceed plant investment thresholds (typically two to three years); (2) limited capital availability; (3) concerns about plant downtime, project supervision time and/or potential maintenance problems; and (4) uncertainty about savings estimates. [9]

Both Wisconsin Electric and Puget Power give customers a choice of a grant or zero interest loan. Both have found that over 90% of customers choose the grant. However, both acknowledge that loans are still useful for the minority of customers who are unable to obtain financing [10].

BPA's Sponsor-Designed program was an RFP program which required customers to pay measure costs up to a three-year simple payback. Beyond this threshold, BPA paid all costs up to its cost-effectiveness threshold. The process evaluation on this program found that the three-year payback criteria exceeded the investment threshold of many firms. BPA has subsequently moved to a $/kWh incentive. This process evaluation also found that due to the competitive nature of the project selection process, many firms were unwilling to invest in proposal preparation unless projects were already under consideration at the plant. Furthermore, the short (two month) period during which proposals were selected did not correspond to the capital budget cycle at most plants. BPA has subsequently moved to an open process where proposals may be submitted at any time. [11]

BPA now operates the Energy $avings Plan program which pays incentives of $.05 per first-year kWh saved. The objective of the program is to encourage the adoption of industrial process improvements with short payback periods. This program has only had moderate participation, due in part to only limited marketing efforts by BPA and the sponsoring utilities. A process evaluation on the program recommended additional field visits and technical assistance to encourage participation, a rapid review process for proposals submitted by customers, and a simple contract [12]. BPA is also considering raising the incentive [13]. Northeast Utilities offers a similar program but pays $.10 per first-year kWh saved from industrial process improvements.

D. MEASURES IMPLEMENTED

Measures implemented through programs have varied widely. Among the first 19 measures funded through BPA's Energy $avings Plan were seven refrigeration upgrades (primarily new computer control systems), six motor upgrades (primarily adjustable-speed drives), and three electrochemical process improvements [14]. NEES's shared savings program primarily involved cogeneration systems, lighting improvements, and energy management systems [15]. CMP's programs primarily include a mixture of motor, lighting and industrial process improvements [16].

Only one of the utilities has estimated program savings as a proportion of pre-program electricity use. In the NEES Enterprise Zone program, savings averaged 36%. However, over 90% of these savings are due to installation of large cogeneration systems, which were an eligible measure under the program [17].

E. FREE RIDERS

Data on free riders in industrial C&LM programs are limited, but the available data indicate that only a small proportion of participants are free riders. For the NEES program, an evaluation estimated that 5% of the savings are due to free riders [18]. In the BPA Sponsor-Designed program, the process evaluation estimated that only one or two of the 14 participants were free riders [19].

F. COST-EFFECTIVENESS

General industrial C&LM programs have generally had low utility costs. Most programs have cost utilities less than $500/kW saved (median of $246) and less than $0.01/kWh saved (median of $0.008). Program costs per kW saved range from $105-2,727. All but three programs cost utilities less than $500/kW. Only two programs cost utilities over $1,000/kW -- a shared-savings program which paid very high incentives and a combined load shifting/load building program which by definition has achieved only limited kW savings. Utility program costs per kWh saved range from $0.0018-0.0461.

At these cost levels, for all of the industrial programs examined, utility costs per kW or kWh saved are less than the long-term avoided costs of all New York State utilities. Thus, from the utility perspective, these programs are likely to be cost-effective to New York utilities. Data on costs incurred by customers who participated in these programs are not available, so cost per kW or kWh cannot be calculated from the total resource cost perspective. However, given the reluctance of industrial customers to invest in energy-saving measures with simple paybacks beyond approximately two years, it is likely that customer investments are limited and hence costs from the total resource perspective are only moderately greater than utility costs. If this is the case, all or nearly all of the programs examined are likely to have a total resource cost less than the avoided costs of New York utilities.

G. CONCLUSIONS

General industrial C&LM programs exhibit a wide array of program choices. Many programs are pilot or start-up programs. Considerably more experimentation needs to take place before definitive conclusions can be drawn.

Most programs have reached less than 3% of eligible customers. However, a few programs have reached a higher proportion, including one program which reached nine out of ten of its eligible customers. Programs with above average participation rates exhibit some or all of the following characteristics:

* Extensive involvement of targeted customers in the planning process.

* Personal one-on-one marketing including provision of technical assistance as needed (some large customers with extensive in-house engineering staffs do not need this assistance). Where technical assistance is needed, due to the specialized nature of many industrial energy saving opportunities, utilities often have to hire outside technical experts.

* Flexibility in measures funded, application deadlines, and other program requirements to meet customer needs (e.g. avoiding disruptions to the production process).

* Targetting of a customer base that is interested in cutting electricity costs and/or in modernizing their facilities in order to meet competitive pressures.

* Inclusion of financial incentives. Industrial customers report they are primarily interested in measures with a simple payback period of two to three years or less. The greater the incentive, the more measures which qualify. All other things being equal, programs with high incentives tend to have above average participation, while programs with little or no incentives often have disappointing participation rates. Industrial customers tend to prefer simple grants or rebates to loans or to grants for expenses above a specified payback period. However, this conclusion is based on programs which require customers to pay all expenses up to a three-year simple payback. Customers may be more open to a payback-based incentive if the payback threshold is only one to two years. A minority of industrial customers have difficultly obtaining financing. For these customers, loans or shared savings programs are useful.

Little information on program savings as a percent of pre-program customer electricity use is available. There is a need for utilities to collect and report this information so that estimates of achievable energy savings can be developed.

The limited data available suggests that free riders are not a significant problem with the current crop of general industrial C&LM programs.

Current industrial C&LM programs are generally low in cost -- most programs cost utilities less than $.01 per kWh saved.

While much has been learned about how utilities can promote industrial energy-saving opportunities, extensive additional work is needed. Participation rates have generally been low -- creative approaches are needed if high participation rates are to be achieved. Many programs have concentrated on lighting, motor and cogeneration measures -- additional efforts are needed if energy saving opportunities in industrial processes are to be extensively tapped. Likewise, most programs have concentrated on retrofits to existing plants and production processes. Much greater savings are probably available when new plants, equipment, and process lines are being designed and installed. Several programs have recently begun which try to address some of these issues (e.g. BPA's Design Wise and Energy $avings Plan). Hopefully these efforts are the first of many new innovative efforts in the industrial program area.

H. FURTHER READING

Among the more useful publications on industrial program design are the following:

Gustafson, Greg and Jane Peters, 1987, Process Evaluation of the Industrial Test Program, Final Report (Portland, OR: Bonneville Power Administration).

Linn, Jonathan, 1989, "Energy Management for Large Commercial and Industrial Utility Customers," in Demand-Side Management Strategies for the 90s, Proceedings: Fourth National Conference on Utility DSM Programs, CU-6367 (Palo Alto, CA: Electric Power Research Institute), Section 64.

Peters, Jane and Greg Gustafson, 1987, Process Evaluation of the Sponsor-Designed Site Specific Program (Portland, OR: BPA).

Peters, Jane, 1988, "Lessons in Industrial Conservation Program Design" in Proceedings of the 1988 ACEEE Summer Study on Energy

Efficiency in Buildings (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. 6.177-6.186.

Peters, Jane, 1989, Interim Process Evaluation of the Bonneville Power Administration's Energy Savings Plan (E$P) Program (Portland, OR: BPA).

I. NOTES

1. Energy Information Administration, 1989, Annual Energy Review 1988 (Washington, D.C.: U.S. Government Printing Office), p. 13.

2. Miller, Eto and Geller, 1989, The Potential for Electricity Conservation in New York State (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. S-5 to S-7.

3. Synergic Resources Corp., in a 1989 study for Northeast Utilities, estimates a total conservation potential over ten years of 15.6% in the 57.2% of total industrial electricity sales covered by the analysis, including savings of approximately 13% at a cost of less than $.05 per kWh saved (Synergic Resources Corp., 1989, Appendix D: Assessment of Industrial DSM Potential in Northeast Utilities Service Territory (Hartford, CT: Northeast Utilities). The New England Energy Policy Council estimates total industrial conservation potential of 19% from commercially available measures with a cost of less than approximately $.025/kWh (New England Energy Policy Council, 1987, Power To Spare, A Plan for Increasing New England's Competitiveness Through Energy Efficiency (Boston, MA: New England Energy Policy Council).

4. See note #2, p. S-7.

5. Personal communication with Tom von Muller, BPA, July, 1989.

6. New England Electric, 1988, Evaluation Report on Massachusetts Electric Company's Enterprise Plan, Executive Summary (Westboro, MA: New England Electric), pp. 1.1-1.3.

7. Personal communication with Jim West, TVA, March, 1989. Also, TVA, 1986, Conservation Report '86 (Knoxville, TN: TVA), p. 25.

8. Personal communications with Jon Lynn, CMP. Also, CMP, 1989, Energy Management Report 1988 (Augusta, ME: CMP).

9. Gustafson, Greg and Jane Peters, 1987, Process Evaluation of the Industrial Test Program, Final Report (Portland, OR: Bonneville Power Administration).

10. Based on data provided by Peggy Clippert, Wisconsin Electric Power Company and Sid France, Puget Power and Light.

11. Peters, Jane and Greg Gustafson, 1987, Process Evaluation of the Sponsor-Designed Site Specific Program (Portland, OR: BPA). Also, BPA, 1988, Guidelines for Proposing an Energy $avings Plan Efficiency Project (Portland, OR: BPA).

12. Peters, Jane, 1989, Interim Process Evaluation of the Bonneville Power Administration's Energy Savings Plan (E$P) Program (Portland, OR: BPA).

13. Personal communication with Rod Aho, BPA, July, 1989.

14. Personal communication with Phyllis Evans, BPA, March, 1989.

15. Personal communication with Peter Bardhi, New England Electric, November, 1987.

16. Personal communications with Jon Lynn, Central Maine Power. Also, Efficiency Buyback program brochure.

17. See note # 6, p. 1.6.

18. Ibid.

19. Peters, Jane and Greg Gustafson, 1987, Process Evaluation of the Sponsor-Designed Site Specific Program (Portland, OR: BPA), p. 19.

Chapter 7

STORAGE COOLING AND THERMAL AIR CONDITIONING PROGRAMS

A. INTRODUCTION

Storage cooling is a load management strategy which involves producing chilled water or ice during off-peak periods and then using this stored water or ice to help meet building cooling requirements during peak periods. Under this strategy, peak demand is reduced because the main cooling system is turned off or throttled back during peak periods. In addition, in new buildings, use of cold storage often allows the distribution system to be down-sized, resulting in additional energy savings [1].

Thermal air conditioning involves the use of gas or steam to power an air conditioning cycle. In a conventional, electrically powered cooling system, an electric motor operates the compressor which drives the air conditioning cycle. One type of gas air conditioner uses a natural gas-powered motor to power the compressor which in turn drives the air conditioning cycle. Another type of thermal air conditioner uses heat (typically from natural gas combustion or steam) to drive an absorption cooling cycle in which pressure changes are driven by an absorber-generator instead of a compressor. With these systems, since gas or steam is used to power cooling equipment, electricity use is limited to powering fans and pumps. These systems generally take up less space than storage cooling systems [2]. Gas absorption systems are probably the most common type of thermal air conditioner today. Systems are available from 10-1,500 tons of capacity [3]. Steam systems are generally limited to urban areas served by steam utilities or to facilities which generate steam for cogeneration or process purposes.

The economics of storage cooling and thermal air conditioning systems depend on many factors, most importantly local gas and electric rates, site-specific installation costs (e.g., Is gas service already in the building? Is there sufficient space for storage cooling tanks?), and the availability of rebates [4]. Nationwide, the potential for storage cooling systems in the commercial sector in the year 2000 has been estimated at approximately 17 GW, which is approximately 10% of commercial sector peak demand [5]. In New York State, ACEEE has estimated that storage cooling systems can reduce summer peak electricity demand in the commercial sector by 660 MW (6.6% of the 1986 commercial sector summer peak) [6]. Nationwide, the American Gas Association has estimated that gas systems cool 5% of all air conditioned buildings, that sales of gas cooling equipment have been growing for the past few years and that continued growth can be expected [7]. No assessments of the potential for thermal air conditioning in New York State have been made.

For this study, ACEEE examined 20 storage cooling programs and eight thermal air conditioning programs. We did not attempt to do an exhaustive survey of all programs in the U.S. as several comprehensive studies on programs in these areas have recently been conducted [8]; we did not think it would be worthwhile to replicate these efforts. In addition to programs targeted specifically at storage cooling and thermal air conditioning, a number of the new construction and multiple end-use programs (discussed in Chapters 8 and 10) also promote storage cooling and thermal air conditioning. Summary information on the storage cooling and thermal air conditioning programs studied for this report is contained in Table 7-1. Additional details on these programs can be found in the Appendix.

B. PROGRAM TYPES

Storage cooling programs generally consist of a number of components including marketing, education, technical assistance, rates, and rebates. Most programs contain many of these components but only some programs contain all of these components.

Table 7-1
Summary of Cool Storage and Thermal Air Conditioning Program Results

Program Code	Utility	State	Program	Incentive $/kW	Free Scoping Study?	Feas-ability Study?	TOU Rates?	Time Period Start	Time Period End	Number of Projects Com-ple-ted	Number of Projects Con-trac-ted	Coin. MW Savings Com-ple-ted	Coin. MW Savings Con-trac-ted	1987 Peak Demand	Svgs as % of Pk	Expenses (Thousands of Dollars) Direct	Expenses Indirect	Expenses Total	Util. Costs $/kW	Direct or Total
CS	AZ Pub Serv	AZ	STEP	$115-250			Yes	6/85	3/89	13	15	~4.5	~12.5	3,126	0.54%	~$1,000			$222	D
CS	BECo	MA	Cool Storage Incentive	$200		50%	Yes	1986	12/88	1	8	0.60	3.28	2,477	0.16%	$120	$382	$502	$837	T
CS	Con Ed	NY	Thermal Energy Storage	$500		50%	Yes													
CS	Jersey Cent	NJ	Thermal Storage Clg Reb.	$125-250			Yes	1987	12/88	0	7	0	~5	3,766	0.13%					
CS	LA Dept W&P	CA	Off-Pk Clg Cash Rebates	$250		50%	Yes	5/87	12/88	2		0.86		4,922	0.02%			$640	$743	T
CS	LILCO	NY	Dollars and Sense	$300-500			Yes	10/86	9/88	1		0.14		3,576	0.00%	$41			$288	D
CS	NEES	MA/RI	Storage Cooling	$160	Yes	100%	Yes	7/87	12/88	0	12	0	12.9	3,798	0.34%			$1,435		
CS	NSP	MN	Cool Storage A/C	$40-300/ton		75%	Yes	85/86	12/87	5	0	0.38	0	5,543	0.01%	$85	$100	$185	$485	T
CS	Or. & Rock.	NY	Cool Reserve	$250	Yes		Yes			0	0	0	0	892	0.00%					
CS	Palo Alto	CA	New Constr. Incentive	$300		50%	Yes	1988	7/89	1	3	0.17	0.62	182	0.43%	$67			$400	D
CS	Palo Alto	CA	Partners Elec. Incentive	$300-550		50%	Yes	1985	12/88	2	0	0.97	0	182	0.54%	$536			$550	D
CS	PG&E	CA	Thermal Energy Storage	$200			Yes	1985	12/87	36	48	8.5	6.8	14,142	0.11%	$2,500			$294	D
CS	PSE&G	NJ	Cool Storage Rebate	$125-250			Yes	1987	7/89	0	3	0.00	1.36	8,137	0.02%					
CS	Riverside	CA	Thermal Energy Storage	$200		50%	Yes	1/88	2/89	0	0	0	0	318	0.00%					
CS	Salt R Proj	AZ	Thermal Energy Storage	$60-250	Yes		Yes	1986	2/89	10		2.79		2,785	0.10%					
CS	SDG&E	CA	Thermal Energy Storage	$50-200	Yes		Yes	1985	6/89	32	45	~6	22	2,374	1.18%	$7,200	$1,100	$8,300	$296	T
CS	SMUD	CA	Thermal Energy Storage			100%	No	1987	12/88	1	3	0.34	2.16	1,902	0.13%	$84	$335	$419	$1,247	T
CS	So. Cal. Ed	CA	Off-Peak Cooling	Typ. $200		50%	Yes	1981	12/88	~275		89		14,775	0.60%			$16,604	$187	D
CS	Texas Util.	TX	Thermal Cool Storage	$125-350	Yes		Yes	1984	1988	73		33.1		16,680	0.20%	~$8,000	~$1,000	~$9,000	~$250	T
CS	United Illm	CT	Cool Storage	$150	Yes		Yes	1988	12/88	0	6	0.00	4	1,072	0.37%	$600	~$150	~$750	$188	T
TAC	Boston Gas	MA	Gas A/C Rebate	$100/ton	Yes			1988	11/89	4		0.50				$52			$105	D
TAC	Con Ed	NY	Gas Space Conditioning				Yes	12/88	12/88		1		0.40	9,386	0.00%					
TAC	Con Ed	NY	Steam Space Conditioning	$100-230 ton			Yes	7/87	12/88	56		56		9,386	0.60%					
TAC	LILCO	NY	Dollars and Sense	$300			Yes	10/86	9/88	2		0.37		3,576	0.01%	$107			$288	D
TAC	Or. & Rock.	NY	Non-Electric A/C	$250	Yes		Yes	1/89						892						
TAC	Peoples Gas	IL	Gas A/C Promotion	$100-150/ton				1987	2/89	28	3	1.37	1.44							
TAC	SDG&E	CA	Gas A/C	$50-200	Yes		Yes	1985	6/89	12	23	2.5	11	2,374	0.57%	$2,200	$381	$2,581	$191	T
TAC	Tenneco	TX	Mkt Specific Project	$100/ton				1988	12/88	11		1.58				$112			$71	D

Notes:
When utility supplied data for completed and contracted systems is combined, data is listed in the completed column.
Data on program expenditures sometimes is for completed projects and sometimes is for both completed and contracted projects. Calculations of $/kW are based on either completed or contracted data, depending on which data is available for a particular program.

Marketing consists of promoting the program to building owners, developers, and architects and engineers who make cooling system design decisions. Most utilities use a combination of direct mail and personal contacts.

Education consists of educating the target audience on the benefits and practical applications of cool storage systems. Popular approaches include educational publications, seminars for architects, engineers and contractors, preparation of case studies on storage cooling installations, and tours of completed installations.

Technical assistance activities help design professionals assess whether storage cooling makes sense for a particular project and provides support in system design. Technical assistance activities include free "scoping studies" which provide an approximate assessment of the costs and savings of a storage cooling system, detailed engineering feasibility studies (occasionally performed by the utility but more often conducted by a private consulting engineer under a cost-sharing arrangement between the utility and the customer), consulting assistance provided to a project's design team, and review of cooling system plans.

Rates are an important determinant of the economic viability of a storage cooling system. In order to justify the expense of installing a storage system, building owners need a rate incentive (high on-peak rates and/or low off-peak rates) to provide the operating cost savings needed to justify the initial investment. These incentives typically take the form of time-of-use rates, which differentiate the cost of electricity by hour of use. High demand charges for on-peak use are also common. Generally, the bigger the differential between peak and off-peak rates, and the shorter the peak demand period (i.e., less hours per day), the greater the incentive for storage cooling systems [9].

Rebates are designed to help offset the first cost of storage systems (however, in some cases, particularly with large systems, the cost of the storage system may be offset by savings resulting from the use of downsized system components [10]). Rebates typically take the form of payments per kW shifted off-peak. These rebates range from a low of $50/kW to a high of $550/kw. A few utilities provide rebates per ton of cooling capacity or per ton-hour of storage capacity.

Thermal air conditioning programs are similar in many respects to storage cooling programs. They also typically contain marketing, education, technical assistance and rebate components. Some gas utilities also provide special rates for gas air conditioning systems [11]. Thermal air conditioning programs are offered by retail gas utilities, wholesale gas distributors, combined electric and gas utilities, and electric-only utilities. Technical assistance activities are generally more limited in thermal air conditioning programs than in storage cooling programs; of the thermal air conditioning programs studied in our project, only two provide scoping studies and none provide feasibility studies. A major emphasis of gas cooling marketing efforts is to provide cost and performance data on gas and electric cooling systems to key HVAC decision makers. Rebates for thermal air conditioning are generally per ton of equipment capacity, although electric utilities often provide rebates per kW of electric load displaced.

An intriguing program approach that has yet to be tried is for the utility to provide performance guarantees for storage cooling or thermal air conditioning systems. This approach, which is suggested by Piette, et al. [12], is designed to address user uncertainties about the performance of new types of equipment. This guarantee could supplant the need for financial incentives for systems with rapid payback periods (e.g. less than three years). For applications where payback periods are longer, financial incentives would still be needed to reduce the first cost of the storage cooling or thermal air conditioning system to the point that most developers would consider them financially attractive.

C. PARTICIPATION

Most cool storage systems are installed in new facilities, because (1) it is easier to create space for the storage tanks in a new facility than in an existing facility, and (2) it is easier and less costly to design and construct the systems in new buildings. Since so many systems are installed in new buildings, calculating participation rates based on the number of existing C&I customers is meaningless. Instead, in order to identify which programs have the highest participation rates, we focused on reductions in peak demand (from completed projects as well as those under contract) as a percentage of the utility's total peak demand.

San Diego Gas and Electric (SDG&E) has reduced peak demand by 1.75% over four years with their storage cooling and gas air conditioning programs. Two-thirds of the savings are from storage cooling and one-third from gas air conditioning. The gas air conditioning program has 35 projects totaling 13.5 MW under contract, making this the largest gas air conditioning program in our study (see Table 7-1). Participation has been encouraged by very high on-peak demand charges ($14.42/kW) and by steep off-peak discounts in electricity charges (discounts of $0.032-0.039/kWh). In addition, SDG&E has an active marketing program (including personal contacts, trade shows, seminars and a C&I newsletter) and provides free scoping studies. Incentives in this program range from $50-200/kW shifted, less than most other utilities are providing. Unique among utilities, SDG&E varies the incentive according to the cost-effectiveness of the specific installation to the customer and the utility [13].

The City of Palo Alto has reduced peak demand by nearly 1% as a result of their program over a four-year period. This program features one-on-one marketing with developers, architects and engineers, jointly funded feasibility studies, plan reviews, limited engineering assistance and high incentives (up to $550/kW for retrofit projects in the early years of the program -- incentives have since been reduced to $300/kW) [14].

Southern California Edison (SCE) has helped support the installation of over 200 storage cooling systems totaling 89 MW of shifted load over an eight-year period. The load shift totals 0.6% of their peak demand. This program features a special "super off-peak rate" for storage cooling customers, jointly funded feasibility studies and incentives for system installation [15]. SCE estimates that their incentive payments have reduced average system simple payback periods from 5.6-7.1 years down to 4.4 years [16]. Simple payback periods for individual systems are highly variable and depend on many site-specific considerations.

Arizona Public Service has reduced its peak demand by 0.54% over four years with its storage cooling program. The program features personal contacts with engineers and free scoping studies [17].

New programs offered by United Illuminating and New England Electric have achieved impressive results in just one to two years.

The United Illuminating (UI) program has contracts totaling 0.37% of the utility's peak demand after one year. UI has three full-time sales engineers dedicated to the program. These engineers market the program one-on-one, provide economic analyses, plan reviews and other technical assistance [18].

The New England Electric program has contracts totaling 0.34% of the utilities peak demand after one-and-a-half years of operation. The program features personal marketing by field representatives, technical seminars, scoping studies, free feasibility studies (at the utility's option), plan reviews, and engineering consultation. Through the end of 1988, the program offered only moderate incentives ($160/kW shifted). Furthermore, the company's demand charges and off-peak discounts are low and only provide limited incentive for the installation of storage cooling systems. The program's success must be credited to their marketing, education and technical assistance efforts. In 1989, the incentive was increased to $10-80/ton-hour of storage capacity (approximately equivalent to $35-300/kW). Higher incentives are paid for small projects and for full-storage projects (projects which shift all cooling loads off-peak) than for large and partial storage projects (projects which shift only part of the cooling load off-peak). Small systems receive higher incentives because they generally have higher costs per ton-hour of storage than large systems. Full-storage systems are favored because they provide greater load relief to the utility [19].

Consolidated Edison offers a steam air-conditioning program which has been very successful. Con Ed sells steam to customers in mid-town Manhattan. In the summer, much of this steam powers absorption cooling systems. However, the old absorption cooling systems were inefficient. As they wore out, customers were installing electric systems, contributing to Con Ed's peak electric demand. To stem the loss of steam air conditioning customers, Con Ed provides $100-230/ton to pay the first cost difference between a new, high-efficiency steam air conditioning system and an electric system. After one-and-a-half years, the program has reached 12% of eligible customers and has saved 0.6% of Con Ed's peak electric demand. The program has been more successful than expected due to extensive marketing efforts by manufacturers of steam air conditioning equipment [20].

Programs offered by Texas Utilities, Commonwealth Edison and People's Gas are also worthy of mention.

Texas Utilities (TU) has completed over 70 storage cooling projects totaling 33 MW, making the program second only to Southern California Edison's in absolute size. These savings amount to 0.2% of the utility's peak demand. The TU program includes five to six full-time employees who provide marketing, scoping studies and design assistance. The role of the program in meeting corporate goals is clearly articulated to the program staff. The program also includes preparation of an extensive set of case studies and monitoring of actual system performance. During 1984, TU estimates the program reached 38% of new office buildings greater than 50,000 square feet in Dallas, Texas. In recent years TU has promoted systems for smaller buildings as well as for retrofit projects. The retrofit efforts have only been moderately successful -- approximately ten such projects have been completed. Another interesting feature of the program is that when a customer's system accidentally operates on-peak, on a case-by-case basis, they will consider excusing the error when calculating peak demand for billing purposes [21].

Commonwealth Edison has shifted 15 MW of load (0.1% of their peak load) with a program that provides no rebates. Instead, their program features design assistance and informational seminars aimed at engineers, architects, plant managers and developers. Program impact is attributed to high on-peak demand charges ($13.34/kW in the summer) and to a few dynamic design engineers in the area who promote storage cooling systems [22].

People's Gas operates one of only two gas air conditioning programs in our study which has achieved savings of at least 2 MW. The People's Gas program has contracted for 31 systems including six large commercial systems and 25 small residential systems. The program is marketed through personal contacts, bill inserts and advertisements, and includes a component to educate prospective customers about system types and economics [23]. The success of this program can be attributed in part to high demand charges billed by the local electric utility.

D. SAVINGS

A properly designed and operated system can displace up to 100% of the load of a building's cooling compressor (pumps and fans still operate on-peak). Sometimes, in order to reduce the size and expense of a system, only a partial storage system is installed. Even when full storage systems are installed, systems are prone to considerable errors in design and operation, so that many systems do not shift 100% of the load 100% of the time. These errors are often corrected during the first few years of system operation. In fact, Southern California Edison now has a regular program to monitor system performance in order to correct operating problems [24]. An additional problem is that since most utilities pay incentives based on the amount of load shifted, there may be a tendency by some engineers to overestimate the load shift in order to increase the amount of the incentive. While most utilities check engineering calculations, these checks probably do not correct the problem in all situations [25].

E. PROGRAM COST-EFFECTIVENESS

Cool storage and thermal air conditioning programs generally have only modest costs for the utility per kW shifted. The storage cooling programs in our study range in utility cost from $188-1,247/kW shifted (median $296). Only three programs cost over $600/kW. All three of these are start-up programs with substantial marketing and technical assistance costs but only a limited number of systems under contract. Thermal air conditioning programs range in utility cost from $71-288/kW saved. These low costs are due to the modest services and incentives provided by most programs. Both storage cooling and thermal air conditioning programs appear to have a very low number of free riders, since system installations in the absence of a utility program are limited. Data on customer costs for the individual utility programs are not available, so the cost-effectiveness of storage cooling and thermal air conditioning programs cannot be appraised from the total resource cost perspective.

The cost-effectiveness of storage cooling and thermal air conditioning programs depends in part on the value of summer capacity to the individual utilities. For summer peaking utilities in New York, from the utility perspective, typical program costs are generally less than long-term avoided capacity costs. For winter peaking utilities the cost-effectiveness of storage cooling and thermal air conditioning programs will depend on: (1) how much summer peaking utilities will pay for additional summer peaking capacity (storage cooling can free up summer capacity for sale) and (2) the availability of transmission capacity to wheel power to summer peaking utilities. If transmission capacity is available, and summer peaking utilities are prepared to pay more for capacity than the cost of a storage cooling or thermal air conditioning program, then these programs will likely be cost-effective to winter-peaking utilities.

F. CONCLUSIONS

Storage cooling and thermal air conditioning both have the potential to substantially reduce peak air conditioning requirements.

Many programs have had impressive participation rates. For example, San Diego Gas and Electric, United Illuminating, the City of Palo Alto and New England Electric are reducing their peak demand by approximately 0.2-0.4% per year with their storage cooling and thermal air conditioning programs. Texas Utilities reports reaching 38% of large buildings built in Dallas in a single year. Consolidated Edison has reached 12% of its steam service customers in just over a year.

The successful programs combine all or most of the following features:

* A marketing effort which emphasizes regular one-on-one contacts with architects, engineers and building developers.

* Education efforts, including seminars and case studies, to inform the target audience about the virtues and technical details of storage cooling and/or thermal air conditioning systems.

* Technical assistance (scoping studies and/or feasibility studies) to determine if storage cooling and/or thermal air conditioning is viable for a particular project.

* Time-of-use electric rates, discount gas air conditioning rates and/or high peak electric demand charges.

* Rebates to reduce the initial costs of storage cooling or thermal air conditioning equipment.

Most programs have primarily reached new construction projects. It is more difficult to promote installations in existing buildings and in small buildings. To deal with these problems, some utilities offer greater rebates for projects in existing buildings or in small buildings. Additional work is needed in this area.

Storage cooling systems generally function well after a few initial shake-out years. However, system design and operating problems are not uncommon. Increased utility efforts to monitor system performance are justified, so that operating problems can be identified and solved.

Storage cooling and thermal air conditioning programs are generally moderate in cost to the utility (typically $100-500 per kW shifted or saved) and are likely to be cost-effective (from the utility perspective) for summer peaking New York utilities as well as for winter peaking utilities who can cost-effectively wheel power to summer peaking utilities.

G. ADDITIONAL READING

Among the more useful reports on storage cooling, thermal air conditioning, and programs to encourage their use are the following:

American Gas Association, 1988, "Gas Cooling Vs. Thermal Energy Storage: Peak-Shaving Options", Issue Brief 1988-6 (Arlington, VA: AGA).

American Gas Association, 1988, "1988 Commercial Gas Cooling Fact Sheet and Market Assessment (Arlington, VA: AGA).

McDonald and Davis, <u>Cool Storage Marketing Guidebook</u>, EM-5841 (Palo Alto, CA: Electric Power Research Institute).

Piette and Harris, 1988, Program Experience Report: Commercial Cool Storage, LBL-25782 (Berkeley, CA: Lawrence Berkeley Laboratory).

Piette, Mary Ann and Edward Wyatt, 1988, "Measured Energy Performance of Cool Storage in Commercial Buildings: An Update of BECA-LM" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings, pp. 3.215-3.227.

Piette, Wyatt and Harris, 1988, Technology Assessment: Thermal Cool Storage in Commercial Buildings, LBL-25521 (Berkeley, CA: Lawrence Berkeley Laboratory).

Sterrett, Strickler and Steudtner, 1989, "Load Reduction and Operations Performance of Commercial Cool Storage Systems" in Demand-Side Management Strategies for the 90s, Proceedings: Fourth National Conference on Utility DSM Programs, EPRI CU-6367 (Palo Alto, CA: Electric Power Research Institute), pp. 66-1 to 66-13.

Wirtshafter and Shinn, 1988, "Marketing Efforts by Gas Utilities to Promote Cogeneration and Gas Air-Conditioning" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. 4.137.

H. NOTES

1. Many publications are available which explain this technology in more detail. See for example Piette, Wyatt and Harris, 1988, Technology Assessment: Thermal Cool Storage in Commercial Buildings, LBL-25521 (Berkeley, CA: Lawrence Berkeley Laboratory).

2. Additional information on thermal cooling technologies is contained in a number of publications. See for example American Gas Association, 1986, Natural Gas Cooling (Arlington, VA: American Gas Association). Also, EPRI, 1985, "Gas Air Conditioning Technology" (Palo Alto, CA: Electric Power Research Institute).

3. Wirtshafter and Shinn, 1988, "Marketing Efforts by Gas Utilities to Promote Cogeneration and Gas Air-Conditioning" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. 4.137.

4. Personal communication with Linda Linderman, San Diego Gas and Electric , July, 1989. Also, American Gas Association, 1988, "1988 Commercial Gas Cooling Fact Sheet and Market Assessment Summary", Issue Brief 1988-15 (Arlington, VA: AGA).

5. Lann, R.B., et. al., The COMMEND Planning System: National and Regional Data and Analysis, EM-4486 (Palo Alto, CA: Electric Power Research Institute).

6. Miller, Eto and Geller, 1989, The Potential for Electricity Conservation in New York State (Washington, D.C.: American Council for an Energy-Efficient Economy), p. 183.

7. American Gas Association, 1988, "1988 Commercial Gas Cooling Fact Sheet and Market Assessment Summary", Issue Brief 1988-15 (Arlington, VA: AGA).

8. Two major studies have recently looked at utility storage cooling programs: Piette and Harris, 1988, Program Experience Report: Commercial Cool Storage, LBL-25782 (Berkeley, CA: Lawrence Berkeley Laboratory). Also, McDonald and Davis, Cool Storage Marketing Guidebook, EM-5841 (Palo Alto, CA: Electric Power Research Institute). The American Gas Association has surveyed gas air conditioning programs. See Wirtshafter and Shinn, 1988, "Marketing Efforts by Gas Utilities to Promote Cogeneration and Gas Air-Conditioning" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. 4.136-4.143.

9. High peak/off-peak differentials increase the financial savings from shifting loads. Short peak demand periods means that less storage capacity is needed to meet cooling needs during the peak period.

10. Personal communication with Jim Block, Vanderweil Engineers, Boston, MA. Also, Piette, Mary Ann and Edward Wyatt, 1988, "Measured Energy Performance of Cool Storage in Commercial Buildings: An Update of BECA-LM" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings, pp. 3.215.

11. See note # 7.

12. Piette, M.A. and J.P. Harris, 1988, Program Experience Report: Commercial Cool Storage LBL-25782 (Berkeley, CA: Lawrence Berkeley Laboratory), p. 4.

13. Personal communication with Linda Linderman, San Diego Gas and Electric, July, 1989.

14. Personal communication with Peter Govea, July, 1989. Also, program brochures for the 1985-89 period.

15. Southern California Edison, Demand Side Management Annual Reports, 1981-1988/89 (Rosemead, CA: Southern California Edison. Also, see note # 11, p. 7.

16. See note #1, pp. 39-40.

17. Personal communication with Linda Willoughby, Arizona Public Service, March, 1989. Also, the utility's information packet for the program.

18. Personal communication with Tony Vallillo, United Illuminating, February, 1989.

19. Personal communication with Michael McAteer, New England Electric.

20. Consolidated Edison, April, 1989, "Status Reports for Con Edison's Electric End-Use Conservation Investment Plan Program" (New York: Consolidated Edison). Also, Science Applications International Corp., 1988, "Steam Rebate Program Assessment Final Report" (New York: Consolidated Edison).

21. Personal communication with Bob Tackett, Texas Utilities, February, 1989. Also, "Summary of TU Electric Demand-Side Programs 1981-1988" (Dallas: Texas Utilities). Further information on the TU program was obtained from Piette, M.A. and J.P. Harris, 1988, Program Experience Report: Commercial Cool Storage LBL-25782 (Berkeley, CA: Lawrence Berkeley Laboratory), p. 9.

22. Ibid., pp. 6-7.

23. Personal communication with Tom O'Sullivan, People's Gas Light and Coke Co., February, 1989. Also, program information packet.

24. Sterrett, Strickler and Steudtner, 1989, "Load Reduction and Operations Performance of Commercial Cool Storage Systems" in Demand-Side Management Strategies for the 90s, Proceedings: Fourth National Conference on Utility DSM Programs, EPRI CU-6367 (Palo Alto, CA: Electric Power Research Institute), pp. 66-1 to 66-13. Also, Piette, Mary Ann and Edward Wyatt, 1988, "Measured Energy Performance of Cool Storage in Commercial Buildings: An Update of BECA-LM" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings, pp. 3.215-3.227.

25. See note # 7, p. 10.

Chapter 8

NEW CONSTRUCTION PROGRAMS

A. INTRODUCTION

New commercial construction can be a major source of load growth for electric utilities. For example, New England Electric System (NEES) has estimated that 75-80% of commercial sector load growth over the 1987-1997 period will be due to new buildings (as opposed to additional energy use in existing buildings) [1]. The rationale for offering a new construction program is that it is generally easier and less expensive to incorporate energy-saving measures at the time of building construction than to retrofit a building after it is completed. Costs per kW saved can be as much as 80% lower when measures are incorporated into new construction instead of being retrofit [2].

If conservation measures are not installed at the time of new construction, many conservation opportunities are lost, some until equipment wears out and needs replacement, but others for as long as the building stands. New construction C&LM savings are often referred to as "lost opportunity" resources, because with these measures, there is a one-time opportunity to achieve savings. If these savings are not achieved, then potential savings may be lost forever.

Due to this one-time opportunity, even utilities with short and medium-term capacity surpluses often find it advantageous to promote high-efficiency new construction. New buildings typically stand for 40 years or more. New construction programs offer an opportunity to save energy over the life of a new building. Even if the savings are not needed in the short-term, nearly all utilities can benefit from long-term savings, particularly if these savings can be obtained at moderate cost.

The Tennessee Valley Authority (TVA), based on computer simulations for over 100 new commercial buildings, has identified potential energy savings averaging 54% from the addition of conservation measures not included in initial building plans [3].

For this report, 17 C&I new construction programs were investigated. Summary information on each of these programs is contained in Table 8-1. Additional details can be found in the Appendix. In addition to these programs, a number of retrofit programs mentioned in other chapters of this report also fund energy-efficiency measures for new construction. Besides programs examined in this study, a number of other programs, particularly non-utility programs, have been offered. Many of these programs are discussed in a report compiled recently by the Lawrence Berkeley Laboratory [4].

B. PROGRAM TYPES

C&I new construction programs fall into three main categories: technical assistance programs, rebate programs, and comprehensive programs. A few programs span the boundaries of these categories.

Technical assistance programs assist building designers to improve the energy-efficiency of their design. Typical services provided include workbooks, educational seminars, and free computer simulations of how much energy the building will use under different design scenarios. Some informational programs also include awards to recognize the designers and developers of exemplary buildings. Examples of informational programs include TVA's C&I New Construction Program and the Bonneville Power Administration's (BPA) Energy Smart Program.

Rebate programs provide rebates for incorporation of specific measures into new buildings. Common measures include high-efficiency lighting fixtures, motors, and cooling systems. Some programs provide incentives for measures proposed by the customer or building designer. Typically, savings from these measures are

Table 8-1
Summary of New Construction Program Results

Utility	State	Program	Services Provided: Simu-la-tions	Services Provided: TA	Services Provided: In-cen-tives	Services Provided: Awards	Measures	Time Period: Start	Time Period: End	Pilot or Full-Scale	Number of Participants: Custo-mers	Number of Participants: Proj-ects	Estimated Savings: Coin. MW	Estimated Savings: Absolute MW	Estimated Savings: GWH /yr	1987 Peak Demand	Svgs as % of Pk	Coin-cident or Abso-lute	Expenses (1000s of $): Direct	Expenses (1000s of $): Total	Util. Cost $/kW	Di-rect or To-tal	Util. Cost $/kWh
Florida P&L	FL	Energy Systems Planning		X						Full						12,394							
NEES	MA/RI	Design 2000	X	X	X	X	All	4/89	10/89	Full	22		1.44	2.08		3,798	0.04%	C	$727		$350	D	
Nevada Pwr	NV	High Effic. Ltg.		X	X		L	1988	7/89	Full	5			0.11		1,740	0.01%	A	$13				
NU	CT/MA	Energy Conscious Constr.	X	X	X	X	All	1/89	12/89	Full	130				2.96	4,242				$1,660			$0.046
Palo Alto	CA	New Constr. Incentive		X	X		All	1988	7/89	Full		10		0.82	0.07	182	0.45%	A	$319		$390	D	
Puget P&L	WA	Design Assistance	X	X			All	9/88	7/89	Full	~35					3,528							
Snohomish	WA	New Comm'l Construction	X	X			All	9/88	12/88	Full	22					1,156							
So. Cal. Ed	CA	Energy Excellence		X	X	X	D,H,C,E	1/87	12/88	Full		641		15.50	20.78	14,775	0.10%	A	$2,864		$185	D	$0.015
So. Cal. Ed	CA	Daylighting		X	X		D	1983	12/86	Full		218		9.60	19.19	14,775	0.06%	A		$1,660	$173	T	$0.007
Texas Util.	TX	New Non-Res Struc.&Equip			X		H	1981	1988	Full		1,670	2.14			16,680	0.01%	C					
TVA	TN+	C&I New Construction	X	X		X	All	10/84	9/86	Full	162			3.90	7.40	19,772	0.02%	A		$3,101	$796	T	$0.034
Wisc. Elec.	WI	Smart Money- New Constr.		X	X		All	1/88	3/89	Full		1,234		8.13	31.85	3,810	0.21%	A	$2,093		$257	D	$0.007
BPA	WA/OR	Energy Smart	X	X		X	All			Pilot						16,680							
BPA	WA/OR	Energy Edge	X	X	X	X	All	1986	9/88	Pilot	28				13.43	16,680			$3,350	$11,000			$0.067
Con Ed	NY	C&I New Construction			X		H,M,S	6/88	12/88	Pilot	1					9,386							
PG&E	CA	New Construction Rebate			X		L,S,E	1985	12/88	Pilot	175					14,142			$2,621				
WA En. Off.	WA	Design Assistance	X	X			All	11/86	6/89	Pilot		~40											

Key:
L=lighting; H=HVAC; M=motors; S=storage cooling; D=daylighting; E=envelope; C=controls; W=water heaters; R=refrigeration; All=nearly anything that saves energy.

Note:
$/kWh calculated assuming a 20 year measure life and a 6% real discount rate (see Chapter 1 for an explanation of the methodology employed).

evaluated relative to local building code requirements and/or to prevailing local construction practices. Some rebate programs also include technical assistance provided by utility staff or a private consulting firm on retainer. Examples of rebate programs include Wisconsin Electric's Smart Money New Construction Program, Southern California Edison's Energy Excellence Program, and Con Edison's C&I New Construction Program.

Comprehensive programs combine technical assistance and rebate program features. These programs generally include training and technical assistance services, free computer simulations, construction incentives, incentives for additional design time undertaken by the project design team, and post-construction building commissioning and monitoring services. Most of these programs pay the full incremental cost of efficiency measures not normally included in standard construction practice. Examples of comprehensive programs include BPA's Energy Edge Program, Northeast Utilities recently revamped Energy Conscious Construction Program, and NEES's Design 2000 Program.

A variation on the comprehensive approach is being considered by Pacific Power and Light (PP&L). PP&L is planning a program similar in many respects to the comprehensive programs discussed above, including payment of full design and construction costs for efficiency measures. However, rather than providing payments as a grant, PP&L is proposing to pay the costs as a loan. The loan would be repaid through the customer's electric bill over a period of approximately 15 years [5].

Most programs concentrate on commercial buildings only. However, a few programs also allow participation by new industrial facilities. None of the programs listed in Table 8-1 have comprehensive services for industrial facilities. New England Electric is planning to develop such services [6]. BPA offers a new construction program aimed strictly at industrial customers. This program is discussed in Chapter 6.

C. PARTICIPATION

Most C&I new construction programs are either pilot or start-up programs. As such, most programs have not yet had sufficient time to achieve significant market penetration. Only two programs in our data base have been actively promoted for two years or more.

Unfortunately, participation rates (participating customers as a percent of new buildings) are only available for one program. The Snohomish Public Utility District estimates that their new construction program, during its first-year start-up phase, reached 2.5% of new commercial buildings in 1988. This program features free computer simulations and technical assistance. In 1988, only moderate marketing efforts were undertaken (primarily direct mail). Personal marketing efforts began in 1989 [7].

Wisconsin Electric's new construction program has achieved savings totaling 0.2% of the utility's peak demand after 15 months of operation. This program includes rebates and technical assistance. The program is marketed through direct mail, trade allies, and personal contacts with design professionals and developers. In order to increase participation, program application procedures have been simplified and special point-of-sale incentives are being offered for efficient lighting, motors, and other products [8].

The only other program with savings of at least 0.1% of system peak is the City of Palo Alto's program. However, 90% of Palo Alto's savings are from cool storage systems. The program has achieved minimal savings in other areas [9].

While participation datr is limited or not available on other programs, examination of the results from many of these programs provides some insights into the factors linked with high participation levels.

1. Program implementers have generally found that personal contacts with architects, engineers, and building developers is the most effective marketing approach. For

example, most of the participants in the Energy Edge program were solicited through personal visits to architecture and engineering firms [10]. Architects, engineers, and developers receive dozens of promotional brochures in the mail every day. Most direct mail pieces are quickly thrown away [11].

2. In order to have an impact on design decisions, it is important to reach the design team early in the design process. For example, in a series of interviews with 89 developers and design professionals around the country, Synergic Resources Corp. found that nearly half the HVAC specification decisions are made during the schematic design stage and most of the rest are made in the design development stage. Only 7% of HVAC specification decisions are made during the construction document preparation stage [12].

3. Design professionals worry that a utility program will add another stage to the design process, thereby delaying a project. They are also concerned that building owners are not prepared to pay for the additional design time that designing an efficient building requires or that utility staff or consultants will take design work away from architecture and engineering firms. Given these problems, in order to get design professionals to participate in new construction programs, utility program managers suggest working with the existing design team in a non-threatening way, to fit within, rather than delay, the project team's schedule, and, if possible, to provide reasonable payments to the project team for additional design time caused by program participation [13].

4. In order to target marketing efforts, and to emphasize the most appropriate conservation measures, it is important to conduct research on current construction practices and trends in a utility's service area. For example, Northeast Utilities found that prevailing construction practice generally exceeded the state building code. This finding allowed them to pay incentives only for measures exceeding prevailing practice [14]. Likewise, market research allowed New England Electric to determine that the majority of C&I construction in their service territory was concentrated in the office and retail sector, allowing program design features and marketing efforts to target those sectors [15].

5. Building developers and designers like good publicity. Developers need to secure tenants and designers are looking for new projects. Several programs (Energy Edge and TVA's program for example) have found that the lure of awards and publicity can help attract participants [16].

6. Programs without incentives often have difficultly convincing building owners to implement energy-saving design suggestions. For example, Northeast Utilities originally offered a technical assistance program without incentives. They estimate that approximately 10% of the buildings which received technical assistance adopted a significant percentage of the energy-saving recommendations that were made [17]. Likewise, Puget Power and Light and TVA have found that the lack of financial incentives limit adoption of energy-saving recommendations [18].

7. Comprehensive programs which provide in-depth technical assistance and large incentives generate a lot of interest among potential participants. For example, the Energy Edge program could not accept all of the projects which wanted to participate [19]. Similarly, Northeast Utilities and New England Electric have had to limit marketing of their programs until staff and consultant resources can handle the demand [20]. Northeast Utilities is projecting that their program will reach approximately 10% of commercial new construction projects in 1989 and 62% in five years [21]. An additional year or more of experience will be needed to see if these high participation levels can be achieved.

D. SAVINGS

Only one program in our study has estimated energy savings achieved by participating buildings relative to identical buildings constructed according to standard local construction practice. In the Energy Edge program, based on computer simulations, savings in the 28 participating buildings averaged 29% of total energy consumption and 34% of building energy use excluding miscellaneous equipment [22]. The goal of this program was to reduce energy use in participating buildings by 30%. Incentives were paid only for measures that would help achieve this target. Incentives were not paid for measures that would lead to savings exceeding 30%. These savings were achieved using off-the-shelf equipment, no non-commercialized technologies were required. In fact, building designers were surprised at how easy it was to achieve 30% savings. Program managers credit extensive technical assistance, including computer simulations, and large financial incentives (BPA paid all incremental design and construction costs) to the high savings [23].

Monitoring and periodic operations and maintenance audits of completed projects show that some buildings exceed the savings estimates and some fall short. In the Energy Edge Program a few buildings did not install all measures originally contracted for. In addition, a few of the measures were not functioning properly due to inadequate commissioning procedures. These problems are now being corrected. While these problems were limited, program managers recommend that future programs include careful monitoring and assistance during the building construction and start-up stages in order to make sure all measures are installed and functioning properly [24]. (A similar recommendation is made by PG&E, which, conducted very few inspections during building construction and as a result experienced many problems with contracted-for measures not being installed [25].)

Two technical assistance programs have kept track of how many energy-saving recommendations are adopted. TVA found that 41% of recommendations were adopted. If all recommendations were implemented, savings would have averaged 54% relative to prevailing construction practices in the region [26]. Multiplying the 41% and 54% figures implies an average of 22% savings. However, it is likely that many of the implemented measures are inexpensive measures with limited savings [27]. Actual savings from the implemented measures are likely to be less than 22%. The Washington State Energy Office estimates that 46% of recommendations will be adopted [28]. Both of these programs feature free in-depth computer simulations and technical assistance.

Lighting and HVAC measures are the most common measures implemented through C&I new construction programs. For example, 68% of the kWh savings achieved by Wisconsin Electric's program are for lighting measures and an additional 6% from HVAC measures [29]. In the Washington Energy Office program, 33% of recommendations were for HVAC improvements and 28% for lighting [30]. In the Energy Edge program, nearly all of the buildings received lighting and HVAC improvements of some sort and many buildings received building shell improvements [31].

E. PROGRAM COST-EFFECTIVENESS

Cost and savings information is available on only a limited number of programs. Utility costs per kW were calculated for six programs. Costs ranged from $173-796/kW, with a median of $259. Utility costs per kWh were also calculated for six programs. Costs ranged from $0.007 to $0.067 (median of $0.024).

The lowest costs were for programs operated by Southern California Edison and Wisconsin Electric (utility cost less than $0.01/kWh). Both of these programs combined some technical assistance with moderate rebates. Both programs are extensively marketed and are reaching hundreds of buildings per year. This combination of services appears to result in moderate participation and low costs per unit of energy saved.

The highest costs are for the Energy Edge ($0.067/kWh) and Energy Conscious Construction Programs ($0.046). Energy Edge is a research project that contains many research costs (including a multi-million-dollar monitoring budget) which would not be part of a normal operating program. When only design and construction costs are considered, the levelized cost per kWh saved averages approximately $.02 [32]. Since the utility paid all incremental design and construction costs, the total resource cost for the program is likely to be less than $0.03/kWh, even if we make generous allowances for utility administrative costs.

The Energy Conscious Construction program is still in its start-up phase. Much money has been spent on program development and initial design assistance, but only a few buildings have been completed. Despite these high start-up expenses, the utility cost per kWh is less than the long-term avoided costs of all New York utilities. Since the utility pays nearly all incremental design and construction costs, costs from the total resource cost perspective are nearly the same as from the customer perspective, and hence it is likely that total resource costs are less than avoided costs of New York utilities.

In sum, all the programs examined have lower utility costs than the avoided costs of all New York utilities. Thus, all programs are likely to be cost-effective in New York from the utility perspective. In addition, the two comprehensive programs for which data is available have lower utility costs and lower total resource costs than the long-term avoided costs of all New York utilililities, making it likely that these programs will be cost-effective in New York from both the utility and total resource perspectives.

F. CONCLUSIONS

C&I new construction programs are still generally in their infancy. Participation rates appear to be generally low, but this is likely due in large part to the pilot and start-up nature of most programs. Participation rates as high as 60% (after five years of program operation) are being targeted by some utilities. Few programs presently collect and report data on participation rates (participating projects as a percent of new construction projects). We recommend that all utilities make an effort to collect and report this data in the future.

Programs have achieved energy savings in participating buildings as high as 30%. Even higher savings may be possible if incentives are provided for additional cost-effective measures. Programs targeting high percentage savings are generally programs offering comprehensive technical assistance, including free computer simulations, and incentives covering all or most of the design and construction costs for energy-conserving measures. Cost data on these programs is limited, but available data indicates that even comprehensive programs can achieve savings at total resource costs of approximately $0.03/kWh saved.

Rebate programs which are well-marketed and which provide moderate rebates and technical assistance appear to achieve moderate participation rates. Percentage savings information is not available on these programs. With these programs, utility costs can be less than $0.01/kWh saved.

Technical assistance programs which provide free computer simulations and other technical assistance can achieve significant energy savings. Results from two of the more successful of these programs indicate that just under half of the energy-saving recommendations are adopted. Information on percentage savings is unavailable but savings are likely to be less than 20%. These programs include extensive contact between the project design team and the technical assistance providers. Programs with less extensive contact report lower measure adoption rates. Operators of many technical assistance programs report that higher savings could be achieved if financial incentives are offered.

Regardless of the type of program, successful programs are those that feature most or all of the following elements:

* Market research to identify C&I construction practices and trends, so that program requirements and marketing efforts can be properly targeted;

* Personal marketing to architects, engineers and developers;

* Efforts to enroll participants early in the design process, before design and specification decisions are made;

* Extensive training and technical assistance to the project design team;

* Publicity on the designers and developers of successful energy-efficient projects;

* Technical assistance and monitoring through the construction and project start-up stages.

* Financial incentives to help pay the incremental cost difference between standard and high efficiency equipment and designs.

Program experience to date indicates that even comprehensive programs can cost less than $.03/kWh saved (total resource cost perspective). At these costs, C&I new construction programs are likely to be cost-effective for all New York State utilities.

New construction programs (including whole-scale renovations of existing buildings) are popular with utilities in part because they offer a one-time opportunity to capture large energy savings at a relatively low cost. If efficiency measures are not incorporated into a new building, retrofitting the same measures at a later date would generally be more expensive and would sometimes be impossible. A similar situation prevails when existing buildings are remodeled. Remodeling typically takes place when tenants change or when the "look" or a space needs to be updated. In these situations, some systems are retained (e.g. HVAC) and some are replaced with entirely new systems (e.g. lighting). To our knowledge, none of the new construction programs examined in this study target remodeling (although a few may allow remodeled buildings to apply). A remodeling strategy would target some of the same decision-makers as a new construction program, but in addition would need to target other parties such as interior designers, large tenants, and real estate management firms. Such a strategy could be incorporated into a new construction program or could be packaged as a separate program. The Conservation Law Foundation of New England is now working with several utilities on the design of remodeling programs [33]. Other utilities should consider similar efforts.

G. FURTHER READING

Among the more useful publications on C&I new construction programs are the following:

Anderson, Ken and Nancy Benner, "The Energy Edge Project: Energy Efficiency in New Commercial Buildings", paper presented to the American Society of Mechanical Engineers, 1988.

Benner, Christle, McFerran and Miller, 1988, "Lessons Learned in Demand-Side Planning for Connecticut Light and Power's New Building Program: Commercial Sector" in Demand-Side Management of the 90s, Proceedings: Fourth National Conference on Utility DSM Programs (Palo Alto, CA: Electric Power Research Institute), Section 10.

Kilpatrick , Douglas and Linda Dethman, 1988, "Design Assistance for New Commercial Buildings: Modeling for Energy Efficiency" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings (Washington, D.C.: American Council for an Energy-Efficient Economy), p. 3.130-3.139.

Kreiter, Virginia, 1989, "Influencing Professionals in the Commercial New Construction Market" in Demand-Side Management of the 90s, Proceedings: Fourth National Conference on Utility DSM Programs (Palo Alto, CA: Electric Power Research Institute), Section 62.

Vine, Edward and Jeff Harris, 1988, Planning for an Energy-Efficient Future: The Experience of Energy Conservation Programs with New Residential and Commercial Buildings LBL-25525 and 25526 (Berkeley, CA: Lawrence Berkeley Laboratory).

H. NOTES

1. New England Electric System and the Conservation Law Foundation of New England, Strategic Energy Efficiency Investment for the 1990s (Boston: Conservation Law Foundation), p. 5.

2. Ibid.

3. Letter from Jim West, Tennessee Valley Authority, January, 1987.

4. Vine, Edward and Jeff Harris, 1988, Planning for an Energy-Efficient Future: The Experience of Energy Conservation Programs with New Residential and Commercial Buildings LBL-25525 and 25526 (Berkeley, CA: Lawrence Berkeley Laboratory).

5. Personal communication with Ken Anderson, PP&L, July, 1989. Also, Bolender, Dave, "Promoting Energy Efficiency Will Make Pacific More Competitive" from PP&L employee newsletter.

6. See note #1, p. 6.

7. Personal communication with Don Pendleton, Snohomish PUD, July, 1989.

8. Personal communications with Peggy Clippert, Wisconsin Electric and Greg Olson, Anco Engineers.

9. Based on data supplied by Jane Sigeunza, City of Palo Alto, summarizing program results through July 31, 1989.

10. Personal communication with Nancy Benner, Energy Edge Program Manager in the Portland, OR area, Portland Energy Conservation, Inc.

11. Based on author's observation of a series of focus groups and interviews conducted by New England Electric with architects, engineers, lighting designers and developers.

12. Kreiter, Virginia, 1989, "Influencing Professionals in the Commercial New Construction Market" in Demand-Side Management of the 90s, Proceedings: Fourth National Conference on Utility DSM Programs, CU-6367 (Palo Alto, CA: Electric Power Research Institute), PP. 62-6.

13. Personal communications with Robin Calhoun, Greg Olson, Fred Wajcs, Nancy Benner and Mike McAteer, C&I new construction program managers at PG&E, Wisconsin Electric, Northeast Utilities, Portland Energy Conservation, Inc. and New England Electric.

14. Benner, Christle, McFerran and Miller, 1988, "Lessons Learned in Demand-Side Planning for Connecticut Light and Power's New Building Program: Commercial Sector" in Demand-Side Management of the 90s, Proceedings: Fourth National Conference on Utility DSM Programs, CU-6397 (Palo Alto, CA: Electric Power Research Institute), pp. 10-7 to 10-8.

15. Personal communications with Michael McAteer, New England Electric.

16. Personal communications with Nancy Benner, Portland Energy Conservation, Inc. and David Burrows, TVA.

17. Personal communication with Jan Sayko, Northeast Utilities, April, 1988.

18. Personal communications with Sid France, Puget Power and Light, August, 1989 and David Burrows, TVA, April, 1988.

19. Personal communication with Nancy Benner, Portland Energy Conservation, Inc.

20. Ibid. Also, personal communication with Michael McAteer, New England Electric.

21. See note #14, p. 10-6.

22. Anderson, Ken and Nancy Benner, "The Energy Edge Project: Energy Efficiency in New Commercial Buildings", paper presented to the American Society of Mechanical Engineers, 1988.

23. See note #14, p. 10-4.

24. Personal communication with Grant Vincent, BPA, July, 1989. Also, Anderson, Kenneth and Lorna Stucky, 1989, "Preliminary Evaluation of Computer Modeling Forecasts of Energy Consumption in Six Energy Edge Buildings" in Solar '89 Technical Papers, Proceedings of the 1989 Annual Conference, American Solar Energy Society (Boulder, CO: American Solar Energy Society), pp. 479-482.

25. Personal communication with Diane Calden, PG&E, April, 1988.

26. See note #3.

27. Based on data presented in Chapter 2, Section D.

28. Kilpatrick, Douglas and Linda Dethman, 1988, "Design Assistance for New Commercial Buildings: Modeling for Energy Efficiency" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings (Washington, D.C.: American Council for an Energy-Efficient Economy), p. 3.135.

29. Based on data supplied by Peggy Clippert, Wisconsin Electric, for program results through March, 1989.

30. See note #28.

31. See note #22. Also, Benner, Cody and Harding, 1987, "Bonneville Power Administration Energy Edge" in Proceedings of the 1987 Conference Energy Conservation Program Evaluation: Practical Methods, Useful Results (Argonne, IL: Argonne National Laboratory), pp. 220-221.

32. Based on ACEEE analysis of data from Anderson, Ken and Nancy Benner, 1988, "The Energy Edge Project: Energy Efficiency in New Commercial Buildings", paper presented to the American Society of Mechanical Engineers, Table 1.

33. Personal communication with Joe Chaisson, Conservation Law Foundation, Boston, MA.

Chapter 9

MISCELLANEOUS MEASURE PROGRAMS

A. INTRODUCTION

Miscellaneous measure programs are those which address end-uses and measures not specifically discussed in the preceding seven chapters (programs which deal with multiple end-uses are the subject of the next chapter). The most common miscellaneous programs are those that address water heating, refrigeration, electric thermal storage heat, agriculture, and building shell measures.

Miscellaneous end-uses together consume a substantial amount of electricity in the C&I sectors. Nationwide, miscellaneous end-uses (all uses except HVAC and lighting) account for approximately 17% of commercial sector electricity use. Approximately 25% of this miscellaneous use is for water heating [1]. In New York State we estimate that approximately 13% of commercial sector electricity use is for miscellaneous uses -- of which nearly half is for refrigeration in supermarkets [2].

There is significant C&LM potential among miscellaneous end-uses. Water heating electricity use can be reduced by approximately 8% with the installation of heat traps and insulating blankets [3]. Savings of approximately 10-15% can be achieved by the purchase of improved efficiency conventional electrical water heaters. Much higher savings (approximately 50%) can be achieved with use of heat pump water heaters [4]. These units make particular sense in restaurants, laundromats and other high-water-use C&I establishments. Similarly, refrigeration electricity use can be reduced by the use of high-efficiency compressors and motors (approximately 10-15% savings), floating head pressure control (approximately 8% savings) and refrigeration case covers (15-40% savings) [5]. Additional savings are possible through the use of mechanical subcooling, hot gas defrost, variable-speed controls, anti-condensate heater controls, energy-efficient fan motors, and heat recovery for water heating [6].

For this study, 16 miscellaneous measure programs were examined including stand-alone programs and miscellaneous measure components of multiple end-use programs. In addition to these programs, many of the multiple end-use programs discussed in Chapter 10 provide incentives for miscellaneous measures. Summary information on each of the programs discussed in this chapter is contained in Table 9-1. Additional details can be found in the Appendix.

Given the diversity of end-uses and measures addressed by miscellaneous programs, this chapter will deal with each type of measure separately. Within each of these sections, program approaches, participation, costs and savings are each discussed, to the extent information is available. Specific sections address the following measures: water heater wraps, heat pump water heaters, refrigeration, electric thermal storage heat, windows and insulation, and agricultural pumps.

B. WATER HEATER WRAPS

Three utilities in our sample offer specific programs or incentives to promote water heater wraps for C&I customers. Wisconsin Electric offers $10 rebates for a water heater wrap. After nearly two years, 17 rebates had been granted [7]. Central Maine Power and Seattle City Light both have offered free water heater blankets and installation to commercial customers. The Seattle City Light program was a pilot program which was discontinued due to a power surplus and budget cutbacks at the Bonneville Power Administration, the sponsoring organization [8]. The Central Maine Power program is ongoing and to date has reached approximately 11% of commercial electric water heating customers. The program is promoted through direct mail, personal contacts, and telemarketing. Utility costs average $62 per water heater. There are no customer costs. Each wrap is estimated to save 480 kWh/year [9]. Assuming a 10-year wrap life and a 6% real discount rate, the program costs $.019 per

Table 9-1
Summary of Miscellaneous Program Results

Utility	St	Program	Measures	Time Period Start	Time Period End	Pilot or Full-Scale	Number Eligible	Number of Participants: Customers	Number of Participants: Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings: Coin. MW	Estimated Savings: Absolute MW	Estimated Savings: GWh /yr	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute	Expenses (1000s of $): Direct	Expenses (1000s of $): Total	Util. Cost $/kW	Direct or Total?	Util. Cost $/kWh
CMP	ME	Comm'l Wtr Htr Insulat'n	Wraps	1985	12/88	Full	21,900		2,374	10.8%	P	0.24		1.14	1,455	0.02%	C		$147	$620	T	$0.017
Florida P&L	FL	Heat Pump Water Heating	HPWH	1988	3/89	Full	324,915	556		0.2%	C			5.71	12,394							
Met-Ed/GPU	PA	Elec. Thermal Storage	ETS	1/88	12/88	Full			1			0.04			1,673	0.00%	C		$9	$250	T	
Met-Ed/GPU	PA	Heat Pump Water Heater	HPWH	1/88	12/88	Full	43,959	2		0.0%	C		0.06	0.20	1,673	0.00%	A		$8	$126	T	$0.005
NYSEG	NY	Comm. Elec Thermal Stor.	ETS	1/88	9/88	Full	67,233	48		0.1%	C		5.22		2,540	0.21%	A	$425		$81	D	
Palo Alto	CA	Partners Elec. Incentive	Wndw, Refr	1985	7/89	Full	2,409		66	2.7%	P		0.63	0.57	182	0.35%	A	$100		$158	D	$0.031
PG&E	CA	Refrig Curtain/Door	Refr	6/83	12/83	Full	~500,000		510	0.1%	P			18.00	14,142			$280				$0.003
PG&E	CA	Agricultural En. Mgmnt	Ag pumps	1/83	12/85	Full	~30,000		24,126	80.4%	P		23.22	86.01	14,142	0.16%	A		$5,571	$240	T	$0.008
Puget P&L	WA	Comm'l Cons. Financing	Refr, Shell	1980	12/88	Full	69,236		620	0.9%	P			20.68	3,528			$4,433	$5,652			$0.035
So. Cal. Ed	CA	Ag. & Water Pump Test	Ag pumps	1/80	12/87	Full	26,630			~12%/yr				252.17	14,775				$8,616			$0.004
So. Cal. Ed	CA	Hardware Rebate	Refr	1/82	12/84	Full	393,754						9.33	48.35	14,775	0.06%	A	$1,013		$109	D	$0.004
So. Cal. Ed	CA	Hardware Rebate	Shell, WH	1/82	12/84	Full	393,754						12.12	107.94	14,775	0.08%	A	$2,181		$180	D	$0.004
Texas Util.	TX	Elec. Wtr Htg Assist	WH	1981	1988	Full	242,647		<120	0.0%	P				16,680							
Wisc. Elec.	WI	Smart Money	Refr, Ag, WH	6/87	3/89	Full	81,750		2,080	2.5%	P		3.02	27.92	3,810	0.08%	A	$2,236		$742	D	$0.014
Iowa El L&P	IO	Comm'l Refrig. Replace.	Refr	12/85	5/86	Pilot	25,000	5		0.0%	C				978				$33			
Seattle C.L	WA	Comm'l Tank Wrap	Wraps	1982	1983	Pilot		997						0.50	1,725				$65			$0.017

Key: Wraps= water heater wraps; HPWH= heat pump water heaters; Refr= refrigeration; ETS= electric thermal storage heat;
Wndw= window films, screens and glazing; Shell= building shell; Ag= agricultural; WH= water heating.

Note:
$/kWh calculated assuming a 10 year measure life and a 6% real discount rate (for an explanation of the underlying rationale, see Chapter 1).

kWh saved (utility and total resource perspectives). Because small water heaters account for only a small fraction of electricity use in C&I facilities, the overall savings potential from such programs is quite low.

C. HEAT PUMP WATER HEATERS

Heat pump water heaters use a refrigeration cycle instead of an electric resistance element to heat hot water. Heat pump water waters are approximately twice as efficient as a conventional water heater, but their first cost is approximately four times greater than a conventional water heater [10]. Three programs in our database offer specific incentives for heat pump water heaters. Florida Power and Light offers a technical assistance and loan program promoting heat pump water heaters. The company provides free technical and economic analyses and offers loans. After approximately one year, over 500 water heaters have been installed. Heat pump water heater distributors have heavily promoted the program because utility involvement lends credibility to their sales efforts. To date no one has used the utility financing. The Florida program primarily reaches medium and large C&I customers. Savings average approximately 10,000 kWh per water heater. No cost information is available on the program but given the limited financial incentives, the program is likely to have low utility costs per kWh saved [11]. Metropolitan Edison offers a rebate of $100/kW for heat pump water heaters. The program has received only limited promotion -- in the first year only two rebates were issued. So far, this program has cost the utility $250/kW saved [12]. Texas Utilities offers rebates for heat pump, solar and heat recovery water heaters to residential and commercial customers. Rebates are $50 to customers plus $30 to dealers. Interest by commercial customers has been low. After eight years less than 120 commercial rebates have been given [13]. This low participation is not surprising since the rebates generally cover less than 10% of the cost of the units.

A successful heat pump water heater program requires the local presence of reliable and knowledgeable vendors and contractors. From our experience, this condition is not satisfied in much of the country (particularly colder regions). In such areas, utilities could play a useful role by helping to establish vendors through such efforts as demonstration programs, bulk purchases, and/or financing dealer inventories.

D. REFRIGERATION MEASURES

In our research we were able to collect data on over half a dozen programs which promote refrigeration improvements. Pacific Gas and Electric, Puget Power and Light, Southern California Edison, the City of Palo Alto, New England Electric, and Wisconsin Electric Power all provide rebates for refrigeration measures as part of multiple end-use rebate programs. Among the measures promoted are strip curtains, glass doors, subcooling, electronic controls, variable-speed compressors, new door gaskets, energy-efficient fan motors, heat recovery for water heating, and custom refrigeration improvements. As can be seen in Table 9-1, typically 0.1% of eligible customers participate each year, savings range from 4-46 MWh/project and utility costs per kW are typically $100-200.

One utility, Iowa Electric Light and Power has run a program specifically targeted at refrigeration system upgrades. The program provided engineering assistance and low interest-loans (the utility commission mandated loans and would not consider rebates). The program suffered from a variety of operational problems (e.g., limited marketing efforts, problems with the engineering consultant hired to implement the program, and premature cancellation at the behest of the legislature) and only resulted in five completed projects [14]. It is unclear whether correction of these problems would have improved program performance.

Obstacles to promoting refrigeration improvements have been extensively investigated by the Bonneville Power Administration (BPA). BPA has found that ownership of equipment is concentrated among national grocery, convenience store and restaurant chains. Equipment decisions are not made by local store managers but instead are made by regional or national energy managers. These energy managers are flooded by proposals from equipment vendors and utilities, so getting their attention is very difficult. Many grocery chains intensively manage their energy use and have difficulty believing that there are energy-saving opportunities that they have missed. Utility programs to date have not impressed them. Furthermore, groceries traditionally look for 8-18 month paybacks -- only a few chains will go longer. In addition to these marketing obstacles, there is a shortage of technicians who can install sophisticated equipment (e.g. controls, compressor systems, whole-building systems). Expert installers and system designers are primarily employed by equipment manufacturers. Independent experts are rare. These barriers combine to make refrigeration efficiency improvements a difficult market for utilities to tap. [15]

E. ELECTRIC THERMAL STORAGE HEAT

Electric thermal storage heat (ETS) is a load management strategy which combines electric resistance heat with ceramic storage. The electric heating element operates during off-peak hours to heat up the storage mass. During on-peak hours, air is blown across the warm storage mass and is heated. The warm air is then distributed throughout the building to provide heat. ETS systems can function as part of a load shifting or valley-filling strategy depending on whether electric or non-electric heat is being displaced.

Two programs in our database promote ETS for C&I buildings. New York State Electric and Gas (NYSEG) provides rebates of $100 per kW for ETS systems. In addition, NYSEG offers seminars and educational materials on ETS systems. The program is promoted through mailings and personal contacts. Both utility representatives and trade allies earn points towards gifts for each system they sell. Nearly 100 systems have been installed during the pilot and full-scale stages of the program. The average system is 88 kW [16]. Surveys by the utility indicate that approximately 30% of the installations are load-shifting and 70% are valley-filling. Due to the heavy valley-filling component of the program, program benefits are relatively low and the benefit-cost ratio for the program is only 0.2 from the utility perspective (benefits are 20% of costs) and 1.0 from the total resource cost perspective (benefits equal costs). Due to the low benefit-cost ratios for the program, NYSEG plans to continue promoting ETS systems, but to phase-out rebates for the systems [17].

Metropolitan Edison also offers ETS rebates of $100/kW plus a 50% cost-share on a feasibility study. In the first year of operation the program was not extensively promoted. Only one system was installed in this first year [18].

F. WINDOWS AND INSULATION

Several utilities provide incentives for reflective window films, solar screens, and insulation. In sunny regions of the country, such as California, window film and screen rebates are often popular. For example, the City of Palo Alto has paid 65 rebates for window film (approximately 2% of eligible customers). Average savings and utility cost per rebate are 9.7 kW, 800 kWh/year and $158/kW [19]. In colder regions of the country, window films and screens may not be cost-effective because films and screens reduce useful wintertime heat gains. For example, the ACEEE study on the cost of conserved energy in New York State estimates that window films cost an average of $0.134/kWh saved, well in excess of consumer electric rates [20].

Programs promoting insulation for commercial buildings are few and far between. Puget Power and Light provides grants or loans for insulation as part of its comprehensive multiple end-use program. Over eight years, nearly $2 million in insulation incentives have been paid for 276 projects (less than 1% of eligible customers but approximately 16% of projects funded through the program). Savings total 8486 MWh/year, making for an average cost to the utility of approximately $0.02/kWh assuming a 20-year measure life and a 6% real discount rate [21]. In areas where commercial building insulation is already common, such as New York State, programs to retrofit additional insulation may not be cost-effective. For example, the ACEEE study on New York State estimates that the cost of conserved energy for roof insulation in commercial buildings is $0.60/kWh saved [22].

G. AGRICULTURAL PUMPS

Two California utilities offer very aggressive programs to test and adjust agricultural pumps. In addition, pump modifications are recommended and incentives offered. The pump tests are free. These programs have been offered by PG&E and Southern California Edison for over 60 years. The PG&E program reaches approximately 25% of eligible customers each year, the Southern California Edison program serves approximately 12% annually (see Table 9-1). The programs are promoted through direct mail and personal contacts. These programs illustrate the participation rates that are possible when aggressive promotion and free services are combined. Costs to the utility per kWh saved are less than $0.01 for both programs, if a five-year average measure life is assumed (see Table 9-1).

H. OTHER MEASURES

A variety of other measures are promoted through miscellaneous measure programs. For example, Palo Alto and Wisconsin Electric promote low-temperature chemical dishwashers. No participation data are available for this measure. PG&E, Wisconsin Electric and Wisconsin Power and Light promote special measures for agricultural customers. Participation, cost, and savings data on these measures are generally not available.

I. CONCLUSIONS

A considerable amount of electricity can be saved from miscellaneous end-uses. However, only a limited number of programs are offered to promote these savings and most of these programs have had only moderate participation rates. Among the more promising programs are the following:

* Programs which provide free electric water heater wraps and are promoted via telemarketing.

* Heat pump water heater programs which include extensive technical assistance and dealer involvement (including, where needed, efforts to help establish dealers in a local area).

* Rebate programs for simple refrigeration improvements (measures which do not require engineering assistance) such as strip curtains, glass doors, and anti-condensate heater controls.

* Technical assistance and incentive programs for more complex refrigeration improvements which do require engineering analysis.

* Technical assistance and incentive programs for electric thermal storage heating systems for utilities interested in winter load shifting or valley-filling.

* Agricultural pump testing and adjustment programs for areas with extensive use of irrigation equipment.

Based on the available data, it appears that these programs can be run at costs to the utility less than $.04 per kWh saved. Many of these programs cost utilities less than $200/kW or $.02/kWh. Due to these low costs, these programs are likely to be cost-effective, from the utility perspective, for New York State utilities. Data on customer costs, and hence on the total resource cost of these programs are not generally available.

J. NOTES

1. Geller, Howard, 1988, "Commercial Building Equipment Efficiency: A State-of-the-Art-Review" (Washington, D.C.: American Council for an Energy-Efficient Economy), Table 2.

2. Miller, Eto and Geller, 1989, The Potential for Electricity Conservation in New York State (Washington, D.C.: American Council for an Energy-Efficient Economy), p. 28.

3. Ibid., pp. S-5, 13.

4. Geller, Howard, 1988, "Residential Equipment Efficiency: A State-of-the-Art Review" (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. 5-6.

5. See note #2, pp. 150-151.

6. Personal communication with Michael Kaplan, PE, Kaplan Engineering, Lake Oswego, OR.

7. Based on data supplied by Peggy Clippert, Wisconsin Electric, March, 1989.

8. Personal communication with Brian Coates, Seattle City Light, July, 1989.

9. Central Maine Power, Energy Management Report, 1988 (Augusta, ME: Central Maine Power), p. 39. Also: personal communication with Linda Ecker, CMP, July, 1989; Spellman, Richard, 1988, "Demand-Side Management Market Penetration: Modeling and Resource Planning Perspectives from Central Maine Power" in Demand-Side Management for the 90s, Proceedings: Fourth National Conference on Utility DSM Programs, CU-6367 (Palo Alto, CA: Electric Power Research Institute), pp. 52-6.

10. See note #4.

11. Letter from and personal communication with David Derthick, Florida Power and Light, March, 1989. Also, program promotional brochure.

12. Based on data supplied by Ronald Weitz, Metropolitan Edison, April, 1989.

13. Personal communication with C.C. Benson, Texas Utilities, June, 1989.

14. Personal communication with Robert Holmes, Iowa Light and Power. Also, Iowa Light and Power, 1987, "Pilot Program for Commercial11XRefrigeratiorProgram Evaluation" (Cedar Rapids: Iowa Light and Power).

15. Hobson, Gordon, Baylon and Katz, 1988, "Energy Efficiency Decision-Making in Chains and Franchises" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings (Washington, D.C.: American Council for an Energy-Efficient Economy), p. 6.75-6.88. Also, Gordon, Fred, Pacific Energy Associates, Portland, OR, letter to Dave Wolcott dated Dec. 6, 1989.

16. Letter from and personal communication with Ronald Foster, NYSEG, July and August, 1989. Also: Dobish, Diane and Donna Gargiul, 1989, Surveys of Non-Residential Electric Thermal Storage Systems Installed in 1985-1988 (Binghamton, N.Y.: NYSEG); Emerson, C.R., 1987, "Final Report Non-Residential Electric Thermal Storage R&D Program" (Binghamton, N.Y.: NYSEG).

17. NYSEG, 1989, "Economic Analysis of NYSEG's C/I ETS Rebate Program (Binghamton, N.Y.: NYSEG). Also, personal communication with Sam Swanson, N.Y. Department of Public Service, Albany, N.Y.

18. See note #12.

19. Based on data supplied by Jane Siguenza, City of Palo Alto, August, 1989.

20. See note #2, p. S-6.

21. Based on data supplied by Sid France, Puget Power and Light, August, 1989.

22. See note #20.

Chapter 10

MULTIPLE END-USE PROGRAMS

A. INTRODUCTION

Multiple end-use programs generally try to address all C&I end-uses at once rather than concentrate on specific end-uses. In some cases multiple end-use programs represent a careful packaging of rebates for different measures and end-uses. This packaging makes the programs easier for customers to understand. In other cases multiple end-use programs combine audits with financing and arranging services to get recommended measures installed. For this report, 54 multiple end-use programs were studied. These programs exhibit a number of different approaches for promoting energy savings, as is described below.

B. PROGRAM TYPES

Multiple end-use programs fall into approximately seven categories: rebate, loan, performance contracting, request for proposal, bidding, comprehensive and other.

Rebate programs generally provide pre-calculated rebates for a long list of C&LM measures. Some programs also provide rebates for custom measures proposed by customers. Rebates are typically paid per measure (e.g. $1/lamp, $10/ton of air conditioning) but in some cases rebates are paid per unit of energy savings. Rebate programs are commonly promoted via direct mail, through trade allies, and through personal contacts with large customers. Many programs offer audits to help customers identify C&LM measures. Generally these audits are optional but a few programs require an audit as a condition of receiving a rebate.

Loan programs offer financing for C&LM measures at interest rates ranging from 0% to just above prime. Most loan programs include an energy audit.

Performance contracting programs involve an energy service company (ESCo) which contracts with a utility to provide energy management services to the utility's customers. The utility provides payments to the ESCo for each kW or kWh saved and assists the ESCo in marketing the program to the utility's customers. The ESCo takes the lead in program marketing, provides audits, arranges for measure installation, finances the measures (although in some programs customers may cost-share) and often provides post-installation follow-up services. Utility payments are typically based on the utility's avoided costs although some programs cap payments at the cost of the measure plus a reasonable administrative fee. Utility payments to the ESCo are generally made over a series of years and are often subject to monitoring or other verification that the measures are functioning properly. Some utilities make ESCo payments up-front based on engineering estimates of measured savings. ESCo's are usually chosen through competitive bidding with the winning ESCo(s) selected based on qualitative factors and, in some cases, price per unit of energy saved. [1]

A variation on performance contracting is Commonwealth Electric's guaranteed savings program. Under guaranteed savings the customer finances the work and receives annual payments per unit of energy saved, but an outside third party (typically an ESCo or a distributor of energy-saving measures) guarantees that estimated savings will be achieved.

Request for proposal (RFP) programs allow customers or ESCo's with engineering expertise to propose specific C&LM projects to utilities for funding. In some programs (e.g. Northeast Utilities' Customer Initiated Program) utility payments are preset by the utility (e.g. 100% of measure cost beyond a three-year payback) and proposals are judged for quality. In other programs (e.g. Central Maine Power's Efficiency Buy-Back program) proposals are judged for price as well as quality. In many of the RFP programs, proposals are accepted on a first-come, first-served basis.

Bidding programs allow customers, equipment distributors or ESCo's to propose specific C&LM projects to utilities for funding. Bidding programs differ from RFP programs in that with RFP programs utilities carefully proscribe what can and cannot be proposed whereas bidding programs are much more open. Bidding programs are usually not limited to C&I facilities -- in most programs residential proposals are accepted and in some programs even new generation facilities are included. Bidding programs were pioneered by Central Maine Power in 1987. Their Power Partners Program is briefly described in the Appendix. Other bidding programs have begun in the past year, and many more are planned (including programs offered by all seven New York utilities). A major study on bidding programs is now being prepared by Lawrence Berkeley National Laboratory and Oak Ridge National Laboratory [2].

Comprehensive programs generally provide one-stop-shopping to the C&I customer. Services provided under a comprehensive program typically include audits, arranging (e.g., preparing specifications and soliciting bids), financing assistance (loans or partial grants), and sometimes operations and maintenance and other follow-up services. These programs are designed for customers who lack the time or expertise to identify and implement C&LM projects.

Not all programs use the above-listed approaches. Among the other approaches used by utilities are jointly funded feasibility studies for C&LM measures (offered by Southern California Edison), dealer promotions for sales of energy-efficient equipment (also offered by Southern California Edison), and free and low-cost packages of measures for small C&I customers (offered by the Snohomish Public Utility District).

C. PARTICIPATION

Participation rates for multiple end-use programs range from less than 1% (for some start-up and/or poorly marketed programs) to approximately 70% (see Table 10-1).

Table 10-1
Summary of Multiple End-Use Program Results

Utility	State	Program	Program Type	Time Period Start	Time Period End	Pilot or Full-Scale	Number Eligible	Number of Participants: Customers	Number of Participants: Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings: Coin MW	Estimated Savings: Absol. MW	Estimated Savings: GWh /yr	1987 Peak Demand	Svgs as % of Peak	Coincident or Absolute	Expenses (1000s of $): Direct	Expenses (1000s of $): Total	Util. Cost $/kW	Direct or Total	Util. Cost $/kWh
Atlantic El	NJ	Energy-Effic. Cash Reb.	Rebate	9/86	12/88	Full	1,827	72		3.9%	C				1,609				$92			
Austin	TX	Commercial Energy Mgmnt	Rebate	10/87	9/88	Full	26,609	182	412	0.7%	C	4.09		10.06	1,391	0.29%	C	$1,146		$280	D	$0.020
BECo	MA	Encore	Perform	9/88	12/89	Full	2,400	48		2.0%	C		4.00		2,477	0.16%	A					
CMP	ME	C&I Energy Mgmnt. Loan	Loan	1984	12/88	Full	43,686	25	27	0.1%	C			1.96	1,455							
Jersey Cen.	NJ	Comm'l Cons. Incent. Reb	Rebate	1986	12/88	Full	~85,000		196	0.2%	P				3,766							
LILCO	NY	Dollars and Sense	Rebate	10/86	9/88	Full	95,871		857	0.9%	P	9.68		56.94	3,576	0.27%	C	$1,718	$2,084	$215	T	$0.005
NEES	MA/RI	Lg C&I Perform. Contract	Perform	7/87	12/88	Full	563	63		11.2%	C	0.94			3,798	0.02%	C		$1,159	$1,227	T	
NEES	MA/RI	Lg C&I Custom Programs	Rebate	4/88	12/88	Full	1,890	308		16.3%	C	3.10			3,798	0.08%	C		$1,640	$529	T	
NU	CT/MA	Energy Action	Compre.	1/88	12/89	Full	2,478	150		6.1%	C		22.00		4,242	0.52%	A		$3,139	$143	T	
NU	CT/MA	Customer Initiated	RFP	4/89	12/89	Full	2,409	5	5	0.2%	C		0.02	1.32	4,242	0.00%	A		$30	$1,714	T	$0.003
Palo Alto	CA	Partners Elec. Incentive	Rebate	1985	7/89	Full	2,409		387	16.1%	P		5.90	22.28	182	3.24%	A	$1,432	~$2,220	$376	T	$0.013
PG&E	CA	Small Comm'l Direct Reb.	Rebate	1983	12/84	Full	~475,000		16,847	3.5%	P			46.96	14,142			$9,269				$0.034
PG&E	CA	Customized Rebates	Rebate	1983	12/86	Full	511,322		14,810	2.9%	P			1026	14,142			$46,067				$0.008
PG&E	CA	Direct Rebate	Rebate	1/85	12/86	Full	511,322		17,282	3.4%	P			145.9	14,142			$9,429				$0.011
PG&E	CA	Direct & Customized Reb.	Rebate	1/87	12/88	Full	511,322						16.20	93.70	14,142	0.11%	A		$4,962	$306	T	$0.007
PSE&G	NJ	CASH Rebate	Rebate	1/87	12/88	Full	~4000	44		1.1%	C				8,137			~$50				
Puget P&L	WA	Comm'l Cons. Financing	Compre.	1980	12/88	Full	69,236	1,152	1,719	1.7%	C			161.4	3,528			$22,825	$29,101			$0.023
Snohomish	WA	Comm'l Non-Profits	Compre.	3/88	12/88	Full	~35	25		71.4%	C			0.90	1,156			$171				$0.033
Snohomish	WA	Schools & Local Govt.	Compre.	1/88	12/88	Full	35	7		20.0%	C			0.23	1,156							
So. Cal. Ed	CA	Lg. Comm'l Plan	Compre.	1/80	12/83	Full	855	629		73.6%	C		55.00	233.1	14,775	0.37%	A					
So. Cal. Ed	CA	Survey & Hardware Rebate	Rebate	1/80	12/86	Full	393,754						1134	5287	14,775	7.68%	A		$93,344	$82	T	$0.002
So. Cal. Ed	CA	Hardware Rebate	Rebate	1/81	12/87	Full	393,754			~1%/yr	P		270.0	1437	14,775	1.83%	A		$40,023	$148	T	$0.004
So. Cal. Ed	CA	Conserv. Means Business	Other	9/81	7/83	Full	393,754							89.34	14,775			$318				$0.001
So. Cal. Ed	CA	Joint Funded Feas. Stud.	Other	1983	12/86	Full			95						14,775			$596				
So. Cal. Ed	CA	Hardware Rebate	Rebate	1/88	12/88	Full	393,754	1,074		0.3%	C		11.80	55.52	14,775	0.08%	A		$2,438	$207	T	$0.006
TVA	TN+	C&I En. Mgmnt. Survey	Loan	1979	9/86	Full	360,131	24,485		6.8%	C		155.0	767.0	19,772	0.78%	A		$45,800	$295	T	$0.008
Wisc. Elec.	WI	Smart Money	Rebate	6/87	3/89	Full	81,750	5,600	9,932	6.9%	C		61.93	307.8	3,810	1.63%	A	$36,305		$586	D	$0.021
Wisc. Elec.	WI	Direct Rebate	Rebate			Full	81,750								3,810							
Wisc. P&L	WI	Bright Idea for Business	Perform	4/87	5/89	Both	38,516	94		0.2%	C		2.04	8.36	1,634	0.13%	A			~$500	T	

Table 10-1
Summary of Multiple End-Use Program Results

Utility	State	Program	Program Type	Time Period Start	Time Period End	Pilot or Full-Scale	Number Eligible	Number of Participants: Customers	Number of Participants: Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings: Coin MW	Estimated Savings: Absol. MW	Estimated Savings: GWh /yr	1987 Peak Demand	Svgs as % of Peak	Coincident or Absolute	Expenses (1000s of $): Direct	Expenses (1000s of $): Total	Util. Cost $/kW	Direct or Total	Util. Cost $/kWh
Austin	TX	Commercial Energy Mgmnt	Rebate	10/86	9/87	Pilot	~5,000	120	247	2.4%	C	1.90		5.08	1,391	0.14%	C	$504		$265	D	$0.017
BECo	MA	Encore	Perform	11/86	12/88	Pilot	162	24		14.8%	C		3.50	12.00	2,477	0.14%	A	$4,401	$4,648	$1,328	T	$0.050
BECo	MA	Design Plus	Compre.	7/87	7/89	Pilot	10	7		70.0%	C	4.66		25.31	2,477	0.19%	C		$5,592	$1,200	T	$0.028
BPA	WA/OR	Institutional Bldgs.	Compre.	10/82	9/87	Pilot	34,852	633		1.8%	C		24.00	126.6	16,680	0.14%	A		$25,600	$1,067	T	$0.026
BPA	WA/OR	Purch. En. Svgs Fld Test	Perform	11/83	11/86	Pilot		5						8.93	16,680			$924				$0.018
BPA	WA/OR	Purchase of Energy Svgs	Perform	5/85	7/89	Pilot		15	40 bldgs					7.75	16,680			$2,170	$2,810			$0.046
BPA	WA/OR	Comm'l Incentives Pilot	Compre.	1985	12/89	Pilot			535					25.79	16,680			$5,212	$6,803			$0.034
Cen. Hudson	NY	Interim Rebate	Rebate	11/87	1/88	Pilot	50 w/audit	6	6	12.0%	C				824			$7	$9			
Cen. Hudson	NY	Dollar Saver's	Rebate	5/88	12/88	Pilot	27,904	14	16	0.0%	C		0.15	0.34	824	0.02%	A	$22	$27	$183	T	$0.010
CMP	ME	Shared Savings	Perform	9/86	10/89	Pilot	45	1		2.2%	C	5.50		12.10	1,455	0.38%	C	$650		$118	D	$0.009
CMP	ME	Efficiency Buy-Back	RFP	12/86	10/89	Pilot	255	6		2.4%	C	5.10		26.03	1,455	0.35%	C					
CMP	ME	Power Partners	Bidding	1987	10/89	Pilot							17.10	91.39	1,455	1.18%	A					
Comm Ed	IL	Small C&I Audit/Loan	Loan	2/88	1988	Pilot	1,500	19		1.3%	C				15,683				$50			
Comm. Elec.	MA	Energy Effic. Rebate	Perform	3/87	8/88	Pilot	37,247	50	59	0.1%	C	6.34		25.00	873	0.73%	C	$5,887	~$6,036	$952	T	$0.031
Con Ed	NY	Selected Network	Rebate	4/87	12/88	Pilot	~2,700		49	1.8%	P	1.10			9,386	0.01%	C	$331		$300	D	
Con Ed	NY	Incentives for C&I Retro	Rebate	9/87	12/88	Pilot		24				1.19			9,386	0.01%	C	$326		$274	D	
Detroit Ed	MI	Business En.Eff. Finance	Loan	3/87	9/88	Pilot	353	11		3.1%	C				8,427			$42	~$92			
Met-Ed/GPU	PA	Custom	Rebate	1/88	12/88	Pilot	43,959								1,673							
NEES	MA	Enterprise Zone - Lg C&I	Perform	8/85	5/87	Pilot	113	8		7.1%	C	6.60	6.60	50.00	2,502	0.26%	C	~$17,650	~$18,000	$2,727	T	$0.046
NU	CT	Shared Savings	Perform			Pilot									3,865							
NU	MA	Performance Contracting	Perform	2/86	12/87	Pilot	179	3		1.7%	C			3.10	700			$448				$0.025
Seattle C.L	WA	Comm'l Incentives Pilot	Compre.	1986	12/88	Pilot	31,666	80		0.3%	C			3.25	1,725			$1,458	$2,402			$0.095
SMUD	CA	Peak Load Rebate	Rebate	1987	12/88	Pilot	26,000	189	351	0.7%	C	5.71		18.49	1,902	0.30%	C	$778		$136	D	$0.007
Snohomish	WA	Comm'l Incentives Pilot	Compre.	1/88	12/88	Pilot	15,759	113		1.1%	C			3.35	1,156			$994	$1,104			$0.042
Snohomish	WA	Comm'l Low Cost	Other	4/88	12/88	Pilot	15,759		312	2.0%	P			0.38	1,156							

Key: Perform= performance contracting; Compre.= comprehensive; RFP= request for proposals.

Note:
$/kWh calculated assuming a 10 year average measure life and a 6% real discount rate (see Chapter 1 for explanation of methods and assumptions employed).

Comprehensive Programs

Generally, the highest participation rates have been achieved by comprehensive programs offered to a limited group of customers. For example, Southern California Edison achieved a participation rate of 74% for a program which offered free detailed energy audits, rebates and technical assistance to 855 commercial customers with peak demand of 500 kW or more. The program was personally marketed to all eligible customers and included extensive post-audit follow-up visits to promote and verify measure installation [3].

The Snohomish Public Utility District reached 71% of its 35 commercial non-profit customers with a program which combined audits, extensive arranging assistance and 100% financing of cost-effective conservation measures. The program was personally marketed to all eligible customers who were told that the program was only available for one year [4].

Boston Edison has achieved 70% participation with its pilot Design Plus Program. The program includes a free detailed engineering analysis of C&LM opportunities, preparation of specifications, supervision of bids and construction, and a grant of 50% of the measure cost. The program was initially offered to ten of Edison's largest commercial customers through a CEO to CEO letter and personal contacts. All customers initially agreed to participate although three customers subsequently dropped out (one customer moved, one decided to change the building's use and one was involved in a takeover fight) [5].

Several comprehensive programs have been offered to all of a utility's C&I customers including programs offered by Puget Power, Bonneville Power Administration (BPA), Snohomish Public Utility District and Seattle City Light. These programs reach approximately 1% of eligible customers each year through word-of-mouth advertising. Limited financial and staff resources prevent them from serving more customers even though it would be easy to generate more customer demand. For example, despite the limited marketing, the Puget Power and Light program has had a backlog of customers waiting to get into the program as long as two years [6].

<u>Rebate Programs</u>

Rebate programs vary in participation rates from 0% of approximately 10%. Participation rates among large C&I customers can approach 25%.

The City of Palo Alto's Partners program has a participation rate of 16%, although this rate is based on the number of projects implemented and not the number of customers served [7]. Assuming the average participating customer undertakes 1.5-2 projects [8], the Partners program has reached approximately 8-11% of eligible customers. Most marketing efforts have been directed at large customers (peak demand greater than 200 kW). These large customers account for 75% of the projects implemented under the program. Participation rates among these customers are likely to be in the 20-27% range [9]. The Partners program is marketed through repeated and extensive personal contacts with large customers. A single account representative is assigned to each customer who is responsible for repeated contacts and "handholding" [10].

Most of the projects undertaken through the program were implemented in the first few years. Activity has fallen in the latter years of the program. This drop appears to be due in part to changes in rebate structure during the fourth year of the program. However, participation remained low in the fifth year (despite a return to the original structure) which may be due to the fact that easy conservation opportunities (easily reached customers and easily implemented projects) are largely implemented and remaining C&LM opportunities are more difficult to achieve [11].

Pacific Gas and Electric has operated rebate programs since the early 1980s. Through 1986, they estimate that approximately 7% of eligible customers were reached including approximately 5-10% of small customers and 40% of large customers [12]. However, these participation figures double count customers who implement more than one project. When figures are adjusted to eliminate double counting, participation rates drop by 50-67% [13]. In recent years marketing efforts and rebate levels have been reduced and participation has dropped as a result. During its active promotion phase, this program featured catchy marketing materials, free energy audits, simple application materials (materials which are easy to understand and fill out) and extensive personal contacts including regular contacts with large customers and single contacts with small C&I customers over a five-year period [14]. PG&E has recently announced that program activities will be greatly expanded during the 1990-91 period [15].

Southern California Edison (SCE) has run a C&I rebate program since the late 1970s. This program reached approximately 1% of eligible customers each year during the 1980-1986 period. In recent years rebate levels and marketing efforts have been reduced and participation has declined somewhat [16]. The program is similar to PG&E's program in most respects. The one significant difference is that Southern California Edison generally requires an energy audit before a rebate is given. During the audit, customers are given rebate coupons for recommended measures. SCE has recently announced that program activities will be expanded significantly over the 1990-91 period [17].

Two programs begun in the past few years have achieved substantial participation rates.

Wisconsin Electric has reached 7% of eligible customers in less than two years with its Smart Money program [18]. The program features easy application procedures (simple applications and, when needed, utility assistance filling them out) and an extensive marketing effort involving direct mail, trade allies, and personal contacts. An engineering firm on retainer provides technical assistance to customers. Knowledge of the program is widespread. A survey of non-participants found that two-thirds were familiar with the program [19]. Recently, program staff have found that much of the easy conservation savings (easy to reach customers and easy to implement measures) have been achieved and that additional marketing efforts are needed to keep participation rates up [20]. In the first half of 1989 participation is slightly below 1988's pace [21].

New England Electric began offering rebates to C&I customers with peak demands greater than 100 kW in April, 1988. By the end of the year, 16% of the eligible customers had participated. The high participation is due in part to extensive efforts by lighting dealers to promote the program. The lighting dealers receive rebates through another utility program. The combination of the two programs allows the dealers to provide efficient lighting products to customers at little or no cost. In addition to dealer marketing efforts, the program features regular personal contacts by utility representatives. These marketing efforts are encouraged by the utility's bonus system. Senior management, including directors of field offices, are assigned specific goals, including C&LM program participation goals each year. Bonuses are linked in part to goal achievement, giving senior management, and hence the staff working for them, a strong incentive to do a good job promoting the programs. The rebate structure was considered by the utility to be somewhat cumbersome and was simplified in mid-1989 [22].

All of the successful rebate programs discussed above feature multiple marketing approaches including direct mail and regular personal contacts with trade allies and large customers. This necessitates a large staff (either utility staff or contractors) to market and manage the program. Most programs have catchy marketing materials and easy application procedures. Most of the programs provide rebates which cover from 20-50% of measure cost, although one program with a particularly high participation rate featured lighting rebates (in combination with another program) of up to 100% of measure cost). Rebate programs are generally more successful at reaching large customers (peak demand greater than 100-500 kW) than small customers. There is limited evidence that participation in rebate programs may decline after the easiest to reach customers participate and the easiest to implement measures are installed. Further investigation of this issue is required before conclusions can be drawn.

Loan Programs

Only four loan programs are included in this study (plus two programs which offer both rebates and loans). For the three programs studied, participation rates range from less than 1% to nearly 7%.

The highest participation rate was achieved by the Tennessee Valley Authority program over an eight-year period. This program provides energy audits (free for small customers and for large customers who implement audit recommendations) and loans at just below the prime rate. Most participants (over 98%) just received an audit and did not go on to take out a loan [23].

Detroit Edison achieved a 3% participation rate with its loan program after 1 1/2 years. Program non-participants often expressed preference for rebates or preferred to finance measures out of pocket. Also loans were limited in both amount and subsidy, which made them unenticing to many prospective customers [24]. Central Maine Power has reached less than 1% of eligible customers with its loan program (see Table 10-1).

The combined rebate/loan programs offered by Wisconsin Electric and Puget Power and Light provide additional information on the customer appeal of loan programs. Both utilities offer customers a choice of a zero interest loan or a rebate which is approximately equivalent to the interest subsidy on the loan. In both programs, over 90% of the participating customers have chosen rebates instead of loans [25]. However, the use of loans by some customers indicates that loans can be useful for a minority of customers who do not have sufficient cash to finance C&LM improvements.

Performance Contracting

There are ten performance contracting programs in our sample. Participation rates ranged from less than 1% to 15%.

The highest participation rate was for Boston Edison's pilot Encore program. This program was offered to a random sample of 162 C&I customers; 15% of these customers participated including approximately 25% of the customers with peak demand of 150 kW or more. ESCo's were particularly interested in customers with peak demand greater than 500 kW. ESCo's market the program through letters and personal contacts with some assistance from the utility. ESCo's are paid each year for energy savings based on the utility's avoided costs. Utility payments are sufficient for ESCo's to provide many measures at no cost to the customer and still make a profit [26].

Following the successful completion of the pilot program, Boston Edison began a full-scale version of the program which targets 2,400 customers with a billing demand of 150 kW or more. After 15 months, 13 ESCo's are actively participating in the program. Contracts have been signed with 2% of the eligible customers and proposals are outstanding with an additional 15% of eligible customers. [27]

New England Electric has reached 11% of eligible customers with its Performance Contracting Program. This program is marketed by ESCo's to customers with peak demand of 500 kW or more. The majority of projects are for lighting measures; many of these are provided to the customer at no cost. Participation was slow in the first year of the program but has picked up recently as (1) ESCo's are under pressure to achieve contract goals (if goals are not met, they forfeit a bond) and (2) customers become more comfortable with the program and can obtain necessary approvals to sign a contract with an ESCo. Even with the recent upsurge in participation in this program, participation rates are lower than in a companion rebate program offered by the utility, despite the fact that the rebate program offers lower incentives (approximately 30% lower), has been in operation for a shorter period of time (over six months less), and is offered to customers with lower electric demand. [28]

Prior to the current Performance Contracting Program, New England Electric offered a pilot program which reached 7% of eligible customers over two years. This pilot, dubbed the Enterprise Zone Large C&I Program, included free energy audits provided by the utility, followed by submission by ESCo's of bids to individual customers. ESCo's were offered payments up to $0.07 per kWh saved for up to ten years. 85% of the customers accepted the energy audits but ESCo's submitted bids for only 23% of the customers. Generally bids were only submitted for schools and hospitals and for customers with annual electricity use above 200,000 kWh. [29]

One other performance contracting program, Commonwealth Electric's Energy Efficiency Rebate program, has achieved significant participation. While the participation rate is less than 1% of all eligible customers, the program is reaching many large customers with multiple measure projects, and as a result, savings, as a percentage of utility peak demand, are approaching 1%. Interestingly, 90% of the projects are done on a guaranteed savings arrangement (described in section B above) and not a performance contracting arrangement. This program is primarily marketed by ESCo's and guaranteed savings contractors. Incentives are sufficient to cover the full installed cost of many measures [30].

Other performance contracting programs have had low participation rates (less than 3%) and only moderate savings. For example, Northeast Utilities reached only 3 out of 179 targeted customers with its performance contracting program. They found that ESCo's were interested in "cream-skimming" -- working only with the largest customers and the most profitable measures (primarily lighting) [31]. Similarly, Central Maine Power (CMP) has reached only 1 out of 45 targeted customers with its Shared Savings program. Participation rates have been higher with the utility's RFP and bidding programs (see Table 10-1). CMP now believes that performance contracting serves a market niche (large customers who lack financing or staff time to implement C&LM measures) but that most customers prefer other program approaches [32]. Likewise, Wisconsin Power and Light has been disappointed in the results from its shared savings program and is now complementing its shared savings program with a rebate program [33].

In summary, programs which provide high incentives to ESCo's can achieve significant participation rates. However, ESCo's are primarily interested in large customers and many customers are reluctant to sign performance contracting agreements. Limited side-by-side comparisons indicate that when customers are offered a choice between performance contracting and other program choices, the majority will choose the other choices. Still, some customers like performance contracting arrangements and thus this arrangement may serve an important market niche. Most utilities which offer/offered performance contracting programs now emphasize other program approaches in their dealings with large customers.

<u>Request for Proposal and Bidding Programs</u>

Three C&I RFP and bidding programs are included in our study (one other industrial-only program is discussed in Chapter 6). These programs are generally available to all C&I customers but as a practical matter only the largest customers are likely to prepare a proposal. Accordingly, participation rates, measured as a proportion of all eligible customers are generally low, but savings, measured as a proportion of the utility's peak demand can be significant. For example, CMP's Power Partner's and Efficiency Buy-Back Programs have signed contracts totaling 1.5% of the utility's peak demand. Power Partners requires a detailed proposal, but offers the potential of high payments (approaching the utility's avoided costs). Efficiency Buy-Back offers slightly lower payments (payments are capped at 50% of measure cost) but easier application procedures [34].

Northeast Utilities has recently begun an RFP-type program. As these programs expand in number, it will be possible to better evaluate their participation rates and other results [35].

D. SAVINGS ACHIEVED

For this study we collected three types of savings data. First, we collected data on average savings per customer as a percent of the pre-program electricity use of participating customers. Second, we looked at yearly savings achieved by each program as a proportion of the utility's peak demand. Third we looked at the distribution of savings among different types of measures (e.g., lighting, HVAC). The first type of data tells how much electricity use is reduced at the individual customer level. It measures the "depth" of savings achieved, i.e., are savings only superficial or are comprehensive retrofit projects undertaken. The second type of data essentially capture the combined effects of participation rates and the depth of savings. These data are useful for determining which program approaches achieve the greatest impact towards reducing utility capacity requirements.

Percentage Savings

Available data on average savings as a percent of pre-program electricity use are summarized in Table 10-2. Nearly all of this data is for either comprehensive programs or performance contracting programs which pay high incentives and provide services similar to comprehensive programs. Nearly all of the savings figures are based on engineering estimates and need to be confirmed based on analysis of actual electricity bills.

Table 10-2

Average Electricity Savings from Multiple End-Use Programs as a Percent of Participating Customer's Pre-Program Electricity Use

Utility	Program	Program Type	Avg. % Savings
Boston Edison	Design Plus	Compre.	22-23%
Boston Edison	ENCORE	Perform	15%
BPA	Commercial Incentives Pilot	Compre.	12%
BPA	Purchase of Energy Savings	Perform	18%
BPA	Institutional Buildings	Compre.	11% *
NU	Energy Action	Compre.	11%
Puget P&L	Comm'l Conservat'n Financing	Compre.	10-12%
So. Cal. Ed.	Hardware Rebate	Rebate	7% *

* Based on billing analysis (remainder of savings figures are based on engineering estimates).

Key: Compre.= comprehensive; Perform= performance contracting

Note:

Savings estimates come from published reports on the above listed programs or from personal communications with the program managers.

The highest savings (22-23% and 18%) were achieved by Boston Edison's Design Plus program and BPA's Purchase of Energy Savings program. Both programs made special efforts to include all cost-effective measures in the package of implemented measures. Five comprehensive programs which do not make special efforts to implement all cost-effective measures average 10-15% savings. The savings estimate for BPA's Institutional Buildings program is based on an analysis of electricity bills. Actual savings were only approximately 60% of estimated savings. The discrepancy is attributed primarily to overly optimistic initial engineering assumptions [36]. All of the savings estimates discussed in this paragraph are not adjusted to eliminate free riders.

Only one estimate of rebate program savings is available. Fortunately it is based on a detailed statistical analysis of billing data. The 1983 Southern California Edison Hardware Rebate program achieved 7.2% average savings. This savings estimate is not adjusted to eliminate free riders. Auditor savings estimates were in close agreement with the results of the billing analysis [37].

Thus, from the analysis of energy savings studies, it appears that 18-23% savings are achieved if special efforts are made to implement all cost-effective measures, that savings of 10-15% are achieved if comprehensive services are offered but special efforts to implement all cost-effective measures are not made, and that a successful rebate program achieves average savings of approximately 7%. These conclusions should be used with caution since only limited data is available and most of the data is based on engineering estimates.

No data on percentage savings from loan or RFP programs is available. Efforts to collect this data are needed, as are efforts to collect percentage savings data on rebate programs and actual savings data (as opposed to engineering estimates) on all types of programs.

Savings as a Percent of Utility Peak

Examination of the data on savings as a proportion of total utility peak demand (Table 10-3) yields somewhat different findings

The programs which achieve the highest savings each year are primarily rebate programs with high participation rates. A few performance contracting or RFP programs which achieve large savings from a limited number of very large customers are also high on the list. Existing comprehensive programs generally achieve less savings each year, in part because the programs can only serve a limited number of customers each year, but in part because nearly all of the current programs are pilot, start-up or limited efforts.

The five programs with the highest annual savings are worth noting. Southern California Edison's Survey and Hardware Rebate program has saved 1.3% of peak each year, although approximately half of these savings are due to free riders [38]. The program resembles a comprehensive program in many respects in that it combines audits, rebates and regular post-audit follow-up visits to encourage and verify measure installations. The program provides rebates for a long list of C&LM measures and also includes custom rebates for measures proposed by customers. The Wisconsin Electric and Palo Alto rebate programs (savings of 0.9% and 0.7% of peak each year) are two of the rebate programs with the highest participation rates. They also include extensive technical assistance and "handholding" with targeted customers. Both programs have found that participation and savings may drop after a few years of intensive efforts. Additional experience is needed before any definitive conclusions can be drawn on this issue. The CMP Power Partner's and Commonwealth Electric programs owe the majority of their savings to large customers. Both programs pay incentives at close to the utility's avoided cost, making these programs attractive to outside service providers (e.g. ESCo's and contractors) but also raising program costs (see Section F).

Table 10-3
Savings from Multiple End-Use Programs as a Percent of Utility Peak Demand

Utility	State	Program	Program Type	Time Period Start	Time Period End	MW Savings as % of System Peak Cumm.	MW Savings as % of System Peak Annual
So. Cal. Ed	CA	Survey & Hardware Rebate	Rebate	1/80	12/86	7.68%	1.28%
Wisc. Elec.	WI	Smart Money	Rebate	6/87	3/89	1.63%	0.93%
Palo Alto	CA	Partners Elec. Incentive	Rebate	1985	7/89	3.24%	0.72%
CMP	ME	Power Partners	Bidding	1987	10/89	1.18%	0.59%
Comm. Elec.	MA	Energy Effic. Rebate	Perform	3/87	8/88	0.73%	0.51%
So. Cal. Ed	CA	Hardware Rebate (w/o Survey)	Rebate	1/81	12/87	1.83%	0.30%
Austin	TX	Commercial Energy Mgmnt	Rebate	10/87	9/88	0.29%	0.29%
NU	CT/MA	Energy Action	Compre.	1/88	12/89	0.52%	0.26%
NEES	MA	Enterprise Zone - Lg C&I	Perform	8/85	5/87	0.26%	0.15%
SMUD	CA	Peak Load Rebate	Rebate	1987	12/88	0.30%	0.15%
Austin	TX	Commercial Energy Mgmnt	Rebate	10/86	9/87	0.14%	0.14%
LILCO	NY	Dollars and Sense	Rebate	10/86	9/88	0.27%	0.14%
BECo	MA	Encore (pilot)	Perform	11/86	12/88	0.14%	0.13%
BECo	MA	Encore (full-scale)	Perform	9/88	12/89	0.16%	0.13%
CMP	ME	Shared Savings	Perform	9/86	10/89	0.38%	0.13%
So. Cal. Ed	CA	Lg. Comm'l Plan	Compre.	1/80	12/83	0.37%	0.12%
CMP	ME	Efficiency Buy-Back	RFP	12/86	10/89	0.35%	0.12%
NEES	MA/RI	Lg C&I Custom Programs	Rebate	4/88	12/88	0.08%	0.12%
TVA	TN+	C&I En. Mgmnt. Survey	Loan	1979	9/86	0.78%	0.11%
BECo	MA	Design Plus	Compre.	7/87	7/89	0.19%	0.09%
So. Cal. Ed	CA	Hardware Rebate	Rebate	1/88	12/88	0.08%	0.08%
Wisc. P&L	WI	Bright Idea for Business	Perform	4/87	5/89	0.13%	0.06%
PG&E	CA	Direct & Customized Reb.	Rebate	1/87	12/88	0.11%	0.06%
Cen. Hudson	NY	Dollar Saver's	Rebate	5/88	12/88	0.02%	0.03%
BPA	WA/OR	Institutional Buildings	Compre.	10/82	9/87	0.14%	0.03%
NEES	MA/RI	Lg C&I Perform. Contract	Perform	7/87	12/88	0.02%	0.02%
Con Ed	NY	Incentives for C&I Retro	Rebate	9/87	12/88	0.01%	0.01%
Con Ed	NY	Selected Network	Rebate	4/87	12/88	0.01%	0.01%
NU	CT/MA	Customer Initiated	RFP	4/89	12/89	0.00%	0.00%

Key: Perform= performance contracting; Compre.= comprehensive; RFP= request for proposals.

Source: Derived from Table 10-1.

Note: Remaining programs are not included because information on kW savings from these programs is not available.

Distribution of Savings Among Measures

A number of utilities have reported data on the distribution of savings among different conservation measures. Most programs report that the largest proportion of kWh savings are due to lighting measures. The proportion of savings due to lighting measures ranges from approximately 38% for Puget's Commercial Conservation Financing Program [39] to 79% for the pilot year of the City of Austin's rebate program [40]. Generally, new programs report a high percentage of savings from lighting measures while more mature programs report a lower percentage. For example in addition to the high Austin percentage, Wisconsin Electric reports that 72% of the savings in the first year of its Smart Money Program was from lighting measures. In the second year, the lighting percentage dropped to 56% [41]. Similarly, both SMUD and BPA report that 63-64% of the savings in the initial stages of their programs are due to lighting changes [42], while Puget and Palo Alto report lower lighting percentages (38% and 49% respectively) [43].

Besides lighting, most programs report the largest savings from HVAC and industrial process measures. For example, Wisconsin Electric reports 13-21% of savings from HVAC measures in the first year and 34% in the second year [44]. Puget reports that 34% of their savings is due to HVAC measures and 12% from process [45]. Palo Alto reports 34% of kWh savings are from process measures and approximately 10% from HVAC measures [46].

E. FREE RIDERS

During the course of our research, we collected estimates on free riders for 12 programs (see Table 10-4). Free rider shares ranged from a low of 5% to a high of 70%. Most programs estimate that free riders comprise 30-60% of the program participants and/or of the savings achieved. The lowest reported free rider proportion was for the New England Electric Enterprise Zone Program that paid very high incentives, primarily for installation of cogeneration

Table 10-4

Percentage of Participants or Savings in Multiple End-Use Programs Which are Due to Free Riders

Utility	Program	Program Type	Free Rider Percent
Central Hudson	Dollar Saver's	Rebate	30-60%*
NEES	Enterprise Zone - Lg C&I	Perform	5%**
NEES	Lg. C&I Custom Programs	Rebate	30%***
NEES	Lg. C&I Perform. Contract	Perform	34%***
NU	Energy Action	Compre.	30%
PG&E	Direct Rebates	Rebate	19-63%*
PG&E	Customized Rebates	Rebate	19-68%*
SMUD	Peak Load Rebate	Rebate	36-53%****
So. Cal. Ed.	Survey and Hardware Rebate	Audit & Rebate	51%**
So. Cal. Ed.	Hardware Rebate	Rebate	70%**
Wisc. Elec.	Smart Money - 1st yr	Rebate	50%*
Wisc. Elec.	Smart Money - 2nd yr	Rebate	30%*

* % of participants
** % of kWh savings
*** % of implemented measures
**** % of rebate dollars paid

Note:

Data obtained from personal communications with or published reports furnished by the respective utilities.

equipment. The highest reported free rider proportion was for recipients of Southern California Edison's Hardware Rebates in comparison to audit-only recipients.

Most programs estimate free riders based on customer surveys. As such these estimates are often not reliable and should be used with caution. Free rider estimates often vary depending on how customers are questioned. Typically, when a series of questions are asked, the result is that some participants are clearly free riders and some may be free riders. For example PG&E found that 30-37% of rebate recipients would not have made the change without the rebate while the remainder would have made the change if the rebate were not offered. However, of the 63-70% free riders, approximately 75% said the rebate speeded up the change [47]. It is likely that some, if not many, of the respondents who had planned to make the change at a later date, would never have gotten around to making the change.

Likewise, SMUD classified rebate recipients into three groups: (1) those where the rebate had no influence (36% of rebate recipients); (2) those who would not have implemented their project without the rebate (47%); and (3) those who were somewhat influenced by the rebate, but it was one of several factors influencing their decision (17%) [48].

Similarly, when New England Electric asked customers if they would have made changes without the program, 42-58% of the respondents said yes. However, when they were asked if they would have implemented all changes without the program or only some changes, most participants said they would have implemented only some changes without the program. On a weighted average basis, respondents reported that 30-34% of the measures would have been implemented without the program [49].

Another interesting finding is that free riders may decline with time. Wisconsin Electric estimates that 50% of the participants in the first year were free riders, but free riders declined to 30% in the second year [50].

In sum, free rider estimates vary widely depending on the program examined and how program participants are questioned. Free rider data on programs is very limited, and is generally available only for rebate programs. In the majority of rebate programs examined, free riders appear to account for approximately 30-60% of the participants and the savings. When simplistic questions are asked, free riders are often estimated near the upper end of this range. When multiple questions are asked and clear free riders are separated from possible free riders, free rider estimates tend to fall at the low end of this range. There may also be a tendency for programs to have a higher proportion of free riders in early years than in later years.

However, just because free riders may account for 30% of the participants in the "typical" rebate program does not mean they will account for this percentage in any specific program. Free rider proportions are highly influenced by the measures being promoted. When measures which already have high market shares (such as reduced wattage fluorescent lamps) are being promoted, free rider shares are often high. When products with low market share are promoted, free rider shares are generally low. To a large extent, free rider proportions can be regulated through the products and efficiency levels which are promoted. Free rider proportions can also be reduced through pre-inspection requirements and payback thresholds. Pre-inspection requirements eliminate customers who already use efficient equipment but want to replace worn-out equipment with new equipment. Payback thresholds (e.g. requiring customers to fully finance rapid payback measures, where "rapid payback" may be defined to be "one year or less") limit utility incentives to measures with medium or long paybacks. While no specific data is available, it is likely that free rider proportions are lower for measures with medium or long paybacks than for measures with short paybacks.

F. PROGRAM COST-EFFECTIVENESS

Utility program costs per kW and kWh saved vary widely, ranging from less than $0.01/kWh and $100/kW to as high as $0.095/kWh or $2,727/kW (see Table 10-1). Most of these cost estimates are not adjusted to eliminate free riders (see the Appendix to see which programs are adjusted). All but one program has a utility cost per kWh of $0.05 or less. Likewise, all but one program has a utility cost per kW of less than $1,600/kW and all but five programs cost utilities less than $1,000/kW.

Rebate programs range in utility cost from $0.002-$0.034/kWh (median of $0.009) and $82-586/kW (median of $277), making rebate programs among the least-costly (from the utility perspective) of the program types analyzed. Since in all rebate programs customers pay a substantial portion of measure costs, costs from the total resource perspective will be significantly higher. The least expensive programs per unit of energy saved (from the utility perspective) are Southern California Edison's which has achieved high participation levels through repeated personal contacts and features below average rebate levels. The most expensive rebate programs from the utility perspective are ones with above average rebate levels. It is unclear whether these high rebate levels help cause the high participation levels achieved by these programs.

Cost data are available for only one loan program -- TVA's. This program cost the utility $0.008/kWh saved, which, coincidentally is the same utility cost as the median rebate program.

Performance contracting programs range in utility cost from $0.009-0.05/kWh (median of $0.028) and from $118-2,727/kW (median of $1,090). Many of these programs, including all of the programs with above average cost, pay incentives close to utility avoided cost, making these programs among the more expensive (from the utility perspective) of the program types examined in this Chapter. In many cases programs with high utility costs have low customer costs (utility payments are sufficient in many cases to pay 100% of the measure costs). In these cases total resource costs will be approximately the same as utility costs.

Comprehensive programs range in utility cost from $0.023-0.095/kWh (median of $0.033). All but one of these programs cost utilities less than $0.05/kWh (the one exception is a program with a high proportion of free riders, resulting in low net savings [51]. Costs per kW are only available for three programs, which range in utility cost from $143 and $1,600/kW. From the utility perspective, comprehensive programs are one of the more expensive of the multiple end-use program types. However, since many comprehensive programs pay most costs and customers pay few costs, costs per kWh or kW are often similar for both the utility and total resource cost perspectives.

No cost information is available for the RFP programs.

G. CONCLUSIONS

There are five major types of multiple end-use programs: rebate, loan, performance contracting, comprehensive and RFP.

Rebate programs are the most common type of multiple end-use program. The best rebate programs have reached approximately 10% of eligible customers including approximately 25% of large customers. Programs with above average participation rates feature multiple marketing approaches including catchy, easy to understand brochures and applications, and extensive, regular personal contacts with trade allies and eligible customers. Limited data suggest that approximately 30% of the savings achieved by a typical rebate program could be due to free riders but free rider proportions are likely to vary from program to program, depending on the measures and efficiency levels being promoted. Only limited savings information is available for these programs -- this data indicates that average savings of approximately 7% of pre-program electricity use can be expected from programs which provide rebates for nearly all C&LM opportunities. Additional savings data are needed before conclusions can be drawn. Rebate programs have median costs of $0.008/kWh and $277/kW making them among the lower cost program approaches examined in this chapter (from the utility perspective).

Of the programs examined in this study, the three programs with the greatest annual savings as a percent of the utility's peak demand were rebate programs, indicating that the combination of moderate participation levels and moderate savings can combine to produce substantial energy savings. A few of the more successful programs have begun to see a slackening of interest, due in some cases to reduced support from the sponsoring utility. It is possible that rebate programs are useful for achieving easy energy savings (easy to reach customers and easy to implement measures), but once the easy savings are achieved, rebate programs are less effective at achieving additional energy savings. Further information is needed on this issue before conclusions can be drawn.

Only a few loan programs are presently offered by utilities. Side-by-side comparisons between rebate and loan programs offered by the same utility indicate that most customers (over 90%) prefer rebates but that loans serve a market niche -- the minority of customers who lack sufficient capital to finance C&LM improvements. Loan programs appear to have similar costs per kWh saved as rebate programs, making them an inexpensive program approach (from the utility perspective).

Performance contracting programs range widely in their effectiveness. The more successful programs achieve participation rates of 10-15% of eligible customers and savings of up to 0.73% of utility peak. These results can be obtained from programs which primarily target large C&I customers (peak demand of 100-500 kW or more) and which offer incentives approaching the utility's avoided cost. Left to their own devices, many ESCo's show a tendency to cream-skim, i.e., concentrate on the largest customers and the most lucrative energy-saving measures such as lighting improvements and cogeneration systems. Side-by-side comparisons between performance contracting and rebate programs appear to show that C&I customers prefer rebates to performance contracting, although performance contracting does fill a small market niche -- large customers with neither the time and/or money to implement C&LM improvements on their own. In addition, performance contracting allows a utility to achieve significant savings without adding many new staff people. Essentially, the utility is paying ESCo's to do much of the administrative work, which means that performance contracting is among the more expensive types of multiple end-use programs (median utility cost of $0.028/kWh saved).

Thus far, comprehensive programs have been limited to pilot, limited, and start-up efforts. Comprehensive programs can achieve very high participation rates (several programs have reached 70% of targeted customers) and very high savings (one pilot program achieved 22-23% savings). Highest participation rates are achieved by programs which use personal marketing with a limited target group of customers. Highest savings are achieved when efforts are made to implement all cost-effective measures. When these efforts are not made, savings average approximately 10-15% of pre-program electricity use. Due to staff and budget limitations these programs are reaching approximately 1% of C&I customers each year. Even with stepped up efforts, it will take many years to reach the majority of C&I customers with comprehensive programs. Due to the cost of extensive services and high incentives, comprehensive programs are among the more expensive program approaches (from the utility perspective). The median program costs utilities $.033/kWh saved.

Only a few RFP and bidding programs have been offered. These programs primarily reach only a limited number of very large customers, but due to the size of the customers reached, savings of over 1% of utility peak demand can be achieved. In many respects these programs are similar to performance contracting programs including their reliance on outside contractors and the tendency to concentrate on the largest customers and easy to implement measures. In addition, the incentive payments in RFP and bidding programs tend to approach the utility's avoided cost. In fact, many RFP program bids are submitted by ESCo's. However, unlike performance contracting programs, RFP and bidding programs allow customers to participate directly, without working with an ESCo. Additional experience is needed before conclusions can be drawn on the efficacy of RFP and bidding programs in relation to other program approaches.

With all types of programs there is a need for additional data on energy savings achieved as a percentage of pre-program electricity use. Whenever possible, this data should be based on analyses of pre- and post-program electricity use. Measured data on free rider proportions (i.e. comparison of participants with a control group) are also needed, particularly in performance contracting, RFP and comprehensive programs.

Nearly all of the programs examined have lower utility costs per kWh saved than the avoided costs of New York utilities, indicating that most of the multiple end-use programs examined are likely to be cost-effective in New York from the utility perspective. A number of comprehensive and performance contracting programs in which the utility pays all costs, also cost less than the avoided cost of New York utilities, indicating that some of these programs are likely to be cost-effective in New York from the total resource perspective. Data on the total resource cost of other program types are not presently available.

H. ADDITIONAL READING

Among the most useful publications on multiple end-use programs are the following:

Calhoun, Robin, "The Great PG&E Energy Rebate" in ACEEE 1984 Summer Study on Energy Efficiency in Buildings, Doing Better: Setting an Agenda for the Second Decade (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. I-30 to I-41.

Cole, Wolcott and Weedall, 1988, "Competitive Bidding of Demand Side Management" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. 6.11-6.26.

Dimit, Mary, 1987, "The Palo Alto Experience: Rebates as an Incentive for Commercial/Industrial Customers" in Proceedings: Third National Conference on Utility Demand-Side Management Programs, DSM Strategies in Transition, EPRI EM-5452 (Palo Alto, CA: Electric Power Research Institute), Section 19.

Haeri, Peters and Gustafson, 1988, Comparative Analysis of Commercial Sector Financing Mechanisms: CIPP, PES Pilot and Puget Incentive Programs (Portland, OR: Bonneville Power Administration), p. 43.

Hawley, Thomas, 1988, "Wisconsin Electric and the Smart Money Energy Program" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. 6.70-6.74.

Hicks, Elizabeth, 1989, "Third Party Contracting Versus Customer Programs for Commercial/Industrial Customers" in Energy Program Evaluation: Conservation and Resource Management, Proceedings of the August 23-25, 1989 Conference (Argonne, IL: Argonne National Laboratory), pp. 41-45.

Owens, Kevin, 1987, "Marketing Energy Management to Commercial/Industrial Customers, Utility Program Field Perspective", paper presented to the Demand Side Management Conference, Boston, MA, January, 1987 (Bellevue, WA: Puget Power and Light).

I. NOTES

1. For additional information on how some of these programs are structured, see Cole, Wolcott and Weedall, 1988, "Competitive Bidding of Demand Side Management" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. 6.11-6.26.

2. Preliminary results of this work are described in Goldman, C.A. and Eric Hirst, 1989, "Key Issues in Developing Demand-Side Bidding Programs", LBL-27748 (Berkeley, CA: Lawrence Berkeley Laboratory).

3. Southern California Edison, 1984, 1983 Conservation/Load Management Results (Rosemead, CA: Southern California Edison), pp. 3-4.

4. Personal communication with Don Pendleton, Snohomish Public Utility District, July, 1989. Also, Pendleton, Don, 1989, "Commercial Conservation Report: 1988 Summary" (Everett, WA: Snohomish Public Utility District).

5. Personal communication with Mark Barry, Boston Edison, July, 1989.

6. Personal communication with Sid France, Puget Power and Light, July, 1989. Also, Owens, Kevin, 1987, "Marketing Energy Management to Commercial/Industrial Customers, Utility Program Field Perspective", paper presented to the Demand Side Management Conference, Boston, MA, January, 1987 (Bellevue, WA: Puget Power and Light).

7. Based on data supplied by Jane Siguenza, City of Palo Alto, August, 1989.

8. This is the median range for the 20 programs in our database which provided information on both number of projects and number of participating customers.

9. Through July, 1989, 304 rebates had been granted to large customers (see note #6). Palo Alto has approximately 750 large customers (Gandhi, Sunita and Florentin Krause, "Program Design and Success: A Preliminary Overview of Utility Lighting Programs" in <u>Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings</u>, p. 6.45). Thus the large customer participation rate (based on number of projects) is 40%. Assuming 1.5-2 projects per participating customer (<u>Ibid</u>.), the participation rate is 20-27% of large customers.

10. Dimit, Mary, 1987, "The Palo Alto Experience: Rebates as an Incentive for Commercial/Industrial Customers" in <u>Proceedings: Third National Conference on Utility Demand-Side Management Programs, DSM Strategies in Transition</u>, EPRI EM-5452 (Palo Alto, CA: Electric Power Research Institute), Section 19.

11. See note #7.

12. Personal communication with Robin Calhoun, formerly with PG&E, March, 1988. Also, Barakat, Howard and Chamberlin Inc., 1988, <u>Demand-Side Management Program Analysis, Volume III: Commercial/Industrial Sector Report</u> (Woodbury, N.Y.: Long Island Lighting Company), p. 130.

13. See note #8.

14. Calhoun, Robin, "The Great PG&E Energy Rebate" in <u>ACEEE 1984 Summer Study on Energy Efficiency in Buildings, Doing Better: Setting an Agenda for the Second Decade</u> (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. I-30 to I-41. Also, personal communications with Robin Calhoun and Diane Calden, PG&E, April, 1988.

15. An Energy Efficiency Blueprint for California, Report of the Statewide Collaborative Process, report submitted to the California Public Utilities Commission, January, 1990.

16. Based on information contained in Southern California Edison's annual reports on Conservation and Load Management Program Results.

17. See note # 15.

18. Based on data supplied by Peggy Clippert, Wisconsin Electric, March, 1989.

19. Wisconsin Electric, 1989, 1988 Smart Money Energy Program Evaluation, Final Report (Milwaukee: Wisconsin Electric), p. II-12. Also, Hawley, Thomas, 1988, "Wisconsin Electric and the Smart Money Energy Program" in Proceedings of the 1988 ACEEE Summer Study on Energy Efficiency in Buildings (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. 6.70-6.74.

20. Personal communication with Greg Olson, Anco Engineers, Milwaukee, WI, July, 1989.

21. Based on data supplied by Peggy Clippert, Wisconsin Electric, August, 1989. Also, Wisconsin Electric, 1989, 1988 Smart Money Energy Program Evaluation Final Report (Milwaukee: Wisconsin Electric), p. III-16 to III-17.

22. New England Electric, 1989, Conservation and Load Management Annual Report (Westboro, MA: New England Electric). Also personal communications with Don Robinson and John Eastman, New England Electric.

23. TVA, 1987, Conservation Report '86 (Chattanooga, TN: TVA), p. 21. Also, personal communication with Jim West, TVA.

24. Detroit Edison, 1988, "Business Energy Efficiency Financing Program Summary Report" (Detroit: Detroit Edison).

25. Based on data provided by Peggy Clippert, Wisconsin Electric and Sid France, Puget Power and Light.

26. Boston Edison, 1989, Encore Status Report (Boston: Boston Edison). Also, personal communication with Steve Murphy, Boston Edison, July, 1989.

27. Personal communication with Richard Costello, Boston Edison, Boston, MA, Dec., 1989.

28. See note #19. Also, Hicks, Elizabeth, 1989, "Third Party Contracting Versus Customer Programs for Commercial/Industrial Customers" in Energy Program Evaluation: Conservation and Resource Management, Proceedings of the August 23-25, 1989

Conference (Argonne, IL: Argonne National Laboratory), pp. 41-45.

29. New England Electric, 1988, Evaluation Report on Massachusetts Electric Company's Enterprise Plan, Executive Summary (Westboro, MA: New England Electric), pp. 1.1-1.8.

30. Temple, Barker and Sloane, Inc., 1988, Evaluation of COM/Electric's Energy Efficiency Rebate Program, prepared for ComElectric (Lexington, MA: Temple, Barker and Sloane).

31. Temple, Barker and Sloane, Inc., 1987, Final Evaluation of the Western Massachusetts Electric Company's Performance Contracting Pilot Program (Hartford, CT: Northeast Utilities). Also, personal communication with Don Cameron, Northeast Utilities.

32. Personal communication with Jon Linn, Central Maine Power, August, 1989.

33. Remarks by Barbara McKellar, Wisconsin Light and Power, at the August 23-25, 1989 Conference on Energy Program Evaluation: Conservation and Resource Management, Chicago, IL.

34. Personal communication with Jon Linn, Central Maine Power, August, 1989.

35. Some additional information on these programs will become available in 1990 with the forthcoming publication of a report on demand-side bidding programs by Chuck Goldman of Lawrence Berkeley Laboratory and Eric Hirst of Oak Ridge National Laboratory.

36. Keating, Ken, and Susan Blachman, 1987, "In Search of an Impact: An Evaluation of an Institutional Buildings Program" in Energy Conservation Program Evaluation: Practical Methods, Useful Results, Proceedings of the 1987 Conference, Volume 1 (Argonne, IL: Argonne National Laboratory), pp. 107-116.

37. Train, Kenneth and Patrice Ignelzi, 1986, "The Economic Value of Energy-Saving Investments by Commercial and Industrial Firms" (Berkeley, CA: Cambridge Systematics), p. 21.

38. Train, Kenneth and Judi Strebel, 1986, "Net Savings from the 1983 Audit and Hardware Rebate Programs for Commercial and Industrial Customers, Volume I: Summary, Final Report," (Rosemead, CA: Southern California Edison), p. 5.

39. Based on data provided by Sid France, Puget Light and Power, July, 1989.

40. Based on data supplied by Brian Clement, City of Austin, March, 1989.

41. Wisconsin Electric, 1989, 1988 Smart Money Evaluation Final Report (Milwaukee: Wisconsin Electric), p. II-10.

42. Codina, Rick, 1989, "SMUD's Peak Load Rebate Program for Commercial, Industrial and Agricultural Customers, Final Report (Sacramento: Sacramento Municipal Utility District). Also, Haeri, Peters and Gustafson, 1988, Comparative Analysis of Commercial Sector Financing Mechanisms: CIPP, PES Pilot and Puget Incentive Programs (Portland, OR: Bonneville Power Administration), p. 43.

43. Based on data supplied by Jane Siguenza, City of Palo Alto, August, 1989. Also, see note #35.

44. See note #41.

45. See note #39.

46. Based on data supplied by Jane Siguenza, City of Palo Alto, August, 1989.

47. Pacific Consulting Group, 1984, Great Energy Rebate Program Evaluation Volume I, Participants and Non-Participants, MR-83-13 (San Francisco: PG&E), p. II-14. Also, Pacific Consulting Group, 1986, Evaluation of PG&E's 1984-85 Customized Rebate Program, Final Report: Volume I, MR-85-0718-11 (San Francisco: PG&E), p. III-18.

48. See note #42.

49. Freeman Research Resources, 1989, Final Report, Comparative Evaluation of the Custom Conservation Program and the Performance Contracting Program (Westboro, MA: New England Electric), pp. 26, 35.

50. See note #41, p. III-28 to III-29.

51. Seattle City Light, 1988, Seattle City Light Conservation Program Accomplishments and Expenditures Through 1987 (Seattle: Seattle City Light), pp. 43-46. Also, personal communication with Brian Coates, Seattle City Light, July, 1989.

Chapter 11

CONCLUSIONS

A. INTRODUCTION

The preceding analysis of utility experiences with C&LM programs for C&I customers was motivated by a desire to learn about programs and program approaches which achieve high participation rates and high electricity savings (net of free riders, to the extent available data permits this determination), while being cost effective to the sponsoring utility. Also, we wanted to review the very latest experience with innovative program approaches -- approaches that might prove useful to utilities in New York as they expand their C&LM activities. If demand-side resources are to play a major role in meeting future electricity needs, then programs will need to reach a substantial proportion of targeted customers and will need to have a significant impact on the electricity consumption of the customers that are reached.

B. OVERALL RESULTS

The results of this research are summarized in Table 11-1. In this table, participation rates, savings, and utility costs per unit of energy saved are summarized for typical programs and for the best programs (in terms of participation rates and savings) in operation today. Unless otherwise noted, all terms used are defined in Chapter 1. In examining this table it is important to bear in mind that the figures are approximate -- data on programs came from many sources and are subject to considerable uncertainties, as was discussed extensively in Chapter 1.

As can be seen in Table 11-1, typical C&LM programs are reaching less than 5% of eligible C&I customers, are reducing energy use among participating customers by less than 10%, and are reducing utility peak demand by less than 1%. The most successful programs do considerably better. Some programs are reaching 70% or more of eligible customers, are reducing customer electricity use by

Table 11-1
Summary of C&I Program Results

Program Type	Number of Programs Examined	Cumulative Participation Rates**		Percent Savings***		Savings as a % of Utility Peak: Cummulative		Savings as a % of Utility Peak: Annual			Utility Cost
		Average Programs	Best Programs	Average Programs	Best Programs	Average Programs	Best Programs	Average Programs	Best Programs	Median $/kW	Median $/kWh
Audits	29	1-4%	60-90%	4-5%	6-8%	<1%	3-5%	0.1%	0.7-1%	$200	$.009
Lighting											
Information	4	1%	3%*	NA	NA	NA	NA	NA	NA	NA	<$.01
Rebate	36	<1-3%	10-25%	2.6%	NA	0-0.3%	1.5%	0-0.1%	0.7%	$246	$.01
Installation	8	2-5%	30-55%	NA	10% or up to 50% of ltg use*	0.1%	0.1%	<0.1%	0.2-0.4%	$316	$.028
HVAC rebate	19	<1%	10%	11% of A/C use		<0.1%	0.1-0.2%	<0.1%	<0.1%	$318	$.029
Motor rebate	15	<1%	15%****	5% of motor use		<0.1%	<0.1%	<0.1%	<0.1%	$356	$.0055
Industrial	17	0-3%	5-9%, 1 @ 90%	NA	NA	0-0.2%	0.4-1%	<0.1%	0.1-0.5%	$246	$.008
Storage cooling	20	NA	38%	>90% of A/C kW		0.1%	0.5-1.2%	<0.1%	0.2-0.4%	$296	---
Thermal a/c	8	NA	NA	>90% of A/C kW		0-0.1%	0.5-0.6%	<0.1%	0.1-0.3%	$144	---
New Construction											
Technical assist.	6	NA	NA	NA	NA	<0.1%	NA	<0.1%	NA	NA	~$.03
Rebate	8	NA	NA	NA	NA	<0.1%	0.2%	<0.1%	0.2%	$221	~$.01
Comprehensive	3	NA	NA	NA	30%*	<0.1%	NA	<0.1%	NA	NA	~$.03*
Miscellaneous											
Water heater wrap	2	NA	11%	NA	NA	<0.1%	<0.1%	<0.1%	<0.1%	$620	$.019
Heat pump WH	2	NA	NA	50% of wtr htr use		<0.1%	<0.1%	<0.1%	<0.1%	NA	NA
Refrigeration	5	0.1%	NA	NA	NA	<0.1%	<0.1%	<0.1%	<0.1%	$100-200	NA
ETS	2	NA	NA	>90% of elec ht kW		<0.1%	0.2%	<0.1%	0.1%	$100-200	---
Multiple End-use											
Rebate	23	0-4%	10-16%	NA	7%	0-1%	3-5%	0-0.3%	0.5-1%	$277	$.009
Loan	6	0-3%	7%	NA	NA	NA	0.8%	<0.1%	0.1%	NA	$.008
Perform contract'g	11	0-2%	15%*	NA	15-18%*	0-0.4%	0.4-0.7%	0-0.2%	0.5%	$1090	$.028
RFP & bidding	3	<2%	NA	NA	NA	NA	1%	NA	0.6%	NA	NA
Comprehensive	10	1-2%	70%*	10%	18-23%*	0-0.4%	NA	0.1%	NA	NA	$.033*

* Based on experience from pilot and/or limited scale programs.
** Percent of eligible customers.
*** Percent of pre-program kWh use by participating customers unless otherwise noted. Most of these figures are based on engineering estimates.
**** Percent of motor horsepower sold in a year.

10-30% (depending on end-use and building type), and are reducing utility peak demand by up to 5%. Nearly all of the programs surveyed, including most of the "best" programs, cost utilities less than $.04 per kWh saved, even if allowance is made for free riders. Since these costs are less than the long-term avoided costs of most utilities, including all utilities in New York State, nearly all of the programs examined are likely to be cost-effective, from the utility perspective, if undertaken in New York.

C. RESULTS BY PROGRAM APPROACH

In general, the highest participation rates and highest savings (as a percent of pre-program electricity use of participating customers) are achieved by comprehensive programs which combine regular personal contacts with eligible customers, comprehensive technical assistance, and financial incentives which pay the majority of the costs of measure installation. These programs have proven to be effective energy savers when implemented on a limited scale. However, the high participation and savings achieved by comprehensive programs come at a price -- these programs typically cost utilities $0.02-0.04 per kWh saved -- a price below the long-term avoided cost of nearly all utilities, but above the cost to a utility of a typical rebate program. At this point in time, full-scale, comprehensive programs are in their infancy, so it remains to be seen how well comprehensive programs scale-up to full-scale operation. Comprehensive programs may be especially appropriate for serving small customers (who are the least likely to participate in other types of programs) and for new construction and building remodeling (where there is a one-time opportunity to capture substantial savings at only the marginal cost of efficient equipment over standard equipment).

Rebate programs are by far the most common type of C&LM program for C&I customers. The most successful rebate programs have reached approximately 10% of C&I customers, including approximately 25% of large customers (customers with peak demand greater than 100-500 kW). These results are typically achieved over a period of three to seven years. The most successful of these programs have reduced C&I electricity use by approximately 5% at costs of approximately $0.01 per kWh saved (this cost figure is not adjusted for the effect of free riders). These programs have proven effective at promoting basic lighting and HVAC equipment improvements. Most rebate programs currently in operation have not been especially effective at promoting "system" improvements, i.e., efficiency improvements involving the interaction of multiple pieces of equipment. C&I rebate programs combine moderate participation levels and moderate savings to, in the most successful instances, reduce utility peak demand by approximately 1% per year. There are limited indications that after several years of aggressive program promotion, participation levels from rebate programs may drop off. Further research is needed in this area.

Loan programs are only offered by a few utilities. Side-by-side comparisons with rebate programs offered by the same utilities show that most customers prefer rebates, although loans are useful for the minority of customers who lack cash to finance energy-saving investments.

Performance contracting programs are also offered by a few utilities. These programs generally rely on energy service companies (ESCo's) to provide services. Left to their own devices, most ESCo's will choose to concentrate on the largest customers and the most lucrative energy-saving measures (particularly lighting and cogeneration). Limited side-by-side comparisons indicate that other program approaches will achieve greater participation than ESCo-based programs. Most utilities which offer or have offered performance contracting programs have either phased-out these programs or chosen to complement them with other types of programs. However, several performance contracting programs, in which incentives approach utility avoided costs, have achieved significant energy savings. These programs are generally more expensive to the utility than utility-operated programs promoting the same measures (due to the fact that the utility must directly or indirectly cover ESCo overhead and profit), but they can be useful for: (a) customers who do not have the time, money, or expertise to implement energy-saving measures on their own, and (b) utilities who prefer that outside contractors deliver energy services, thereby saving utilities the hassle of having to administer the programs themselves.

Request for proposal programs and bidding programs have been in operation for the past year or so. Further experience is needed with these programs before conclusions can drawn. Indications thus far are that these programs can achieve significant energy savings (up to 1.5% of utility peak demand so far). This has been achieved primarily by reaching large customers, either directly through the RFP or bid process, or indirectly through ESCo's who participate in the bid process. These programs, by definition, cost less than utility avoided costs (because bid prices are capped at avoided costs), although there is a tendency for bids to approach utility avoided costs.

Information-only programs generally have low participation and low savings. Programs which offer free energy audits and post-audit follow-up services can achieve high participation rates (60-90%) and achieve energy savings up to 6-8%.

D. FACTORS CONTRIBUTING TO SUCCESSFUL PROGRAMS

Regardless of program type, our analysis of program experience indicates that several program elements contribute to above average participation and savings. The most important of these elements are the following:

> <u>Marketing</u> which employs multiple approaches (e.g., direct mail, media, etc.) but emphasizes personal contacts (via phone and face-to-face) with the target audience. The most successful programs are those that develop a regular, personal relationship with the target audience, including post-installation follow-up contacts to verify that measures are working properly and to promote additional measures. Personal marketing has been successfully used by utilities for all but the very smallest customers. Besides improving program

participation levels, personal contacts can increase customer-satisfaction as well.

Targeting of program approaches and marketing efforts to the different audiences. Program approaches and marketing efforts often need to be packaged differently for different decision-makers (e.g. customers, equipment dealers, architects, engineers, and developers) and for different types of investment decisions (e.g. new construction, remodeling, replacement of worn-out equipment, or retrofit of inefficient but functioning equipment). Target audiences should be involved in program planning so the final program design truly meets their needs.

Technical assistance to help the target audience identify and implement C&LM opportunities. For retrofit programs, technical assistance includes energy audits and advice on equipment and contractors. For new construction, technical assistance often includes computer modeling and education for the target audience on new technologies. The depth of technical assistance should be matched to the type of customer and to the other services offered. Small customers generally require simple analysis and extensive assistance implementing measures. Large customers often need less assistance. If no financial incentives are available, it is often not cost-effective to do detailed technical audits. If sufficient incentives and other services are available so customers are likely to implement audit recommendations, then detailed audits may be worthwhile.

Simple program procedures and materials. Customers and trade allies are generally busy and have little time to decipher complex program procedures or marketing materials. One-step application procedures, assistance in filling out forms, and simple and catchy marketing materials and forms increase the likelihood of program participation. Rebate programs for different measures should often be packaged together to minimize customer confusion. However, while programs should be kept simple from the customer perspective, it does not necessarily follow that program designs and procedures be simple from the utility perspective -- to achieve high participation, savings, and quality control usually requires the utility to prepare and implement detailed marketing, technical assistance, and quality control procedures.

Financial incentives to catch customer attention and reduce the first cost of implementing C&LM measures. Data on the effect of different incentive levels are limited but show that providing free measures results in the highest participation rates. High incentives (greater than 50% of measure cost) appear to promote greater participation than moderate incentives (on the order of 1/3 of measure cost). However, moderate incentives may not achieve higher participation than low incentives.

Multiple measures for customers to choose from. When customers can choose from multiple measures, they are more likely to find appropriate measures and/or to implement more than one measure, thereby increasing savings. Many programs limit themselves to lamps and air conditioners. Inclusion of additional lighting, HVAC, and motor measures, as well as allowing customers to propose their own measures, tends to increase participation and savings.

Promote new technologies which are not widely adopted in the marketplace. In the typical program analyzed in this study, limited data indicates that approximately 30% of the participants were free riders. Free rider percentages are high when rebates are provided for technologies which are already being purchased by many customers (such as reduced wattage lamps and moderate efficiency air conditioners). To the extent programs promote technologies which are not widely adopted, free riders are reduced. Furthermore, by promoting advanced energy-saving technologies (e.g., reflectors and variable-speed drives) greater savings can be achieved than with first generation technologies alone. On the other hand, because end-users are generally unfamiliar with advanced technologies, initial participation rates may be lower for programs emphasizing these technologies and substantial marketing efforts may be required to promote these technologies.

Additional factors linked with high participation and savings are noted in the "Conclusions" section at the end of Chapters 2-10.

E. OVERRIDING ISSUES

In conducting research for this project, it became apparent that a few utilities consistently operate programs with above average participation and/or savings. These utilities include, but are not limited to, the City of Palo Alto, Central Maine Power, New England Electric, Pacific Gas and Electric, Southern California Edison, and Wisconsin Electric. These utilities appear to stand out from the crowd due to several general factors:

* Top management commitment

* Staff who are committed to C&LM goals and have skills needed to achieve them.

* Creativity and flexibility.

To motivate staff and customers, top management needs to send a clear message that C&LM programs are a high priority to the utility and that achievement of program goals will benefit program staff (through awards or bonuses for a job well done) and customers (through lower rates). If top management does not believe in the importance of C&LM programs, it is difficult to motivate staff to promote these programs and customers to participate.

The most effective salespeople are people who believe in what they are selling and can articulate this belief to prospective customers. Utility representatives involved in program promotion are essentially salespeople. To be effective, they need to believe in the importance of C&LM and be articulate and knowledgeable spokespersons. For C&LM programs to flourish, capable and committed staff need to be assigned to C&LM programs.

The New England Electric System (NEES) provides an illustration of how these principles work in practice. NEES bases annual bonuses for senior management, including directors of field offices, in part on the achievement of specified goals. For the last several years, C&LM program participation rates and savings have figured prominently in these bonus calculations. Due to this bonus system, senior management and their staff work hard to achieve annual C&LM goals -- they know that pay and promotions depend in part on achieving these goals [1]. Likewise, management has assigned experienced and capable staff, recruited from both inside and outside the company to C&LM programs. According to staff in the personnel department, C&LM planning and programs are among the "hot" areas within the company for up-and-coming employees [2].

Similarly, the City of Palo Alto has worked hard to get effective staff to work on C&LM programs. They look for staff who are good salespersons, but who complement these skills with a good technical background and strong personal qualities [3].

Creativity and flexibility allow successful utilities to address the problems and constraints which inevitably arise during the course of program planning and implementation. Each utility and each program face unique problems and constraints. To successfully address these issues usually requires creative solutions and flexibility to make changes to programs once the inevitable mistakes are discovered. If creativity is not encouraged or if initial program designs are rigidly adhered to, mediocre results usually follow.

For example, Pacific, Gas and Electric (PG&E) in the early 1980s operated many different rebate programs for C&I customers. The programs were working well but customers were confused by the many different programs that were offered. Rather than rest on its laurels, PG&E repackaged the programs into a single program and marketing effort. Participation and savings increased significantly [4].

Similarly, Wisconsin Electric began operating a comprehensive rebate program in 1987. Participation rates were among the highest in the country. Still, participation among small customers was lagging, so in 1989, the utility designed a new direct rebate program through which rebate program information and applications are distributed to customers at the time they purchase equipment. Initial program results have been promising [5].

F. PRIORITIES

As utilities begin C&LM efforts, a major question they face is which sectors, end-uses, customers, and programs to target. Obviously, a utility's priorities depend in large part on their objectives. For utilities pursuing least-cost planning strategies, long-term objectives are generally to maximize the amount of long-term, cost-effective, net energy and demand savings that are achieved (net of what would happen in the absence of utility efforts). To achieve these objectives will typically require developing a long-term strategy which combines multiple programs to:

1. Serve most customers (including all but the very smallest customers) and promote nearly all applicable C&LM measures -- if only large customers are targeted, or if only certain end-uses or measures are targeted, the savings that can be achieved are substantially reduced. Also, if some customer segments are not served, significant equity issues may be raised (e.g., why should some customers subsidize conservation programs which primarily serve other classes of customers?);

2. Promote measures which result in long term energy-savings (e.g. measures which customers are unlikely to install in the short-term in the absence of utility efforts, and measures with long-lives or for which strategies can be developed to provide a high probability of measure replacement).

In the long-term, utilities with these objectives will need to consider programs with costs to the utility approaching avoided costs.

Short-term priorities are perhaps more difficult to set. For utilities with short-term capcity needs (e.g. capacity needed in approximately five years or less), large-scale C&LM efforts will often be justified, including programs to accelerate retrofits of existing, inefficient equipment. Program options for achieving quick-savings are programs directed at large customers, rebate programs which pay a large portion of meassure costs, and direct-installation programs directed at all customers, with an emphasis on lighting measures, HVAC controls, and other measures which can be implemented without long periods of study or construction. For utilities without short-term capacity needs, efforts should first target "lost-opportunity" resources -- new construction, building remodeling, and equipment replacement -- situations where large C&LM savings can be purchased for only the incremental cost difference between standard and efficient equipment/design practices. In addition these utilities should develop programs in other areas, in order to gain experience and to begin achieving savings, so that needed savings are in place before capacity would otherwise be needed. In these programs, advanced technologies should be emphasized, in order to increase long-term savings. Utilities with short-term capacity surpluses often pay moderate incentives at first, with incentives steadily increased as the need for capacity approaches.

G. COMPARISON OF TECHNICAL SAVINGS POTENTIAL WITH SAVINGS ACTUALLY ACHIEVED BY PROGRAMS

Even though the most successful programs are achieving substantial energy savings, the savings achieved fall far short of the potential savings available. Table 11-2 compares the results of ACEEE's analysis on the technical potential for cost-effective energy savings in New York with the results of this analysis on the achievements of the best programs. This table is meant to provide a general indication of the differences between potential savings and savings achieved. Due to regional differences between New York State and other regions of the country, exact comparisons cannot be made between potential savings in New York and actual savings achieved in other states.

As can be seen in this table, even among participating customers, the best programs are achieving energy savings which are only 20-60% of the cost-effective technical potential (where cost-effective is defined to be cost to the consumer of less than $.05 per kWh saved -- a price less than the average retail C&I electricity price and the long-term avoided cost of all New York utilities). Furthermore, in some cases, "best program performance" is based on the results of pilot and limited-scale programs which have yet to be attempted on a large scale. When pilot programs are excluded, the difference between potential savings and achieved savings increases. The reasons for this difference between potential and achieved savings need to be investigated further.

While the gap between achieved and potential savings is large for the best programs, the gap is even greater when typical programs are examined instead of the best programs. Furthermore, even the best utilities operate some good programs and some mediocre

Table 11-2

Comparison by End-Use of C&I Savings Potential:
Technical Potential Vs. Savings from Best Programs

End-Use	Technical Potential*	Savings from Best Programs**
Lighting	60% of ltg. use	~25% of ltg. use
HVAC	51% of comm'l HVAC use	11% of A/C & heat pump use
Motors	17% of motor use	~5% of motor use
New construction	50% or more***	30%
Multiple end-use retrofits	45% in the comm'l sector	18-23% in comm'l bldgs.

* For measures with a cost-of-conserved energy less than $.05 per kWh assuming a 6% real discount rate. Derived from Miller, Eto and Geller, 1989, The Potential for Electricity Conservation in New York State (Washington, D.C.: American Council for an Energy-Efficient Economy), pp. S-6, S-7, 29, 28, 30 and 31. In calculating technical potential, the costs of program delivery and barriers to measure adoption are ignored.

** Based on Table 11-1. Some of these performance levels were achieved in pilot or other limited-scale programs. Most of these performance levels are based on engineering estimates.

*** Based on TVA computer simulations of over 100 new commercial buildings. Letter from Jim West, TVA, January, 1987.

programs. No utility operates state-of-the-art programs in all areas. Utilities with the largest C&LM programs nationwide have reduced kWh sales by approximately 2-14%, far less than the approximately 35% cost-effective savings potential (from the consumer perspective) found by ACEEE in its study of New York State [6]. Most programs primarily promote a limited number of lighting and HVAC improvements. If achieved savings are to approach potential savings, additional measures need to be promoted, particularly advanced lighting and motor technologies and HVAC and industrial process <u>system</u> efficiency improvements.

To promote additional savings, existing program approaches will likely need modification and new approaches tried. Comprehensive program approaches show promise in this regard, assuming they can be scaled-up successfully from the pilot, start-up, and limited efforts now under way.

In order to encourage utilities to creatively pursue promising C&LM opportunities, utility commissions should develop incentives for utilities to develop and aggressively pursue least-cost planning. There is growing recognition that utilities lose money when they effectively promote electricity conservation -- cutting electricity use reduces revenues and profits in the short run [7]. A few states (e.g. California, New York, Maine, Massachusetts, Rhode Island and Wisconsin) are starting to take steps to overcome this barrier. Making the least-cost strategy also the "most-profit" strategy for the utility could go a long way towards convincing utilities to vigorously promote and finance C&LM programs.

However, even improved utility programs cannot achieve all of the cost-effective savings that are technically achievable. Some customers will always choose not to participate in a program and many customers will not implement all cost-effective C&LM measures. Complementary programs and policies are needed to increase energy savings. Examples of such programs and policies include equipment efficiency standards and building codes. For example, the

California Energy Commission estimates that in 1983, C&LM measures and practices reduced peak demand requirements in the state by 2,718 MW. Of these savings, 45% were due to utility programs, 37% to building code improvements, 16% to appliance efficiency standards, and the remainder to miscellaneous efforts [8].

H. ADDITIONAL WORK NEEDED

In addition to work on improved program approaches and expanded measure offerings, additional work is needed to document and evaluate existing programs. Information on the size of target populations (e.g. number of new buildings built in a year or number of motors in a utility service area) is rarely collected, making calculation of participation rates difficult if not impossible for many programs. Data on percentage savings are also rarely collected, making it difficult to determine the depth of savings that are achieved. Most savings data are based on engineering estimates. At a minimum these data need to be adjusted to exclude savings achieved by free riders. Ideally, savings estimates should be based on actual meter measurements, for a sample of projects implemented. Where possible, savings results should be broken down by end-use or measure. Likewise, most free rider estimates are based on customer self-reports -- a very unreliable indicator. Additional work to determine free rider shares based on statistical analyses of program participants and non-participants is needed.

Ultimately standard definitions and protocols should be developed for key C&LM data types. Among the data that should be defined, and then collected for all programs are the following:

1. Eligible population
2. Number of program participants
3. Participation rate
4. Direct utility costs (e.g. incentives)
5. Indirect utility costs (e.g. staff and marketing costs)
6. Customer costs

7. Net kWh savings

8. % kWh savings (as a % of participating customer pre-program electricity use)

9. Net kW savings (for system coincident peak and for specific standard times such as 3 pm on a summer-peak day and 6 pm on a winter-peak day)

10. Average measure life

11. $/kWh (levelized)

12. $/kW

Positive steps in this direction have been taken by a number of parties, including NORDAX, Inc. (a consortium of utilities in the Northeast who have developed a computerized database of information on C&LM programs offered by member utilities) [9], and Oak Ridge National Laboratory [10]. These efforts should be continued and expanded. As utility C&LM expenditures and savings become increasingly significant from company expenditure and capacity planning perspectives, the objective should be to collect and report data of a quality level similar to that presently collected and reported for supply-side resources.

Utility C&LM programs have been actively pursued for a decade or more. Over this time period, substantial progress has been made, including significant savings achieved to date, and accumulation of a large amount of experience on the results of different program efforts. This experience teaches us many important lessons about ways to structure and promote programs in order to achieve substantial energy and dollar savings. These lessons will prove very useful during the 1990s, as many utilities expand their C&LM efforts. However, much remains to be learned if even half the technical potential for C&LM improvements are to be achieved. C&LM practitioners need to continue experimenting with new and improved programs, as well as to better document existing programs, so that the wealth of information provided by program experience continues to grow, and continues to foster further program improvements.

I. NOTES

1. Personal communication with several different New England Electric staffpeople.

2. Personal communication with Suzanne Relyea, New England Electric, January, 1987.

3. Dimit, Mary, "The Palo Alto Experience: Rebates as an Incentive for Commercial/Industrial Customers" in Proceedings: Third National Conference on Utility Demand-Side Management Programs, DSM Strategies in Transition, EM-5452 (Palo Alto, CA: Electric Power Research Institute), p. 19-6.

4. Presentation by Robin Calhoun, PG&E, at the Demand-Side Management, Options for Today, Opportunities for Tomorrow Conference, January 28-29, 1987, Boston, MA.

5. Personal communication with Peggy Clippert and Frank Byrne, Wisconsin Electric.

6. Geller, Howard, and Steven Nadel, 1989, "Electricity Conservation: Potential Vs. Achievement," paper prepared for the NARUC Least Cost Utility Planning Conference, Charleston, SC, September 11-13, 1989 (Washington, D.C.: American Council for an Energy-Efficient Economy).

7. Moskovitz, David, 1989, Profits and Progress Through Least-Cost Planning (Washington, D.C.: National Association of Regulatory Utility Commissioners).

8. California Energy Commission, 1986, Conservation Report (Sacramento, CA: California Energy Commission), p. II-11.

9. Nordax, 1989, A Regional Demand-Side Management Database Final Report (Washington, D.C.: Edison Electric Institute).

10. Berry, Linda, 1989, "The Administrative Costs of Energy Conservation Programs," ORNL/CON-294 (Oak Ridge, TN: Oak Ridge National Laboratory). Also: Berry, Linda, 1990, "The Market Penetration of Energy-Efficiency Programs," ORNL/CON-299 (Oak Ridge, TN: Oak Ridge National Laboratory). Hirst, Eric, 1990, "Evaluating Utility DSM Programs", talk given to the National Association of Regulatory Utility Commissioners, Washington, D.C., Feb., 1990.

Chapter 12

IMPLICATIONS FOR NEW YORK UTILITIES

A. INTRODUCTION

All seven of New York's investor-owned utilities are presently offering pilot or full-scale C&LM programs for C&I customers. As of mid-1989, approximately 25 C&I programs were being offered by New York utilities. These programs range from initial pilot programs being offered by several utilities (e.g., Niagara Mohawk and Rochester Gas and Electric) to full-scale multiple end-use programs being offered by Long Island Lighting and Consolidated Edison. Of the C&I programs offered in New York, approximately half are pilot and half full-scale. New York programs include at least four audit programs, seven lighting programs, three storage cooling programs, four thermal air conditioning programs, a new construction program, an electric thermal storage heat program, and five multiple end-use programs. Summary information on all of the New York programs is contained in Table 12-1. Additional information on each of these programs can be found in the Appendix.

Among the New York programs are several exemplary programs. Con Edison and NYSEG have both offered pilot energy audit programs which served up to 50-70% of targeted customers. NYSEG and Niagara Mohawk have both completed well-structured experimental studies which provide valuable information on the role of incentives and marketing techniques in determining program participation and measure adoption levels. Con Edison operates a steam air conditioning program which in less than two years has reached over 10% of the targeted customers. LILCo was the first New York utility to offer a comprehensive set of programs system-wide.

While these programs are a good start, New York utilities are still in the process of "gearing up" their C&LM activities. Most utilities have either just begun major programs or are planning to begin these programs in 1990. In particular, as a result of a

Table 12-1
Summary of Results of C&I Programs Operated by New York State Utilities

Program Code	Utility	Program	Pilot or Full Scale	Time Period Start	Time Period End	Number Eligible	Number of Participants: Customers	Number of Participants: Projects	Participation Rate	Customers or Participants	Estimated Savings: Coin. MW	Estimated Savings: Absol. MW	Estimated Savings: GWh /yr	1987 Peak Demand	Svgs as a % of Peak	Coincident or Absolute	Expenses (1000s of Dollars): Direct	Expenses (1000s of Dollars): Indirect	Expenses (1000s of Dollars): Total	Util. Cost $/kW	Direct or Total?	Measure Life	Utility Cost $/kWh
AUDIT	Cen. Hudson	C/I Audit Program	Full	4/87	2/88	27,904	162		0.6%	C		0.21	0.62	824	0.03%	A			$50	$238	T	5	$0.019
AUDIT	Con Ed	Free C&I Audits	Pilot		12/88	~800	562		70.0%	C				9,386								5	
AUDIT	LILCO	Comm. Energy Audit	Full	1986	9/88	95,871	1,927		2.0%	C	13.81		49.98	3,576	0.39%	C			$811	$59	T	5	$0.004
AUDIT	NYSEG	C/I Audits	Pilot	10/86		1,474	413		28.0%	C	0.41		1.72	2,540	0.02%	C						5	
LTG	Con Ed	Free C&I Ltg Audits	Pilot	1987	12/88		135							9,386								5	
LTG	LILCO	Dollars and Sense	Full	10/86	9/88	95,871		585	0.6%	P	8.10		55.24	3,576	0.23%	C	$1,245			$154	D	10	$0.004
LTG	NiMo	Expermnt on Low-Cost Ltg	Pilot	1988	1988									5,403								10	
LTG	NiMo	Fluor. Ltg Reb. Expermnt	Pilot	1988	1989	4,094	154		3.8%	C				5,403								5	
LTG	Or. & Rock.	Switching to Savings	Full			20,902								892								5	
LTG	Or. & Rock.	C&I Efficient Ltg Info	Full	1987	1987	18,000	120 responses		0.7%	C				892			$0	$28	$28			5	
LTG	Rochest G&E	Comm'l Lighting Pilot	Pilot	3/89	7/89	30	6		20.0%	C				1,205								5	
HVAC	LILCO	Dollars and Sense	Full	10/86	9/88	95,871		272	0.3%	P	1.07		1.26	3,576	0.03%	C	$325			$304	D	15	$0.034
MOTOR	NiMo	Motor Rebate Pilot	Pilot	5/86	12/86	24	8		33.3%	C				5,403			$117	$27	$144			15	
CS	Con Ed	Thermal Energy Storage	Pilot																			20	
CS	LILCO	Dollars and Sense	Full	10/86	9/88		1				0.14			3,576	0.00%	C	$41			$288	D	20	
CS	Or. & Rock.	Cool Reserve	Full				0		0.0%	C	0.00			892								20	
TAC	Con Ed	Steam Space Conditioning	Full	7/87	12/88	~462	56		12.1%	C	56.00			9,386	0.60%	C						20	
TAC	Con Ed	Gas Space Conditioning	Full	12/88	12/88		1				0.40			9,386	0.00%	C						20	
TAC	LILCO	Dollars and Sense	Full	10/86	9/88		2				0.37			3,576	0.01%	C	$107			$288	D	20	
TAC	Or. & Rock.	Non-Electric A/C	Full	1/89										892								20	
NEW	Con Ed	C&I New Construction	Pilot	6/88	12/88		1							9,386								20	
MISC	NYSEG	Comm. Elec. Thermal Stor.	Full	1/88	9/88	67,233	48		0.1%	C		5.22		2,540	0.21%	A	$425			$81	D	20	
MULT	Cen. Hudson	Dollar Saver's	Pilot	5/88	12/88	27,904	14	16	0.0%	C		0.15	0.34	824	0.02%	A	$22	$4	$27	$183	T	10	$0.010
MULT	Cen. Hudson	Interim Rebate	Pilot	11/87	1/88	50 w/audit	6	6	12.0%	C				824			$7	$2	$9			10	
MULT	Con Ed	Incentives for C&I Retro	Pilot	9/87	12/88		24				1.19			9,386	0.01%	C	$326			$274	D	10	
MULT	Con Ed	Selected Network	Pilot	4/87	12/88	~2,700		49	1.8%	P	1.10			9,386	0.01%	C	$331			$300	D	10	
MULT	LILCO	Dollars and Sense	Full	10/86	9/88	95,871		857	0.9%	P	9.68		56.94	3,576	0.27%	C	$1,718	$366	$2,084	$215	T	10	$0.005

directive from the New York Public Service Commission (PSC), all seven utilities will offer large-scale "core" C&LM programs during 1990 in the following six areas [1]:

1. C&I Lighting Efficiency Incentives
2. C&I High Efficiency Space Conditioning Equipment Incentives
3. Demand Management Cooperatives
4. C&I Energy Audits
5. Consumer Energy Information Programs
6. Innovative Rate Design Programs

In addition, each of the utilities is planning DSM bidding programs, in accordance with another PSC order [2].

The successful pursuit of these programs is an important part of New York's energy strategy for the next 20 years. The New York State Energy Plan prepared jointly by the State Energy Office, Department of Environmental Conservation and Department of Public Service, calls for electric utility demand-side management programs to achieve annual electric energy savings of 8-10% by 2000 and 15% by 2008 [3]. In order to achieve these goals will require aggressive efforts by the state's utilities. In an effort to help the state's utilities achieve this goal, this chapter reviews existing and planned C&LM programs, and attempts to make constructive suggestions as to how these programs can benefit from the lessons taught by the programs reviewed in this report. Each program area addressed in this report is discussed separately. A final section summarizes the common threads which emerge from the analysis of the individual program areas.

B. AUDITS

As of 1989, four New York utilities offered C&I energy audit programs. Among these programs are pilot programs offered by NYSEG and Con Edison which achieved participation rates of over 50%, and full-scale programs offered by Central Hudson and LILCo (see Table 12-1). In 1990 all seven New York utilities plan to offer C&I audit programs.

The New York programs generally include a number of commendable elements including: (a) providing basic audits at no charge to the customer; (b) use of personal marketing as one of the marketing approaches used; (c) delivering the audit in person in order to explain the audit recommendations and the incentives available for implementing recommendations; and (d) coordination with industrial audit programs offered by the State Energy Office. As was discussed in Chapter 2, these elements tend to be linked with above average rates of audit penetration and/or recommendation adoption. While most New York audit programs contain these elements, a few programs are missing one or more of these elements. We recommend that each utility consider incorporating all of these elements in their C&I audit program.

In addition to these basic program elements, several utilities are planning some additional innovative program features. Con Edison, and NYSEG plan to offer at least two types of audits -- a simple audit which is provided free of charge and is targeted at small and medium-sized customers, and a detailed engineering audit, targeted at large customers, for which customer cost-sharing is required. For the detailed audits, both utilities will assume 100% of the audit cost if customers invest an amount equal to half the audit cost to implement audit recommendations [4]. Rochester Gas and Electric goes a step further and offers four types of audits -- a simple walk-thru audit for the smallest customers, a basic computer-aided audit for medium-size customers, a detailed engineering audit for the largest customers, and an audit review for customers who have previously received an audit from another source and need help interpreting the audit [5]. As was discussed in Chapter 2, experience by other utilities has shown this type of structure to be an effective way to achieve significant savings while efficiently managing program budgets. NYSEG does offer a simple walk-thru audit but limits availability to customers using at least 100 MWh/year. While NYSEG has a large number of very small C&I customers for which audits might not be cost-effective, offering a stream-lined audit for customers using 25-100 MWh/year should be considered. Other New York utilities should also consider varying audit complexity with the size of the customer.

Several utilities plan to offer in-depth technical assistance services on a targeted basis. For example, Central Hudson plans to offer more specialized audits to industrial customers [6]. This is a good idea -- simple computer audits are generally not appropriate for industrial customers. This program should be coordinated with the Energy Advisory Service to Industry Program offered by the N.Y. State Energy Office. Niagara Mohawk plans to work closely with the N.Y. State Energy Office's Energy Advisory Service to Industry and Technical Feasibility Study programs, including paying 25% of the cost of technical feasibility studies (the state pays 50%, leaving the customer to pay only 25%) [7]. Orange and Rockland (O&R) plans to complement its audits with technical feasibility studies for which O&R will pay 75% of the cost. This program should be coordinated with the State Energy Office Technical Feasibility Study Program [8].

While New York C&I audit programs have many strong points, they can probably be strengthened in a few areas including (a) more aggressive marketing, to improve participation rates, and (b) periodic post-audit contacts to encourage and assist recipients to implement audit recommendations. Each of these items is discussed below.

A review of program plans filed by each New York utility shows that only modest participation levels are planned by each utility. With one exception, during the 1990-92 period, New York utilities expect to serve 1.0-2.5% of eligible customers annually with their C&I audit programs [9]. The one exception is Orange and Rockland (O&R). O&R plans to ramp up to approximately a 10% annual participation rate in year three. Based on the programs discussed in Chapter 2, this participation rate is possible, but will require aggressive marketing -- more aggressive than O&R currently plans. Most New York utilities emphasize direct mail to market their audit programs, supplemented with telemarketing and personal contacts. As discussed in Chapter 2, in order to achieve high participation rates, these latter approaches should probably be emphasized. We recommend that all utilities consider steps to substantially increase their planned participation rates in audit programs.

Most New York utilities plan to deliver audit reports in person (or they mail reports and follow-up shortly thereafter with a personal visit). However, one utility (LILCo) plans to deliver reports via the mail with an offer for the customer to request an audit-debriefing. If the customer does not call, a LILCo representative will call 3-6 months after the audit is delivered [10]. LILCo should consider providing both an immediate <u>and</u> a 3-6 month post-audit visit in order to motivate and assist customers to implement audit recommendations. Rochester Gas and Electric plans a series of four post-audit visits -- one immediately after the audit is completed and the others at three-month intervals [11]. Other utilities should consider complementing their immediate post-audit visit with periodic follow-up visits. As was discussed in Chapter 2, periodic post-audit contacts can play a major role in increasing the implementation of audit recommendations.

C. LIGHTING

C&I lighting incentive programs of some sort were operated in 1989 by all but one New York Utility. All were rebate programs, including small-scale pilot programs and full-scale programs. Pilot programs operated by Niagara Mohawk and Rochester Gas and Electric achieved participation rates as high as 20% among groups of customers who received targeted attention (see table 12-1). Full-scale programs operated by several utilities had low participation rates (less than 3% cumulative participation in all cases).

All New York utilities plan to offer a C&I lighting program in 1990 as part of their core program offerings required by the Public Service Commission. All of these new programs are rebate programs. As of 1990, most of these programs plan to provide rebates for an extensive array of lighting improvements including custom measures proposed by customers. All utilities plan to closely coordinate their lighting programs with their audit programs, so that audits can be used to identify potential efficiency improvements and rebates can be used to encourage adoption of audit recommendations.

In addition to these program attributes, several utilities plan additional attributes that are likely to increase the energy savings achieved by their programs. Rochester Gas and Electric is planning to pay rebates equal to 90% of the cost difference between high efficiency and standard efficiency products [12]. With rebates at this level, most financial barriers to customer participation will be eliminated, which should increase participation rates. Both Con Edison and NYSEG plan to provide rebates for packages of measures installed on the same fixture [13]. As discussed in Chapter 3, New England Electric found this to be an effective strategy.

While these programs contain many features which will contribute to their success, New York lighting programs can likely benefit from a number of improvements including adding additional products to the list of eligible measures, increased rebates for some advanced lighting products (such as lighting controls, T-8 lamps, and electronic ballasts), and expanded marketing efforts. Each of these points is discussed below.

All New York programs provide rebates for efficient fluorescent lamps and ballasts. Most programs provide rebates for electronic ballasts, compact fluorescent lamps, reflectors, occupancy sensors, daylight dimming systems, and custom measures proposed by customers (e.g. conversion to high efficiency light sources such as high intensity discharge lamps). Some programs do not cover all of these measures. We recommend that each utility include all of these measures in their programs. In addition, no utility provides special rebates for T-8 lamps. T-8 lamps are more efficient and more expensive than the energy-saving fluorescent lamps generally covered by rebate programs (see Table 3-2). Because of their greater expense and efficiency, we recommend that T-8 lamps be explicitly listed in rebate programs with rebate levels approximately $1/lamp higher than standard energy-saving fluorescent lamps.

Of those utilities that do provide rebates for many of the advanced lighting products listed above, many utilities provide rebates that cover only a small portion of the incremental cost of these advanced technologies. For example, electronic ballasts cost $15-30 more than energy-saving magnetic ballasts (see Table 3-2). Most New York utilities provide rebates of only $5-10. However, Niagara Mohawk provides a $20 rebate for these products -- a rebate level which is likely to stimulate substantial interest by dealers and end-users [14]. Similarly, incentives paid by many New York utilities cover only a fraction of the cost of advanced lighting products such as reflectors, compact fluorescent lamps and lighting controls. Since end-users are often unfamiliar with advanced lighting products, many end-users are unlikely to buy them if incentives are low. We recommend that New York utilities consider higher rebates for these advanced lighting products.

In addition to increasing rebates, fine-tuning of rebate structures may be useful in some cases. For example, most New York utilities pay the same rebate for a ballast, regardless of how many lamps are controlled. However, Con Edison pays higher rebates for 3-lamp and 4-lamp ballasts ($15 and $20 rebates respectively) than for 2-lamp ballasts ($10 rebate) [15]. Generally the more lamps a ballast controls, the less energy waste (e.g. a 4-lamp ballast generally uses less energy than two 2-lamp ballasts). To encourage the energy-savings which can be achieved with multi-lamp ballasts, we recommend that other utilities follow Con Edison's example and base rebates on the number of lamps controlled. Similarly, instead of paying fixed rebates for reflectors, fixtures, and lighting controls, utilities should consider basing rebates on the number of lamps or the connected wattage which is affected (e.g. pay higher rebates for reflectors for 4-lamp fixtures than for 2-lamp fixtures, and higher rebates for HID fixtures which save 200 watts than for fixtures which save 100 watts). At least one utility (Con Edison) is already implementing this suggestion [16].

New York utilities plan to market their programs through a combination of direct mail, trade ally and customer contacts, and telemarketing. In addition, some utilities plan to provide technical assistance to customers -- generally on an as-requested basis. A few utilities, including Con Edison and NYSEG plan to emphasize personal contacts [17]. Other utilities plan to use personal contacts for large customers but to otherwise emphasize direct mail. As was discussed in Chapter 3, personal contacts can be a useful and successful marketing approach for medium as well as large customers. Likewise, personalized technical assistance can be an important tool to assist customers to identify and implement lighting efficiency improvements. We recommend that utilities that are not presently planning an extensive personal contact and technical assistance effort consider doing so.

A few utilities are planning to use telemarketing to promote their lighting programs. Telemarketing can be useful for promoting programs where a yes/no decision is involved (e.g. Would you like us to schedule an energy audit?) but is less useful for complex decisions, such as which lighting retrofits to install. We recommend that expanded personal marketing and technical assistance be substituted for telemarketing.

Even with the improvements suggested above, based on the experience of other utilities, it is unlikely rebate programs will ever reach more than 25% of eligible customers (see Chapter 3).

Unfortunately, as of 1990, no New York utility is planning to offer a direct installation program for lighting. Given the high participation and savings achieved by direct installation programs and their likely cost-effectiveness for New York utilities (see Chapter 3), we recommend that all New York utilities consider inaugurating a direct installation program for their customers. These programs should initially target small C&I customers because these are the customers least likely to respond to rebate programs. Undertaking direct installation throughout New York will be a large undertaking. Hundreds of thousands of customers would be served. Given the large number of customers involved, it will likely take 5-10 years to reach all eligible customers [18]. The longer timeframe is appropriate for utilities which do not need capacity for 10 years or so. The shorter timeframe is appropriate for utilities with capacity constraints in the nearer term.

D. HVAC PROGRAMS

Three New York utilities (Con Edison, Long Island Lighting and Central Hudson) offered HVAC programs in 1989. All seven utilities will offer HVAC programs in 1990.

In general, programs planned by New York utilities provide rebates for purchases of efficient equipment including chillers (for large systems) and packaged air conditioners and heat pumps (for small systems). In general the chiller rebates cover reciprocating chillers (typically used for systems with cooling capacities less than 200 tons) and centrifugal chillers (typically used for systems greater than 200 tons). It appears that only Con Edison provides rebates for rotary screw chillers [19]. Rotary screw chillers are generally more efficient than reciprocating chillers and can often be used instead of reciprocating chillers in systems of approximately 100-200 tons. We recommend that other New York utilities consider adding rotary screw chillers to the list of eligible measures. One utility (NYSEG) is not presently planning to offer rebates for chillers. As was discussed in Chapter 4, chillers represent approximately half of commercial cooling capacity nationwide. They thus represent an important source of cooling savings. NYSEG should consider adding chillers to their HVAC program.

While all New York utilities will provide rebates for high efficiency HVAC equipment, most utilities do not presently provide incentives for other HVAC efficiency improvements such as improved controls, proper sizing, and improved distribution systems. A few utilities (e.g. Central Hudson and LILCo) offer incentives for custom measures proposed by customers. It is unclear from the material we have reviewed how much technical assistance these utilities plan to provide customers to identify and design other HVAC improvements. We recommend that extensive technical assistance be provided, particularly at the time equipment replacements are planned. When existing equipment is being replaced, many efficiency measures can be purchased for only a modest cost premium compared to standard equipment and design practices.

Niagara Mohawk has long-range plans to emphasize overall improvements to HVAC systems including distribution, control, maintenance and building envelope measures [20]. This is a commendable approach -- we recommend that details be fleshed out in the near-future. As best as we can tell, the other New York utilities do not presently have plans to provide incentives for other HVAC efficiency improvements. In light of the large savings that are available from these other measures (see Chapter 4), we recommend that these utilities consider expanding their HVAC programs to allow and encourage a wider array of measures.

In their 1990 program plans, some utilities report a confusing array of rebate amounts and eligibility thresholds. In order to reduce customer confusion, we recommend that rebate criteria be as simple as possible. Similarly, some utilities plan to base rebates on kW savings. While kW savings are important from the utility perspective, customers generally think in terms of efficiency ratings and system size. We recommend that utilities consider basing rebates on units customers are most familiar such as paying on the basis of $/ton or $/ton per EER point for units exceeding specified efficiency thresholds.

All New York utilities plan to promote their programs through a combination of direct mail, trade ally contacts, and personal contacts. Experience by other utilities has shown that a regular working relationship with HVAC equipment dealers and specifiers is perhaps the most important contributor to program success. Likewise, customer contact efforts should probably be directed at identifying and educating customers who are planning to install new equipment in the near future -- either due to new construction or because old equipment is nearing the end of its useful life.

Several utilities plan to offer seminars on equipment sizing, selection, and maintenance. These seminars can be important tools for educating customers, dealers and design professionals on ways to improve the long-term efficiency of HVAC systems. We recommend that all utilities consider holding such seminars and/or similar educational programs.

E. MOTOR PROGRAMS

Three New York utilities (Con Edison, Long Island Lighting and Central Hudson) provided rebates for high efficiency motors in 1989. In addition, Niagara Mohawk operated a pilot motor replacement program several years ago. All New York utilities except NYSEG are planning motor rebates for 1990, although many of these programs are limited to HVAC applications. For those utilities which do not offer rebates for industrial applications, we recommend that programs be expanded to include all applications. Nationwide, electricity used by industrial motors is over two times greater than electricity used by commercial motors [21]. In New York State an estimated 78% of industrial electricity use is due to motors [22].

In addition to encouraging high efficiency motors, LILCo and Rochester Gas and Electric are planning explicit incentives for adjustable speed drives in 1990. Central Hudson, LILCo, and Rochester Gas & Electric also have custom rebate programs which can provide rebates for adjustable speed drives and other measures to improve motor system efficiency. Utilities which do not provide incentives for adjustable speed drives and other motor system improvements should consider adding these measures to their programs.

The motor programs offered by the New York utilities are generally very similar to each other. Each utility provides rebates of approximately $10-12/horsepower for motors which exceed an efficiency threshold. These rebates typically cover about half of the cost difference between standard efficiency and high efficiency motors. With rebates of this magnitude, programs target situations where new motors are needed (e.g. purchase of motors for new applications or replacement of burned-out motors), not retrofit situations (i.e. removing functional inefficient motors and replacing them with higher efficiency equipment).

Programs are generally promoted through direct mail, trade ally contacts and limited personal contacts with large customers. These programs are similar to many of the programs reviewed in Chapter 5 and, like most of the programs discussed in Chapter 5, are likely to result in modest participation levels. In order to increase participation levels, we recommend expanded program promotion efforts, particularly personal contacts and other education and promotion efforts with motor dealers and large motor users. A good model for these efforts is the program operated by BC Hydro which was discussed in Chapter 5.

Two other options which merit consideration by New York utilities are (a) giving an additional rebate to the motor dealer in order to encourage dealers to actively promote motor programs, and (b) offering higher rebates for motors purchased for retrofit applications. As was discussed in Chapter 5, small dealer rebates have been offered by several utilities and generally found ineffective. Larger dealer rebates may be more effective -- their use should be explored through market research or pilot programs. High rebates for retrofit applications are now being used by New England Electric. These rebates are high enough to pay most of the cost of a new motor and hence are often adequate to promote retrofits of functional but inefficient motors. Rebates are only provided for motors whose operating hours exceed a minimum threshold in order to ensure that the benefits of the program are greater than the utility's marginal costs. Initial results have been very positive. Similar rebates should be considered by New York utilities, particularly those with short-term capacity needs (utilities with short-term capacity needs may not be able to wait the 10-30 years that will elapse before most existing motors need to be replaced).

F. INDUSTRIAL PROGRAMS

New York utilities have undertaken only limited efforts directed at industrial customers. While many utilities provide rebates for lighting and other measures to both commercial and industrial customers, only one utility (Niagara Mohawk) is operating a program targeted at the particular needs of industrial customers. The Niagara Mohawk program is an information-only program still in its start-up stage. Niagara Mohawk should consider adding financial incentives to this program.

Three utilities (Central Hudson, LILCo, and Rochester Gas & Electric) offer customized rebate programs in which customers can propose measures for funding. These utilities should encourage industrial participation in these programs through targeted marketing efforts, the development of industrial case studies, and the provision of expert technical assistance (using in-house or outside experts) for those customers who need it.

Other New York utilities should consider the development of programs or program components targeted particularly at industrial customers based on the principles described in Chapter 6.

G. COOL STORAGE AND THERMAL AIR CONDITIONING

Three New York utilities (Con Edison, LILCo, and Orange and Rockland) offered both storage cooling and thermal air conditioning programs in 1989. Included among these programs is a very successful steam air conditioning program Con Edison has operated for several years. In 1990, all New York utilities plan to offer storage cooling programs and all but NYSEG and Niagara Mohawk plan to offer thermal air conditioning programs as part of their required core program offerings. Only a few electric utilities in the country (including combined electric/gas utilities such as Con Ed) presently offer thermal air conditioning programs. Thus, New York utilities are among the leaders nationwide.

Data on the performance of New York storage cooling and thermal air conditioning programs is summarized in Table 12-1. Only the Con Edison steam air conditioning program has had more than a few participants. New York programs generally feature limited technical assistance (primarily seminars and cost-sharing of detailed technical feasibility studies) and rebates based on the kW of demand that are shifted. Marketing efforts typically include direct mail and limited personal contacts with architects, engineers, and developers.

Based on our review of the most successful programs (discussed in Chapter 7) we believe New York programs could be strengthened through increased marketing and technical assistance. Marketing should emphasize regular one-on-one contacts with architects, engineers and developers. Educational and technical assistance efforts can be used to familiarize key decision-makers with storage cooling and thermal air conditioning concepts and to convince them that these concepts merit serious consideration. Among the services that some New York utilities are offering and other New York utilities should consider are:

(a). Educational seminars on system concepts, types and design.

(b). Free scoping studies which give designers and developers an estimate of the likely costs and savings of storage cooling or thermal air conditioning systems on their buildings. Scoping studies are generally not designed to replace a detailed feasibility study but instead are designed to examine whether the benefits of a potential system are great enough to merit the preparation of a detailed feasibility study.

(c). Cost-sharing on detailed feasibility studies. In most cases a 50-50 cost share with the owner/developer should be adequate, but where the benefits are great but the owner/developer is reluctant to proceed, it may make sense for the utility to assume a greater share of the cost, on a case-by-case basis.

As part of this study we did not examine time-of-use rate structures and demand charges in detail. Rate structures (i.e. how a given level of costs are apportioned over the hours of the day and between energy and demand charges) can have a major effect on the economics of storage cooling and thermal air conditioning systems. We recommend that all New York utilities examine the cost-effectiveness of storage cooling systems under their present rate structures. For storage cooling systems to appeal to the majority of building developers, rates and incentives generally need to combine to reduce the simple payback period for a system to approximately three years or less [23]. If current rates and incentives do not provide adequate incentive, we recommend that each company investigate the extent to which new rate structures would more accurately reflect marginal costs and thus provide better price incentives for storage cooling and other load shifting technologies.

Since New York utilities are just beginning to promote storage cooling and thermal air conditioning systems, detailed evaluation procedures have yet to be worked out. As they develop these procedures, we recommend that utilities consider installing recording demand meters on each system in order to (a) accurately determine system demand savings, and (b) provide data to the building operator on system performance and ways this performance can perhaps be improved.

H. NEW CONSTRUCTION

In 1989, Con Edison offered a new construction program. In addition, in 1989, LILCo and Central Hudson allowed new construction projects to participate in their C&I retrofit programs. Data on participation in these programs is limited, but generally indicates that participation rates have been low (see Table 12-1).

In 1990, all New York utilities will provide some form of new construction program. For the most part, these programs are extensions of audit, lighting rebate and HVAC rebate programs also directed at existing buildings. For example, all utilities plan to offer some form of technical and design assistance for new buildings as part of their energy audit programs. Likewise all utilities plan to provide rebates for new buildings under their lighting and HVAC programs.

In some cases eligible equipment and rebate amounts for new buildings are the same (or nearly the same) as for existing buildings, in other cases rebates are paid when building code requirements are exceeded. For example, LILCo, Orange and Rockland, and Rochester Gas and Electric all plan to pay rebates for reductions in connected lighting loads below building code requirements. Rochester, unlike the other New York utilities, is planning to pay 100% of the incremental cost of measures which exceed code requirements (subject to a ceiling of utility avoided costs). In addition to technical assistance and equipment rebates, at least two utilities (LILCo and Rochester Gas and Electric) plan to reimburse designers for some of the extra design costs that are incurred in designing more efficient buildings. Likewise, at least two utilities (Rochester and Orange and Rockland) plan to offer awards to designers and developers of efficient buildings [24].

Overall, while New York new construction programs have many strengths, they also suffer from a number of weaknesses. First programs target a limited number of lighting and HVAC measures. Many measures are not covered including building shell, refrigeration, industrial process, and HVAC system measures. Many programs do not even cover all lighting measures.

Second, all of the programs appear to be designed as afterthoughts to retrofit programs. New construction differs substantially from retrofit in the measures that are most cost-effective, the costs of installing efficient equipment, and the key decision-makers involved. The most successful new construction programs discussed in Chapter 8 are all aimed solely at new construction and are presented to architects, engineers and developers as an integrated package. If building professionals have to wade through three different retrofit programs (audit, lighting and HVAC), participation rates are likely to be very low.

Third, it appears that for the most part, New York utilities have yet to conduct substantial market research on the new construction market, including current practices and responses to planned programs. Experience by other utilities has found that prevailing construction practices vary from region to region and building type to building type. What is commonly installed in one type of building is rarely installed in another. It makes sense to determine current construction practice by utility service territory and by building type, so eligibility levels can be set in ways that reduce free riders. Furthermore, in some cases the building code may not be the appropriate baseline. Northeast Utilities and New England Electric have both found that in some cases prevailing construction practice exceeded the local building code by a significant amount [25].

Fourth, many of the programs are lacking features that have proven important and successful in other programs (although nearly all of these features are found in at least one New York program). Among the features that should be considered as New York utilities flesh out their new construction program plans are:

* Provision of expert technical assistance in the areas of lighting, HVAC, refrigeration and industrial process design and in computer modeling of entire buildings as an integrated system. In most cases this assistance will need to be furnished by outside experts on retainer to the utility.

* Payment of design incentives.

* Payment of equipment incentives equal to the incremental cost of measures.

* Providing recognition and awards for designers and developers of particularly efficient buildings.

* Identifying buildings early in the design process and targeting these buildings for marketing efforts.

* Extensive personal marketing to architects, engineers and developers.

I. MISCELLANEOUS PROGRAMS

Most New York utilities do not offer programs specifically directed at miscellaneous C&I end-uses and measures. The only significant program in New York is NYSEG's ETS program. As was discussed in Chapter 9, major changes to this program are now being implemented in order to increase the cost-effectiveness of the program and to reduce the load-building aspects of the program.

The fact that there are few miscellaneous measure programs in New York is understandable given the fact that New York utilities have only recently begun C&I C&LM programs, and that most of the initial efforts are directed at higher priority end-uses and measures. Given this situation, we recommend that as time and resources permit, the other New York utilities consider offering programs modeled after some of the more promising miscellaneous programs discussed in Chapter 9. Areas to focus on are commercial water heating and supermarket refrigeration. Another worthwhile option is to incorporate aspects of these programs into comprehensive multiple end-use programs.

J. MULTIPLE END-USE PROGRAMS

Three New York utilities presently offer multiple end-use programs. All are rebate programs. In addition all New York utilities are pursuing bidding programs.

Con Edison offered pilot multiple end-use programs in two parts of its territory during 1987-89. The two programs were nearly identical in structure. Both offered rebates for many specific measures as well as customized rebates for other conservation measures proposed by customers. Both programs reached less than 3% of eligible customers [26]. In our opinion these programs could have benefited from expanded personal marketing and technical assistance activities, with an emphasis on building an on-going personal relationship with customers, particularly large customers.

LILCo has offered a multiple end-use rebate program for three years. The program features rebates on many individual lighting, HVAC and motor measures. In 1990 rebates are being added for adjustable speed drives and for custom measures proposed by customers. Participation and savings have been low, due in part to only limited marketing efforts. Marketing efforts have been steadily increased during the 1989-90 period including addition of annual "executive contacts" with the 1000 largest customers. Further improvements should be considered, including expanded technical assistance services, personal contacts with additional customers beyond the 1000 largest, and regular contacts (e.g. more than once a year) with the very largest customers.

Central Hudson began its multiple end-use rebate program in 1988. The program includes rebates for lighting, motors, and custom measures. In 1990 the utility is adding rebates for HVAC equipment, storage cooling and thermal air conditioning. Initial participation has been low (less than 20 rebates in the first seven months). While slow starts are common for programs of this type, this low level indicates that increased marketing efforts could be helpful. We suggest the utility develop a new marketing and technical assistance plan which emphasizes regular personal contacts with customers.

Rochester Gas and Electric recently began offering rebates for custom measures proposed by customers [27]. The program is too new for any results to be available.

As previously mentioned, all New York utilities will begin bidding programs this year. Under these programs customers and outside contractors will all bid to provide conservation savings to the utilities. Successful bids will be chosen on the basis of price and other factors.

In addition to tinkering with current program structures and bidding programs, utilities in need of near to mid-term savings should consider experimenting with new program structures such as comprehensive and RFP programs. Also, experimentation with high rebate levels (considerably higher than those generally paid by utilities nationwide) may prove valuable in order to see whether high rebate levels significantly increase participation rates and savings. By experimenting with these programs, utilities can potentially achieve large energy savings, while providing valuable experience with these promising program approaches.

K. CONCLUSIONS

New York utilities have offered full-scale programs for only a limited time. Of the utilities that began in 1989 or earlier, participation levels and savings achieved are generally low relative to the best programs discussed in the preceding chapters of this report. Low participation and savings levels are common during the start-up stage of a program. However, in order to improve the performance of their programs, New York utilities should study the lessons from nearly a decade of experience around the country. In particular, as they develop new programs and/or modify existing programs, New York utilities should consider:

* Expanding personal marketing efforts, particularly with large customers and trade allies. These efforts should strive to develop an ongoing personal relationship with the target audiences.

* Involving target audiences in program planning, so that program procedures, packaging and marketing are designed to appeal to the targeted audiences. [28]

* Developing a comprehensive list of measures eligible for incentives, including custom measures proposed by customers.

* Promoting advanced energy-saving technologies which are presently being overlooked and/or are underutilized. Examples include advanced lighting technologies, adjustable-speed drives, and HVAC and motor system improvements.

* Expanding technical assistance services provided to customers in order to help customers identify, assess and implement C&LM opportunities.

* Considering innovative programs, such as comprehensive programs, particularly for new facilities and for existing small C&I customers.

In addition to these specific program changes, if New York C&LM programs are to achieve their full potential, utility staff will need to creatively and aggressively administer programs. Successful program implementation depends as much on the people who run the programs as the program design. Skilled, creative staff who can aggressively market programs as well as anticipate and overcome problems are often the difference between average and truly successful programs. Another important contributor to program success is the commitment of senior utility management. If senior managers are fully committed, and they articulate this commitment to staff and customers, then staff and customers are more likely to respond. The New York State Department of Public Service is presently working with utilities and other interested parties to develop procedures to reward successful implementation of utility least-cost planning efforts. New York is a national leader in this area. These efforts will likely play a helpful role in increasing the commitment of senior management to the successful implementation of C&LM programs.

New York's utilities have made significant progress in their efforts to tap cost-effective C&LM opportunities. However, substantial additional steps will be needed if New York is to achieve its goal of 8-10% C&LM savings in 2000 and 15% in 2008.

The third stage of the NYSERDA/ACEEE study will examine ways to achieve the State's C&LM goal by exploring the issue of how much of the technical potential for C&LM savings in New York can actually be achieved through viable program and policy choices. Among the options to be considered are development of expanded C&LM programs throughout the state and equipment efficiency standards. Through this work we hope to apply the lessons taught by the past decade of C&LM program experience to the task of helping New York State and its utilities meet their goals for the coming two decades.

L. NOTES

1. New York Public Service Commission, 1989, Case 28223, Electric Utility Conservation Programs, Opinion No. 89-15. Also, New York Public Service Commission, 1989, Case 28223, Order Concerning 1990 Demand Side Management Plans.

2. New York Public Service Commission, 1988, Case 29409, Opinion and Order Concerning Bidding, Avoided-Cost Pricing, and Wheeling Issues, Opinion 88-15, pp. 37.

3. Cotter, Jorling and Bradford, 1989, New York State Energy Plan (Albany: New York State Energy Office), p. 2.

4. Consolidated Edison, 1989, 1990 Demand Side Management Program Plan (New York: Consolidated Edison), pp. 2-36, 2-38. Also, NYSEG, 1989, Demand Side Management, 1990 Integrated Plan, (Binghamton, N.Y.: NYSEG), pp. 2-41 to 2-45.

5. Personal communication with Marty Morris, Rochester Gas and Electric, March, 1990.

6. Applied Management Sciences, 1989, 1990 Integrated DSM Plan (Poughkeepsie, NY: Central Hudson Gas and Electric), p. 3.41.

7. Niagara Mohawk, 1989, 1990 Demand-Side Management Program Plan (Syracuse, N.Y.: Niagara Mohawk), pp. 2-111 to 2-117.

8. Orange and Rockland, 1989, 1990 Integrated Demand-Side Management Plan (Pearl River, N.Y.: Orange and Rockland), pp. 22-26.

9. See notes # 3, 4, 5 and 6. Also: Long Island Lighting Company, 1989, 1990 Electric Conservation and Load Management Plan (Woodbury, N.Y.: Long Island Lighting), pp. III-95 to III-100. Rochester Gas and Electric, 1990 Integrated Demand Side Management Plan (Rochester: Rochester Gas and Electric), pp. B9-B13.

10. Long Island Lighting Company, 1989, 1990 Electric Conservation and Load Management Plan (Woodbury, N.Y.: Long Island Lighting), pp. III-95 to III-100.

11. See note # 5.

12. Rochester Gas and Electric, 1990 Integrated Demand Side Management Plan (Rochester: Rochester Gas and Electric), Appendix B, p. 4.

13. See note #3: Con Ed p. 2-3, NYSEG, Appendix A, p. 5.

14. See note #5, p. 2-103.

15. Letter from John Spada, Consolidated Edison, March 19, 1990.

16. Ibid.

17. See note #3: Con Ed, pp. 2-6 to 2-8; NYSEG, p. 2-4.

18. New England Electric is conducting a direct installation program in Rhode Island that is seeking to reach as many customers as possible over a five year period (Personal communication with Michael Horton, New England Electric).

19. See note # 15.

20. See note #5, p. 2-17.

21. Lovins, Amory, 1989, State of the Art: Drivepower (Snowmass, CO: Rocky Mountain Institute), p.28.

22. Miller, Peter, Joe Eto and Howard Geller, 1989, The Potential for Electricity Conservation in New York State (Washington, D.C.: American Council for an Energy-Efficient Economy), p. 29.

23. Simple payback period thresholds vary from developer to developer. The three year threshold is used by the City of Austin for purposes of calculating incentive payments for cool storage systems. Piette, Wyatt and Harris, 1988, Technology

Assessment: Thermal Cool Storage in Commercial Buildings, LBL-25521 (Berkeley, CA: Lawrence Berkeley Laboratory), p.39.

24. See note #8, p. III-172; note #6, p. 8; note #9, p. B57.

25. Personal communication with Nancy Benner, Portland Energy Conservation, Inc., April, 1988.

26. Based on data in Table 12-1 plus data reported in Consolidated Edison, 1989, 1990 Demand Side Management Program Plan (New York: Consolidated Edison), p. 4-1.

27. See note # 5.

28. The New York Public Service Commission has recently directed utilities to implement this recommendation. See New York Public Service Commission, 1989, Case 28223, Order Concerning 1990 Demand Side Management Plans, p. 22.

APPENDIX

This appendix contains detailed data on each of the programs discussed in Chapters 2 through 10. Data is organized into sections by program type as described under #1 below). Data on each program is listed on two pages. Descriptive, participation and savings information is on the first page. Cost information and notes are on the second page. Unless otherwise stated, all data comes from the individual utilities operating the programs. Data were obtained from either published reports, from internal utility records supplied by utility staff, or from telephone conversations with utility staff. Specific information collected on each program (as available) is as follows:

1. Program Code. The following codes are used:

   AUDIT= audit
   LTG = lighting
   HVAC = heating, ventilating and air conditioning
   MOTOR= motors
   IND = industrial
   CS = cool storage
   TAC = thermal air conditioning (gas and steam)
   NEW = new construction
   MISC = miscellaneous
   MULT = multiple end-use

2. Utility.

3. State.

4. Program name.

5. Measures being promoted (general description). For a detailed description of the measures being promoted and specific incentive levels, the reader is referred to other publications [1].

6. Incentives (general description -- see note above).

7. Whether the program is a pilot or full-scale program.

8. Start and end dates of the program. In most cases the programs are still ongoing.

9. Start and end dates of the detailed participation, savings, and cost information collected. In many cases detailed data is available for only part of the program's lifetime.

10. Number of customers eligible for the program. In some cases the program is targeted to a specific customer segment (e.g., industrial customers with a peak demand greater than 500 kW). In other cases all C&I customers are eligible. In these latter cases, the total number of C&I customers, as of the end of 1987 is used as the estimate of the target population [2]. Included in these figures are customers with more than one account at a single address, and minimal use customers such as billboards, water pumps, and storage sheds.

11. Number of customers participating in the program. Generally only customers who have completed projects are included, although in cases where the only data available is for projects under contract, this data is noted and used. Customers with two meters are generally not counted twice. Customers who undertook multiple projects are only counted once.

12. Number of completed projects, meaning a particular measure at a particular facility. Customers who install multiple items of a particular measure (e.g., high efficiency motors) are only counted once. Customers who receive rebates for two separate projects are counted twice.

13. Participation rate -- number of participating customers divided by number of eligible customers. If all C&I customers are eligible for a program, then the maximum participation rate will be approximately 50-60%, since typically 40-50% of C&I customers represent multiple accounts at the same address or minimal use accounts [3]. If the number of participating customers is unavailable, the number of completed projects is used to calculate participation rates and is so noted. Since some customers will undertake multiple projects, participation rates based on number of completed projects will be inflated. On average, across all the programs analyzed, the average participating customer completed 1.8 projects.

14. An indication of whether the calculated participation rate is based on the number of participating customers (designated with a "C") or projects (designated with a "P").

15. Estimated MW savings, both coincident with the system peak (i.e., adjusted to account for the proportion of load that is actually operating at the time of the system peak) and "absolute" savings (not adjusted for coincidence). For example, if a 60 Watt light bulb is replaced with a 15 Watt bulb, absolute savings are 45 Watts but, assuming 80% of lights are actually on at the time of system peak, coincident savings are only 36 Watts (45 * 80%). Unless otherwise stated, all savings figures are based on engineering estimates (see #17 below).

16. Estimated annual GWh savings for all measures completed under the program. Unless otherwise stated, all savings figures are based on engineering estimates (see #17 below).

17. Adjustments included in savings estimates. As previously noted, most savings estimates are based on engineering calculations made by the utility sponsoring the program. In a limited number of cases, savings estimates are based on billing analysis (designated "Bill"), submetering (designated "Meter"), or whole-building computer simulations (designated "Simul.). These are noted in the program listing. In addition, in some instances, engineering calculations are adjusted to:

   * Account for free riders (program participants who would have made C&LM improvements anyway, even if the program were not offered) (designated "FR");

   * Include air-conditioning savings resulting from reduced heat output of improved efficiency equipment (designated "AC");

   * Include transmission and distribution benefits of programs (the number of kWh saved at the power plant is approximately 8% greater than the kWh saved on the customer side of the meter because of line losses during power transmission from the power plant to the customer) (designated "T&D");

   * Include reserve margin benefits of programs (saving a kW on the customer side of the meter reduces power plant requirements by an amount equal to the customer savings plus the utility's reserve margin percentage (an allowance for power plant downtime)) (designated "Reserve").

   These adjustments are all noted under the applicable programs.

18. Utility peak demand (for 1987) [4].

19. MW savings as a percent of peak demand. Coincident peak savings are used where available (designated with a "C"), otherwise "absolute" MW savings are used (see #15 above) and are so noted (designated with an "A").

20. Program expenses, including direct expenses (incentives paid to customers), indirect expenses (marketing and staff expenses) and total expenses (the sum of direct and indirect expenses).

21. Average cost per kW -- program expenses divided by MW savings. Whenever possible, $/kW was calculated using total expenses and coincident peak savings (designated with a "T"). Where total expenses are not available, direct costs are used and are so noted (designated with a "D"). Where coincident peak savings are not available, "absolute" MW savings are used. [Note: Average cost per kWh saved was not collected from

individual utilities since different utilities use different assumptions to calculate this figure and the assumptions used have a large effect on the result. Instead, ACEEE calculated cost per kWh using uniform assumptions. Cost per kWh for each program are not listed in the Appendix but instead are listed in summary tables included in each chapter of the report.]

22. Contact name and phone number.

23. Additional notes on the program, including additional descriptive information on the program, marketing methods used, findings of evaluation studies and other interesting results. In particular, in compiling this data, we tried to obtain information on free rider percentages and on savings as a percentage of pre-program electricity use by participating customers.

NOTES

1. See for example Battelle-Columbus Division, 1987 Survey of Commercial-Sector Demand-Side Management Programs, 1989 (Palo Alto, CA: Electric Power Research Institute); or "Utility Rebate Guide", Energy User News, March, 1989, pp. 20-26.

2. Number of C&I customers was taken from Electrical World Directory of Electric Utilities, 1989, 97th Edition (New York: McGraw Hill).

3. New England Electric, in a study of 3768 small C&I accounts in 20 target communities, determined that 40% of the accounts represented customers using less than 500 kWh/month [Evaluation Report on Massachusetts Electric Company's Enterprise Plan, Executive Summary, 1988 (Westboro, MA: New England Electric), p. 2.3]. Phone calls and field visits indicated that 12% of the remaining sites either represented multiple accounts at the same address, were out-of-business, or used no energy for lighting. [Nadel, Steven, 1989, "Electricity Savings from a Small C&I Lighting Retrofit Program: Approaches and Results," in Energy Program Evaluation: Conservation and Resource Management, Proceedings of the August 23-25, 1989 Conference, (Argonne, IL: Argonne National Laboratory), pp. 107-112.] Thus out of the initial pool of accounts, only 53% (1-40%)*(1-12%) were truly eligible for the program. Similar results were found for a similar program operated by the Sacramento Municipal Utility District [Personal communication with Kathy Itow, SMUD, June, 1989].

4. Obtained from Electrical World Directory of Electric Utilities, 1989, 97th Edition (New York: McGraw Hill).

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
AUDIT	BECo	MA	Comm'l Cons. Service	Primarily low & moderate cost	Audit costs $25-100	Full	1986		1986	12/88	~40,000	~1000		2.5%	C	3.04		11.52		2,477	0.12%	C
AUDIT	BPA	WA/OR	Comm'l Audit		Free audit	Pilot	6/84	3/87	6/84	3/87		3,800								16,680		
AUDIT	Cent. IL Lt	IL	ENER-Check	Computerized audit	Sliding scale audit fee	Pilot	3/83	2/85	3/83	2/85	19,353	177		0.9%	C					993		
AUDIT	Cent. IL PS	IL	Small Business Energy Audit	Walk-thru audit	Audit for only $25	Pilot	1/84	12/87	1/84	12/87	4,646	86		1.9%	C					1,632		
AUDIT	Cen. Hudson	NY	C/I Audit Program		Free audit	Full	4/87		4/87	2/88	27,904	162		0.6%	C		0.21	0.62		824	0.03%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
AUDIT	BECo	MA	Comm'l Cons. Service			$650	$214	T	Pat McCarthy	617-424-3799	Bldgs up to 35,000 sq.ft. eligible (50,000 in '89). Market thru direct mail and bill messages. As of '89, generally only a free walk-thru audit is done but program expanded to include free installation of cost-effective measures including lamps, A/C tune-up and cycling, thermostat, and water & weatherizatn pkgs. Under revised program auditor fills out work order & contractor hired by utility does installation. Early jobs avgd 1.5 kW/customer. New program promoted thru word-of-mouth in order to keep program within $ & staff resources. Plan to more actively promote next yr.
AUDIT	BPA	WA/OR	Comm'l Audit			~$7,200			Andy Ekman	503-230-5869	15 different firms provided audits and conducted mktg employing wide variety of methods. Implementation rates for recommended measures avg'd 8.4% & ranged from 0%-19% for the different audit firms. Differences among firms due to types of bldgs audited, measures recommended & mktg ability of auditor. Lighting accounted for half of implemented measures. Lack of incentive linked to low implementation rates. Statistical analysis showed no & low cost measures more likely to be implemented.
AUDIT	Cent. IL Lt	IL	ENER-Check			$175			Laura Skup	312-917-6634	Program available to all but very lg & specialized C&I firms. Program provided computerized audit.
AUDIT	Cent. IL PS	IL	Small Business Energy Audit			$24			Laura Skup	312-917-6634	Marketed via direct mail.
AUDIT	Cen. Hudson	NY	C/I Audit Program	$32	$18	$50	$238	T	Frank Congedo	914-486-5655	26% of all participants acted on at least 1 recommendation. 80-90% of the savings due to replacement of task lighting fixtures, increasing summer cooling setpt and replacement of ceiling lighting fixtures. Savings from measures installed represent 25-35% of savings id'd in audits. Market through bill messages, brochure, service reps.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
AUDIT	CMP	ME	Energy Mgmnt Audits		Free audit	Full	1984		1984	12/88	43,686	1,975		4.5%	C			6.17		1,455		
AUDIT	Con Ed	NY	Free C&I Audits		Free audit	Pilot				12/88	~800	562		70.0%	C					9,386		
AUDIT	Duke Power	NC	Energy Surveys		Free audit	Full	1978		1978	12/88	454,015			~.6%/yr	P	875.4			T&D	12,691	6.90%	C
AUDIT	Florida P&L	FL	C&I Energy Analysis		Free audit if adopt recommendatns	Full	1/81		1/81	12/88	324,915	7,516		2.3%	C	112.6		580.20		12,394	0.91%	C
AUDIT	Interst.Pwr	IL	Comm'l/MF Energy Audit			Pilot	1984	1985	1984	1985	862	0		0.0%	C					822		
AUDIT	LILCO	NY	Comm. Energy Audit		Free audit	Full	1986		1986	9/88	95,871	1,927		2.0%	C	13.81		49.98	FR,T&D	3,576	0.39%	C

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
AUDIT	CMP	ME	Energy Mgmnt Audits						Linda Ecker	207-623-3521	Estimate direct costs are $.06/kWh saved. Market thru direct mail, newsletter, TV & utility rep contacts.
AUDIT	Con Ed	NY	Free C&I Audits						John Spada	212-460-6949	This program was designed primarily to gain info on DSM potential among a carefully selected sample of medium (150-500 kW) C&I customers. Program was mktd w/ a solicitation letter & follow-up phone calls. Audits id'd peak kW savings potential of 10%. ~1/2 recommendations were implemented w/i 6-9 months after audit. Lighting measures had highest implementation rate.
AUDIT	Duke Power	NC	Energy Surveys						Ken Hatley	704-373-4467	Utility reps provide audits. Market program thru personal contacts, bill stuffers. Industrial reps all engineers. Over 80% of the svgs due to industrial conservation efforts. Svgs from load control measures not included in svgs figures. Participation rate based on 1986-88 period. Program was more heavily mktd in earlier yrs.
AUDIT	Florida P&L	FL	C&I Energy Analysis			$17,065	$152	T	David Derthick	305-227-4320	Market via mailings & utility rep contacts. Post-audit follow-up services (follow-up meetings, monitoring & technical consultation) have not been well implemented to date, plan to improve this is near future.
AUDIT	Interst.Pwr	IL	Comm'l/MF Energy Audit			$0.60			Laura Skup	312-917-6634	Customers using <4000 kWh/month eligible. Promoted thru direct mail. Audit fee was $50 plus $30/hr. Very little interest expressed in program & ultimately no response.
AUDIT	LILCO	NY	Comm. Energy Audit			$811	$59	T	Fred Avril	516-364-7707	Marketed thru utility rep contacts, word of mouth, Energy Hotline, referrals from other programs. According to a yr-end survey, 72% of customers implemented at least 1 recommendation, avg. of 3 recommendations implemented/customer. Avg. customer implemented 39% of recommendations. Approx. 60% of savings from lighting measures. A small resurvey 1 yr after first survey indicated that some add'l recommendations were implemented in the 2nd yr after the audit. Savings estimates do not include any adjustments for measures customers were planning to take before they had the audit.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
AUDIT	Madison G&E	WI	C/I Energy Audits		Free or reduced fee audit	Full	1983	11/88	1983	11/88	13,973	1,568		11.2%	C					477		
AUDIT	NSP	MN	C&I Audit Services		Reduced cost or free audit	Full	1987		1/87	12/87	111,751	4,668		4.2%	C					5,543		
AUDIT	NSP	MN	Energy Checkup		Reduced cost audit	Pilot	1984	10/86	1984	10/86	111,751	553		0.5%	C			9.87		5,543		
AUDIT	NU	CT/MA	EnergyCHECK		Reduced fee audit	Full	1982		1/88	12/88	99,254	1,805		1.8%	C	4.00		22.08		4,242	0.09%	C

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
AUDIT	Madison G&E	WI	C/I Energy Audits			~$784			Lynn Hobbie	608-252-4760	Provided free walk-thru audits for customers using <100 MWh/yr and engineering audits for a $125-200 fee for larger customers. Marketed thru bill stuffers, word of mouth. Avg. cost ~$500/audit. Program ended in order not to conflict w/competition pilot.
AUDIT	NSP	MN	C&I Audit Services			$280			Randy Gunn	612-330-7821	Quick-check and walk-thru audits are free. Sliding scale fee charged for detailed audits. Program mktd via direct mail, telephone & field rep contacts. Audits included 167 computer audits, 760 "quick-checks" and 3741 do-it-yourself audits. Customers up to 500 kW of demand eligible.
AUDIT	NSP	MN	Energy Checkup			$711			Randy Gunn	612-330-7821	Mkt thru direct mail, bill inserts, utility rep contacts & telemarketing. 40% of recommended savings from lighting measures, 35% from HVAC. According to a customer survey, 27% of identified measures have been implemented & customers plan to implement an add'l 31% of the measures. If all planned measures are implemented, savings will avg 10.8%. Savings reported in table only for implemented measures.
AUDIT	NU	CT/MA	EnergyCHECK			$617	$154	T	Kathy Thayer	203-721-2290	Adding $100 of free mat'ls in 1989. Bill analysis in 1986 showed average 4% savings. Bldgs < 50,000 sf eligible. Approx. 10,000 participants since program inception. Most of the measures that have been implemented are no/low cost items.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants: Customers	Number of Participants: Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings: Coincident MW	Estimated Savings: Absolute MW	GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
AUDIT	NYSEG	NY	C/I Audits		Free or reduced fee audit	Pilot	10/86	3/87	10/86	1989	1,474	413		28.0%	C	0.41		1.72		2,540	0.02%	C
AUDIT	PG&E	CA	Energy Management		Free audit	Full	late 70's		1/81	12/82		5962					29.98	60.82		14,142	0.21%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
AUDIT	NYSEG	NY	C/I Audits						Ron Foster	607-729-2551	Two different mktg approaches (personal contact & phone prequalification/direct mail) and 3 pricing strategies used (free, sliding scale fee, & sliding scale but free if implement recommendations). Participat'n was 37% for personal contact, 9% for phone/mail, 50% for the free audit, and 13-19% for the sliding scale fees. Cost/sale was $52 for personal contact & $170 for direct mail. Lead generation by phone cost an add'l $16-20/lead but was not especially helpful. Post-audit surveys (1 & 2 yrs after audit indicated ~50% implementation rates for efficient fluorescent lamps & ballasts, 25% for incandescent to fluorescent conversions, 13% for raising a/c setpt. & 10% or less for all other measures. Compared to a control group, audit recipients were 1.7X more likely to implement particular measures than unaudited customers.
AUDIT	PG&E	CA	Energy Management								The Cal. Energy Commission did a detailed analysis on audit findings & results for this time period. Audits id'd potential savings of 15-21% in annual kWh use. Lighting recommendations represented 75% of the savings potential for customers w/ demand <25 kW, and ~50% for customers >25 kW. A/C measures were 28% of potential savings, motors 11% and refrigeration 6%. Customers >500 kW accounted for 5% of the audits & 77% of the potential savings. Surveys of audit recipients 1.5 yrs after audit indicated that 60-100% of the lighting recommendations were implemented. ~50% of A/C, refrigeration, hot water and misc. recommendations were implemented. Overall, measures implemented are cutting kWh by 9-16% of annual use (including measures customers implemented on their own, even though they weren't in audit). Greatest % reductions were by customers using <25 kW and >500 kW. Avg simple payback was <1 yr for >25 kW customers, ~2 yrs for <25 kW customers.

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/kW	Direct or Total	Contact Name	Phone	Notes
LTG	Nevada Pwr	NV	High Efficiency Lighting	$572			$88	D	Joanne Compton	702-367-5112	Program primarily for indoor lighting. Incentives vary w/ facility operating hrs. Maximum incentive for 8-10 hr/day operation, minimum for 24 hr/day operation (because trying to save kW w/o hurting kWh sales). Only existing facilities eligible; companion program for new construction. Doing some work w/ a shared-savings contractor who installs equipment & takes 1/2 of rebate & savings. In 1988 targeted small customers but were unsuccessful as these customers didn't have time, $.
LTG	NiMo	NY	Experiment on Low-Cost Lighting						Andrew Goett	415-843-9390	Program included 4 study groups: (1) mailed free kit, (2) offered free kit by mail, (3) offered free kit by phone, & (4) offered $5 rebate/kit. All groups were offered rebates for add'l kits. Acceptance of kits ranged from 1% (rebate group) to 100% (mailed free kit). Installation rates ranged from 18% (mailed free kit) to nearly 100% (rebate). Overall participation rates (% receiving & installing kits) were: 18% for mailed free kit & offered free kit by phone groups, 5% for offered free kit by mail group, and 1% for rebate group. Mailing free kits found to have lowest cost/installed kit. Receipt of a free kit did not increase response to rebate offer.
LTG	NiMo	NY	Fluorescent Lighting Rebate Experiment						Andrew Goett	415-843-9390	Program included 5 study groups: (1) mailed info brochure, (2) mailed $.40/lamp rebate offer, (3) mailed $.80/lamp rebate offer, (4) in-person $.80/lamp rebate offer (all to lg. customers), and (5) control group. 21% accepted in person rebate offer, only 3% accepted mail rebate offer. Differences between info program and both mail rebate offers were negligible. Also tested rebates to dealers but could not get usable data.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
AUDIT	PG&E	CA	Energy Management		Free audit	Full	late 70's		1/83	12/85	~475,000	54,967		11.6%	C		135.26	642.67		14,142	0.96%	A
AUDIT	Portland GE	OR	C/I Services		Free or reduced cost audit	Full	1980	7/83	1980	7/83	64,247	1,700		2.6%	C					2,809		
AUDIT	PSE&G	NJ	Conservation Survey		Free or reduced cost audt	Full	10/84		10/84	12/88	~220,000	8,423		3.8%	C					8,137		
AUDIT	Seattle C.L	WA	Energy Mgmnt Partnership		Free detailed audit	Full	12/79	12/83	12/79	12/83	434	32		7.4%	C			6.90	Bill	1,725		
AUDIT	Seattle C.L	WA	Walk-Thru Survey		Free walk-thru analysis	Full	12/79	12/83	12/79	12/83	25,900	449		1.7%	C			11.57	Bill	1,725		
AUDIT	Seattle C.L	WA	Energy Mgmnt Survey	Audit, monitoring, O&M training	Services are free	Full	1/84		1/84	12/88	31,975	763		2.4%	C			30.56	Bill	1,725		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/kW	Direct or Total	Contact Name	Phone	Notes
AUDIT	PG&E	CA	Energy Management			$30,106	$223	T	Diane Calden	415-973-8575	Provided detailed audits for lg. customers (>100,000 kWh/yr), simplified walk-thru or computerized audits for smaller customers. Co-fund detailed analyses in some cases. Phone or personal contact w/ all eligible customers over 5 yrs. In early 1980's they reached nearly all lg. comm'l customers. Revisit customers 6, 18 & 42 months after audit to reinforce audit recommendations & document measures implemented. During '83-84 ~25,000 audits done annually.
AUDIT	Portland GE	OR	C/I Services						Bob Dent	503-220-3302	Provided free audits for customers using <4000 kWh/month, $300 subsidy for customers using more. Customers implemented many O&M measures but few capital measures. Program replaced by statewide program in 1983.
AUDIT	PSE&G	NJ	Conservation Survey						Angela Graham	201-430-7934	Only bldgs using less than 4.5 billion BTU/yr are eligible. ~3000 audits in 1988; increased response due to telemktg and elimination of audit fee.
AUDIT	Seattle C.L	WA	Energy Mgmnt Partnership			$234			Brian Coates	206-684-3729	For lg. customers: over 1 million kWh/yr. Marketed thru bill inserts, public presentations. Avg. savings were 2% of pre-program elec. use. Many customers lacked capital to finance measures. Asked customers to designate energy mgr & secure top-mgmt commitment. Auditor works closely w/customer over a yr. Billing analysis found observable savings only for larger bldgs. Electricity prices increased dramatically while program was operating which increased customer interest.
AUDIT	Seattle C.L	WA	Walk-Thru Survey			$459			Brian Coates	206-684-3729	Primarily for small customers -- less than 1 million kWh/yr. Mktd thru bill inserts, public presentations. Avg. savings were 6% of pre-program electricity use. Program emphasized measures w/ paybacks <3 yrs.
AUDIT	Seattle C.L	WA	Energy Mgmnt Survey			$567			Brian Coates	206-684-3729	Mktd thru bill inserts, public presentations. Since 1986, audit recipients are eligible for commercial incentives pilot program.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
AUDIT	SMUD	CA	Small Comm'l Audit		Free audit	Full	1979		1986	1988	~25,500	1,473		5.8%	C		2.18	8.97		1,902	0.11%	A
AUDIT	SMUD	CA	Small Comm'l Audit		Free audit	Full	1979		1982	1985	22,000	2,245		10.2%	C	1.71		4.52	Bill	1,902	0.09%	C
AUDIT	SMUD	CA	Large Comm'l Audit		Free audit	Full	1980		1986	1988	~500	116		23.2%	C		8.46	31.17		1,902	0.44%	A
AUDIT	SMUD	CA	Large Comm'l Audit		Free audit	Full	1980		1980	1985	125	111		88.8%	C	6.36		39.20	Bill	1,902	0.33%	C
AUDIT	Snohomish	WA	Ind'l Energy Mgmnt Service		Free technical assistance	Full	1988		1/88	12/88	~400	35		8.8%	C			0.76		1,156		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
AUDIT	SMUD	CA	Small Comm'l Audit			$546	$250	T	Paula Perscheid	916-732-5433	Customers w/demand <200 kW eligible. Mktd via letters, limited media ads. Savings based on implemented measures determined during post-audit visit. Savings achieved represent ~30% of savings id'd in audits.
AUDIT	SMUD	CA	Small Comm'l Audit			$1,721	$662	T	Rick Wiesner	916-732-5398	Customers w/ demand < 500 kW were eligible. Participation rate among 200-499 kW customers >70%. Savings figures do not include savings from customers audited in 1985, hence $/kW figure excluded 1985 expenditures. 1984 pilot study found that for customers <30 kW, most effective approach is for auditor to "drop-in" & conduct audit on lighting & other limited measures. For 30-200 kW customers, a combination of phone & drop-in solicitation was most effective w/ auditor using discretion to conduct either a limited or detailed audit. For customers >200 kW, letter plus phone solicitation combined w/ a detailed audit is most effective.
AUDIT	SMUD	CA	Large Comm'l Audit			$1,053	$124	T	Paula Perscheid	916-732-5433	Customers w/ demand >200 kW eligible. Mktd via letters, limited media ads & some utility rep contacts. Conduct annual follow-up assessments w/each customer. Savings based on implemented measures determined during follow-up assessments. ~30% of audit id'd savings were implemented.
AUDIT	SMUD	CA	Large Comm'l Audit			$1,541	$242	T	Rick Wiesner	916-732-5398	Marketed via personal contacts w/all eligible customers. Non-participating customers moved or closed. At 1st only comm'l customers w/demand >500 kW eligible. In 1985, industrial customers added. Audited customers have implemented ~50% of recommendations, reducing kW by 6% & kWh by 8%. Yrly revisit includes bill analysis & reaudit as needed.
AUDIT	Snohomish	WA	Ind'l Energy Mgmnt Service						Don Pendleton	206-347-1703	Provide on site technical analyses on facilities, process, power factor correction, demand control, & motorr Make specialized info available to wood & metal industries. Program grew out of informal services provided in previous yrs. Mkt via direct mail, expo, utility rep contacts.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants: Customers	Number of Participants: Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings: Coincident MW	Estimated Savings: Absolute MW	GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
AUDIT	So. Cal. Ed	CA	Energy Mgmnt Surveys	Long list of measures - varies by yr	Free audit	Full	1973		1/88	12/88	393,754	34,826		8.8%	C	51.30		248.38	FR	14,775	0.35%	C
AUDIT	United Illm	CT	C&I Energy Audit	All fuels	Free audit	Full	11/83		11/83	11/89	28,860	2,100		7.3%	C		4.50	30.00		1,072	0.42%	A
AUDIT	Wisc. P&L	WI	Comm'l Energy Efficiency Service		Free audit	Full	1984		1984	4/89	~38,000	3,169		8.3%	C					1,634		
AUDIT	Wisc. P&L	WI	Lg. C&I Energy Mgmnt. Study		Free or reduced fee audit	Full	1987		1987	5/89	~600	21		3.5%	C					1,634		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
AUDIT	So. Cal. Ed	CA	Energy Mgmnt Surveys			$8,916	$174	T	Bob Murphy	818-302-1958	In 1988 methods for calculating savings changed (freeriders excluded from savings calculations, kW savings for coincident peak, audit & rebate results no longer combined) so results not directly comparable to previous yrs. Participation among >500 kW customers ~75%. In adjusting for net savings (i.e. savings directly attributable to SCE program), gross savings reduced by ~50%. Marketed thru personal contacts w/ large customers, mailings & some contacts w/ small customers.
AUDIT	United Illm	CT	C&I Energy Audit			$1,000	$222	T	Bob Mills	203-777-6176	Conduct ~400 audits annually. In 1989 began offering arranging (bids, construction supervision) & financing services (outside loans at competitive rates for mat'ls, labor & admin). Will combine this service w/ incentives in 1990. On avg participants adopt 24% of audit recommendations. Savings avg 4-6% of participating customer's pre-program elec. use.
AUDIT	Wisc. P&L	WI	Comm'l Energy Efficiency Service			$1,109			Bobbi McKellar	608-252-5045	Program targets customers using <48,000 kWh/yr thru 1988. In 1989 program modified to include customers using <100,000 kWh/yr and to provide an assortment of audit services (walk-thru, computer or targeted audit).
AUDIT	Wisc. P&L	WI	Lg. C&I Energy Mgmnt. Study			~$600			Steve Carlson	608-252-3261	Mktd thru utility rep contacts. Audit free if customers participates in Bright Ideas for Business program. Otherwise customer generally pays 20%. Have identified 41 GWh & 5 GW of savings. Most recommendations have yet to be adopted -- they are now planning add'l follow-up work w/ customers.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
LTG	Atlantic El.	NJ	Save-A-Watt Rebates	High efficiency lamps & ballasts	$.05-.10/W saved, $4/ballast	Full	1987		1987	12/88	48,331	224		0.5%	C		1.42	7.09		1,609	0.09%	A
LTG	Austin	TX	Small Comm'l Relamping	Efficient flourescent tubes & compact fluorescents	Materials & installation for $75	Pilot	1987	1988	1987	1988		121				0.16		0.41	A/C	1,391	0.01%	C
LTG	Bangr Hydro	ME	Comm'l Lighting Efficiency	Any, emphasize fluorescent lamps & ballasts	Rebates or loans - vary w/ measure	Pilot	3/86	6/89	3/86	6/89	10,383	~200	310	1.9%	C		0.92	4.25		262	0.35%	A
LTG	BECo	MA	Lite Lights	Compact fluorescent, halogen, & ER lamps	$.25-5/lamp	Full	8/87		8/87	12/88	78,020	123		0.2%	C	0.73		0.62		2,477	0.03%	C
LTG	BECo	MA	Efficient Lighting	Fluorescent lamps, ballasts	$1-1.50/ lamp, $3/ballast	Full	10/86		10/86	12/88	78,020	234		0.3%	C	2.84		8.89		2,477	0.11%	C

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
LTG	Atlantic El.	NJ	Save-A-Watt Rebates			$276	$194	T	Edmond Ragazzi	609-965-0155	Incentive is $.05 for lamps w/ a rated life of 2000-9999 hrs, $.10/W for longer lives. Market via direct mail, trade press ads, personal contacts.
LTG	Austin	TX	Small Comm'l Relamping	$49			$316	D	Alfredo Cobos	512-441-9240	Customers w/ demand <30 kW offered lamps & installation for a fixed charge of $75/bldg. During 1st phase telephoned ~100 customers & ~50% accepted offer. For second phase used direct mail: 4% response rate. Audit costs included in direct cost #. Were interested in making program full-scale but small lighting distributors (who were well connected politically) wanted to participate which drove lamp prices too high. Estimate program reduced electricity use by 15-20%. Avg 100 lamps/bldg, 1/2 day/bldg to install.
LTG	Bangr Hydro	ME	Comm'l Lighting Efficiency	$182			$197	D	John Hunnefeld	207-945-5621	Estimate free riders at 43-85% based on customer surveys (43% of customers would have done work even without rebate plus 42% who were unsure how influential rebate was). Mktd thru direct mail, trade allies, newspaper ads and public presentations.
LTG	BECo	MA	Lite Lights			$299	$412	T	Lynn Fryer	617-424-3418	Program also open to residential customers - #'s reported here only C&I. Do post inspection when >100 lamps. Promoted thru trade shows, demonstration projects, bill inserts, newspaper ads.
LTG	BECo	MA	Efficient Lighting	$284	$414	$698	$246	T	Frank Hendrigan	617-424-2316	Promote thru bill inserts, trade shows, newspaper ads, personal contacts. Pre-inspection required for jobs over 100 lamps. ~900 prechecks have been done. So far less than 1/3 of prechecked customers have installed products. Now set 6 month deadline from precheck for lamp installation. Add'l prechecks pending.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates: Start	Data Dates: End	Number Eligible	Number of Participants: Customers	Number of Participants: Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings: Coincident MW	Estimated Savings: Absolute MW	GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
LTG	BECo	MA	Custom Lighting	Any ltg measure except fluorescent lamps	$.02-.07/1st yr kWh saved	Full	10/88		10/88	12/88	78,020	8		0.0%	C	0.30		1.90		2,477	0.01%	C
LTG	Clark PUD	OR	Industrial Lighting Incentive	HID lighting systems	Full cost beyond 1 yr payback	Pilot	11/85	1/88	11/85	1/88	207	24		11.6%	C		0.75	3.24		649	0.12%	A
LTG	CMP	ME	Lighting Rebate	Lamps, ballasts, controls, fixtures	Typically $.01/kWh saved over measure life	Full	1986		1986	12/88	43,686	433	995	1.0%	C			31.16		1,455		
LTG	Comm Ed	IL	Small C&I Lighting Audit/Grant	Ltg measures recommended in audit	80% grant up to $5000	Pilot	4/87		4/87	1988	500	19		3.8%	C					15,683		
LTG	Con Ed	NY	Free C&I Lighting Audits	Lighting audit & design services	Free design services	Pilot	1987		1987	12/88		135								9,386		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
LTG	BECo	MA	Custom Lighting			$290	$982	T	Frank Hendrigan	617-424-2316	Customers submit proposals. Incentive varies w/ measure life. Maximum incentive for lives of 10 yrs or more, minimum for 1 yr life. Program includes pre- and post-check. New construction (for improvements beyond bldg code) also eligible. Promote thru direct mail, demonstration projects, trade shows, newspaper ads, personal contacts. ~50 applications pending.
LTG	Clark PUD	OR	Industrial Lighting Incentive	$691	$209	$900	$1,197	T	Will Miller	503-248-4636	Many facilities had inadequate light levels - these were increased w/ customer paying for add'l lighting. On avg, increased light levels 36%, reduced energy use 48%. Typical fixture cost $100 & had a 9 yr payback. Need to check manufacturer reps work. Need PCB disposal system. 8 electrical contractors chosen thru application process to do installations. Majority of participants were tenant occupied bldgs - tenants pd their share of improvements. Contractors mktd to lg customers -- small customers only received mailing.
LTG	CMP	ME	Lighting Rebate			$1,275			Linda Ecker	207-623-3521	Market program thru TV, direct mail, personal contacts, & trade allies. Evaluation of 1986 program found ~45% freeriders (according to a survey). In '86, estimate savings were 6400 MWh and 1.2 MW including freeriders and 2804 MWh and .5 MW w/o freeriders.
LTG	Comm Ed	IL	Small C&I Lighting Audit/Grant						Laura Skup	312-917-6634	Lighting audit provided for a $25 fee to customers w/ demand <200 kW. Promoted thru direct mail. Participation #'s for audits, not grants. Add'l customers are being solicited.
LTG	Con Ed	NY	Free C&I Lighting Audits						John Spada	212-460-6949	Provide free lighting audits & debriefing to medium C&I customers. Free design assistance offered to a limited # of customers. Getting an avg response rate of 12% to direct mail mktg. Energy svgs info will be collected in 1989.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
LTG	Eastern Utl	MA/RI	Efficient Lighting Rebate	Efficient incandescent & fluorescent lamps & ballasts	$.50-2.50/lamp or ballast	Full	11/87		11/87	12/88	26,681	85		0.3%	C	0.37		1.29		713	0.05%	C
LTG	Florida P&L	FL	Lighting Incentive	Energy-saving fluorescent lamps	$1-1.50/lamp	Full	7/84		7/84	12/88	324,915	2,258		0.7%	C	5.20		33.60		12,394	0.04%	C
LTG	Gainesville	FL	Comm'l Ltg Service	Efficient fluorescent lamps, lenses	Finance measures up to 3 yrs	Full	10/86		10/86	12/88	5,983	85		1.4%	C	0.31		0.98	A/C	270	0.12%	C
LTG	Jersey Cen.	NJ	Lighting Rebate	Lamps, ballasts, exterior lighting controls	$.10/W for lamps, $4/ballast	Full	7/82		7/82	12/88	87,534						4.33			3,766	0.11%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
LTG	Eastern Utl	MA/RI	Efficient Lighting Rebate			$98	$264	T	Carol White	508-559-1000	Promote via direct mail, personal contacts, during energy audits, ads. Majority of participants are small & medium customers (they have few lg customers but claim many of the lg customers already had adopted lighting measures).
LTG	Florida P&L	FL	Lighting Incentive			$2,326	$447	T	David Derthick	305-227-4320	Require that all eligible lights get changed. Customers have not objected to this requirement. Market thru mailings, personal contacts.
LTG	Gainesville	FL	Comm'l Ltg Service	$46	$29	$75	$242	T	Jerry Donaldson	904-374-2834	Utility conducts audit & recommends measures. If customer wants, utility supplies mat'l, labor (for measures which don't require an electrician) & financing. Customer fee included on electric bill & covers mat'l, labor, interest & lost revenue. Mat'l purchased @ wholesale prices, so final cost to customer, counting all charges, approx. same as retail prices. Measures financed for up to 3 yrs (customer choice) and guaranteed during finance period. ~70% of audit recipients take advantage of program. Send reminder notices to customer @ time of relamping, including option to finance relamping costs. Until recently was a pilot program w/ only word-of-mouth promotion.
LTG	Jersey Cen.	NJ	Lighting Rebate	$2,164			$500	D	Robert Jensen	201-455-8325	Exterior lamps eligible for $.10/W rebate provided lamps connected to an automatic lighting control. Market via direct mail, magazine ads, customer contacts, trade allies.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
LTG	LA Dept W&P	CA	Lighting Efficiency Cash Rebates	Delamping, reflectors, ballasts, fluorescent lamps	Rebates - vary by measure	Full	5/87		5/87	12/88	182,907			~1%	C		5.81	21.20		4,922	0.12%	A
LTG	LILCO	NY	Dollars and Sense	Lamps, ballasts, fixtures & controls	Rebates - vary by measure	Full	10/86		10/86	9/88	95,871		585	0.6%	P	8.10		55.24	FR,T&D	3,576	0.23%	C
LTG	Madison G&E	WI	Comm'l Lighting	Delamping, controls, fluorescent lamps & fixtures	Rebate - varies by measure	Full	12/87	11/88	12/87	11/88	13,973	255		1.8%	C	2.37				477	0.50%	C
LTG	Met-Ed/GPU	PA	High Efficiency Lighting	Energy saving fluorescent, metal halide, & sodium lamps	$0.10/W	Full	1984		1/87	12/88	43,959	75 in '88		.2% in '88	C		2.76	7.84		1,673	0.16%	A
LTG	NEES	MA	Enterprise Zone - Small C&I	Fluorescent & HID lamps & ballasts, compact fluorescents	Free audit & installation	Pilot	8/85	12/86	8/85	12/86	2,263	775		34.2%	C	1.89		5.94	Bill	2,502	0.08%	C

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
LTG	LA Dept W&P	CA	Lighting Efficiency Cash Rebates			$1,635	$281	T	Art Bruce	213-481-3358	Rebates lessor of fixed rebate/measure, $250/kw, $25/fixture or 40% of measure cost. Many customers find multiple rebates confusing. For low cost measures such as delamping, 40% cost cap is often basis of rebate; for higher cost measures fixed rebate usually basis. Promote thru trade shows, seminars, direct mail, personal contact & word-of-mouth.
LTG	LILCO	NY	Dollars and Sense	$1,245			$154	D	Fred Avril	516-364-7707	Market thru direct mail, trade allies, Energy Hotline, personal contacts, & audit referrals. New fluorescent fixtures account for largest % of savings.
LTG	Madison G&E	WI	Comm'l Lighting	$415	$27	$442	$186	T	Lynn Hobbie	608-252-4760	Promote thru direct mail, trade allies, & word-of-mouth. Program ended in order not to conflict w/ competition pilot.
LTG	Met-Ed/GPU	PA	High Efficiency Lighting			$275	$100	T	Ronald Weitz	215-921-6252	Program promoted thru field reps, mailings. Free lighting audits available. Phasing out fluorescent rebates in 1989, will continue HID rebates. Before 1988 program included $4 rebates for efficient ballasts. Maximum rebate $4000/account. Cummulative savings 7.52 MW from 1984 - 12/88.
LTG	NEES	MA	Enterprise Zone - Small C&I	$1,500	$700	$2,200	$1,166	T	Liz Hicks	508-366-9011	Program promoted thru mailings, telemarketing, door-to-door canvass, & word-of-mouth. Over 60% of eligible customers requested free audits. Most customers who received audits but not installations had insufficient operating hrs. to receive free lighting products. Participant electricity use reduced 9-13% as a result of program. Free riders estimated to be 12%.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
LTG	NEES	MA/RI	C&I Lighting Rebate	Lamps, ballasts fixtures, reflectors, HIDs, compact fluorescents	Rebates - vary w/ measure and year	Full	7/87		7/87	12/88	122,307	~4000	6,288	3.3%	C	15.08		59.20	FR	3,798	0.40%	C
LTG	NEES	RI	RI Small C&I	Efficient fluorescent & incandescent lamps, compact fluorescents	Free audit, materials & installation	Full	2/89		2/89	6/89	~20000	372		1.9%	C	0.50	0.62	1.82		703	0.07%	C
LTG	NEES	RI	Narragansett Lighting Rebate	Fluorescent HID, ER & compact fluorescent lamps	Rebates - vary by measure	Pilot	7/86	6/87	7/86	6/87	18,000	431		2.4%	C	1.20		5.40	FR,RM	703	0.17%	C

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
LTG	NEES	MA/RI	C&I Lighting Rebate	$6,333	$2,295	$8,628	$572	T	John Eastman	508-366-9011	Thru 12/88, over half of savings due to compact fluorescent lamps. Program effectively pays 100% of cost of compacts, which has resulted in distributors hiring extra sales staff to sell compacts door-to-door. Free-riders for energy-saving fluorescent lamps estimated to be 65%. Rebate paid to dealers, not customers. Promoted thru personal contacts w/ trade allies, mailings & contacts w/ customers. Rebate amts generally higher than those offered by most utilities. In early '89 pre-inspections required for all rebates to reduce free-riders & improve lighting quality. Lighting controls added to program in '89. In 1989 saved an add'l 27 MW, primarily from compacts, reflectors, ballasts and HID retrofits. Rebates for reflectors and ballasts took off in '89 because of $400/kW rebate for retrofits which combine electronic or hybrid ballasts with lamps &/or reflectors.
LTG	NEES	RI	RI Small C&I				~$200	T	Michael Horton	508-366-9011	Program operates in conjunction w/ RISE program listed below. Utility bulk purchases eligible products & installs @ no charge to customer. Only customers w/ demand <100 kW are eligible. 200 add'l jobs in progress. Very limited mktg so far as wanted to work out bugs. Rebate available thru another program provides partial funding for other measures. Considering augmenting program next yr to include free electronic ballasts, T-8 lamps, reflectors & occupancy sensors.
LTG	NEES	RI	Narragansett Lighting Rebate			$400	$333	T	Bob O'Brien	508-366-9011	Marketed via mailings, newspaper ads, limited telemarketing. Customer surveys indicate that 6-23% of program participants were free-riders. Average participant reduced kwh use by 2.6%.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
LTG	Nevada Pwr	NV	High Efficiency Lighting	Delamping, efficient fluorescent lamps, reflectors	$50-125/kW saved	Full	1986		1986	7/89	32,927		355	1.1%	P		6.52			1,740	0.37%	A
LTG	NiMo	NY	Experiment on Low-Cost Lighting	Fluorescent exit light kits	Free kit &/or $5 rebate	Pilot	1988	1988	1988	1988										5,403		
LTG	NiMo	NY	Fluorescent Lighting Rebate Experiment	Efficient 4' & 8' fluorescent lamps	$.40-.80 per lamp	Pilot	1988	1989	1988	1989	4,094	154		3.8%	C					5,403		

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
LTG	NSP	MN	C&I Lighting Conservation	Energy svg. lamps, ballasts & fixture	Rebates - vary by measure	Full	5/85		1/86	12/87	111,751		2,746	2.5%	P	10.82	12.02	52.28		5,543	0.20%	C
LTG	NU	CT/MA	Energy Saver Lighting Rebate	Lamps, ballasts, fixtures, controls	Rebates - vary by measure	Full	3/86		1/88	12/88	99,254	1,050	1,528	1.1%	C	8.97	9.76	42.85		4,242	0.21%	C
LTG	Or. & Rock.	NY	C&I Efficient Lighting Info	Efficient fluorescent lamps & ballasts	None	Full	1987	1987	1987	1987	18,000	120 responses		0.7%	C					892		
LTG	Or. & Rock.	NY	Switching to Savings	Fluorescent lamps & ballasts	$.50/lamp, $2.50-5/ ballast	Full	1/89				20,902									892		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
LTG	NSP	MN	C&I Lighting Conservation	$1,487	$530	$2,018	$186	T	Randy Gunn	612-330-7821	Promoted thru direct mail, bill inserts, radio & print ads, trade allies. Majority of savings due to fixture conversions for which rebate of $200/kW is paid. Rebates for lamps & ballasts as follows: $.25/ 4' fluorescent lamp, $2/2-lamp 4' fluorescent ballast, $2/screw-in fluorescent. They estimate ~30% of participants are free-riders. Figures given here are for MN. An add'l 106 rebates were paid in 1985. When rebates paid in SD & ND are included, number of rebates increases by ~17%.
LTG	NU	CT/MA	Energy Saver Lighting Rebate	$1,094	$468	$1,563	$174	T	Sharon Stepling	203-721-2924	Promoted thru direct mail, bill inserts, & trade allies (who receive points towards gifts). Savings in 1988 double combined 1986-87 savings. Most popular measures: fluorescent lamps, compacts, HID. Program included new construction in 1988. For '89 outdoor ltg, T-8 systems, reflectors & occupancy sensors added to program. Evaluation of dealer incentives found that dealers liked incentives, that incentives increased dealer interest in the program, but that the dealer incentives appeared to have only limited impact on participation.
LTG	Or. & Rock.	NY	C&I Efficient Lighting Info	$0	$28	$28			Dick Onofry	914-577-2521	Program consisted of an information brochure w/ a tear-out card to request additional info. Respondents were referred to lighting equipment manufacturers. Program replaced with an incentive program.
LTG	Or. & Rock.	NY	Switching to Savings						Fred Rella	914-577-2957	Program in start-up phase. Promote program thru direct mail to customers & distributors.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
LTG	Palo Alto	CA	Partners Electric Incentive	Lamps, ballasts, controls, reflectors, fixtures	Rebates - vary by measure & yr	Full	1985		1985	7/89	2,409		271	11.2%	P		2.85	10.93		182	1.56%	A
LTG	PG&E	CA	Lighting Conversion	Efficient lamps, fixtures	Rebates - vary by measure	Full	1983	1983	1983	1983	~25,000		2,145	8.6%	P					14,142		
LTG	Puget P&L	WA	Comm'l Conservation Financing	Nearly anything that saves energy	0% loan or 50-80% grant	Full	1/80		1980	12/88	69,236		588	0.8%	P			61.80		3,528		
LTG	Puget P&L	WA	Outdoor Lighting Systems	Lighting fixture changes	0% loan or 50-80% grant	Full	1/80	6/87	1/80	12/88	69,236		1,850	2.7%	P			64.65		3,528		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
LTG	Palo Alto	CA	Partners Electric Incentive	$505			$177	D	Jane Siguenza	415-329-2695	Promote program via personal contacts w/ lg customers, mailings to all customers. Reflectors & fixture modifications account for over half of savings. Participation highest in early yrs of program and for lg customers.
LTG	PG&E	CA	Lighting Conversion	$1,368					Diane Calden	415-973-8575	Customers using >100,000 kWh/yr eligible. Promoted thru mailings, trade allies, personal contacts. Concurrent program offered free audits to all customers. Audits emphasized availability of rebates. Lighting program was blended into other programs in late 1983. In addition to this program a ballast conversion program was offered in the first part of the year until CA ballast efficiency stds took effect. A survey in 1983 indicated that 63% of participants would have made the improvements w/o rebates but the rebates induced 70% of these to make the improvements sooner. Avg participant in '83 received 1.5 PG&E rebates.
LTG	Puget P&L	WA	Comm'l Conservation Financing	$9,576	$2,633	$12,209			Sid France	206-462-3742	Part of comprehensive, multi-measure program.
LTG	Puget P&L	WA	Outdoor Lighting Systems	$11,798					Sid France	206-462-3742	Private electrical contractors mkt program & provide TA. Customer submits form detailing job, its cost-effectiveness (<$.03/kWh), & grant or loan requested. Program had low overhead -- 2 staff handled ~$2 million/yr. Avg. cost, including overhd, $.022/lifetime kWh saved. Program merged into Comm'l Conservation Financing in 1987 in order to limit expenses. Program emphasized conversion of mercury, quartz & PAR lights to high pressure sodium.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
LTG	RISE	RI	C&I Conservation	Efficient fluorescent lamps, compact fluorescents, exit signs	Free materials & installation	Full	2/89		2/89	6/89	11,847	381		3.2%	C		1.26			~1050	0.12%	A
LTG	Rochestr G&E	NY	Comm'l Lighting Pilot	34W fluorescent lamps, screw-in fluorescents	20-60% of cost	Pilot	3/89		3/89	7/89	20	2		10.0%	C					1,205		
LTG	Salt R Proj	AZ	Lighting Incentive	Fluorescent lamps, ballasts, reflectors	Rebates - vary by measure	Full	6/88		6/88	2/89	38,760		25	0.1%	P		0.31			2,785	0.01%	A
LTG	Seattle C.L	WA	Lighting Survey		Free lighting survey	Full	1979	12/83	1979	12/83		111						5.64		1,725		
LTG	Seattle C.L	WA	Lighting Incentive	Efficient fluorescent lamps	50% of cost, maximum $.75/lamp	Pilot	12/80	10/83	12/80	10/83		358						12.21		1,725		
LTG	Sierra Pacf	NV	Comprehensive Ltg Efficiency	Nearly anything that saves energy	$50-150/kW -varies w/ op hrs	Full	4/87		4/87	12/88	29,502		116	0.4%	P		2.00			813	0.25%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
LTG	RISE	RI	C&I Conservation			$350	$278	T	Vin Graziano	401-272-1040	Program operated by RISE for Blackstone Valley & Newport Electric. Mktg so far has been limited & emphasizes personal contacts w/ lg. customers. Rebates available thru other programs provides partial funding for other measures. So far have not had sufficient time to actively promote these other measures. Improving lighting portion of audit to help w/ promoting add'l measures.
LTG	Rochestr G&E	NY	Comm'l Lighting Pilot						Marty Morse	716-724-8754	Customers contacted by phone & offered free lighting audit & rebate. Of first 30 that accepted audit offer, 3 have submitted rebate requests w/i 60 days of audit, add'l customers asked for an extension. Now plan to do 60 audits & give customers up to 6 months to implement recommendations. Customers divided into 3 groups: 20%, 40% & 60% rebates.
LTG	Salt R Proj	AZ	Lighting Incentive						Cary Gielniak	602-236-8485	Free lighting survey provided. Program promoted thru personal contacts, trade mags, direct mail.
LTG	Seattle C.L	WA	Lighting Survey			$30			Brian Coates	206-684-3729	Promoted thru letters to building owners, bill inserts. Program merged into energy management survey program in 1984.
LTG	Seattle C.L	WA	Lighting Incentive			$439			Brian Coates	206-684-3729	Two pilot programs were offered, one sponsored by Seattle, the other by BPA. Program not continued due to BPA power surplus & budget cutbacks.
LTG	Sierra Pacf	NV	Comprehensive Ltg Efficiency	$142	$371	$513	$257	T	Paul Bony	702-689-4242	Rebates are $150/kW for 10am-10pm operation, $100/kW for 8am-5pm operation, and $50/kW for 24 hr operation. Program promoted via mailings & personal contacts. Free lighting audits & asssitance dealing w/ contractors available.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
LTG	SMUD	CA	Lighting Incentive	Energy-saving 4' & 8' fluorescent lamps	40-60% of cost up to cap	Pilot	6/84	12/84	6/84	12/84	1,421	101		7.1%	C		0.50			1,902	0.03%	A
LTG	SMUD	CA	Comm'l Lamp Installation	Energy-saving fluorescent lamps	Free lamps & installation	Full	7/86		7/86	12/88	20,000	7,339		36.7%	C		2.24	6.88		1,902	0.12%	A
LTG	Snohomish	WA	Comm'l Energy Efficient Lighting	Compact fluorescent lamps	2 free lamps/business	Full	4/88		4/88	12/88	15,759	729		4.6%	C			0.21		1,156		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
LTG	SMUD	CA	Lighting Incentive	$39	$109	$148	$294	T	Dwight MacCurdy	916-721-5471	Promoted w/ mailing, some personal contacts. 11% of eligible lg customers (>200 kW) participated, 5% of small customers participated. Of eligible small customers, participation rates were 4% w/ 40% rebate & 7% w/ 60% rebate. 28% of customers requesting pre-inspection installed eligible lamps.
LTG	SMUD	CA	Comm'l Lamp Installation	~$320	~$530	~$850	$379	T	Kathy Itow	916-732-5450	Promoted via door-to-door solicitation, personal contacts, word-of-mouth & bill messages. Non-participants include low use customers (e.g. billboards). When these are excluded, participation rate is ~55%. Of remaining non-participants, ~60% due to unavailable decision-maker & 25% due to not meeting eligibility requirements. Efficient incandescent & compact fluorescent lamps added in 1988. Add'l measures promoted thru referrals to Peak Load Rebate Program.
LTG	Snohomish	WA	Comm'l Energy Efficient Lighting						Don Pendleton	206-347-1703	Provide 2 free compact fluorescent lamps to customers & assist w/ installation if needed. Designed to introduce new technologies & stimulate mkt. Estimate cost to be $.011/kWh saved. Customers very positive about program.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
LTG	So. Cal. Ed	CA	Hardware Rebate	Ltg system replacements, controls, reflectors	Rebates - vary by measure & yr	Full	1978		1/82	12/84	393,754						35.98	200.71		14,775	0.24%	A
LTG	So. Cal. Ed	CA	Lighten Your Energy Overhead	Efficicient fluorescent lamps	$1.25-2.50 per lamp	Full	10/86	2/87	10/86	2/87	233,000	888		0.4%	C		1.06	3.90		14,775	0.01%	A
LTG	Texas Util.	TX	Efficient Lighting	Lamps, ballasts, delamping, current limiters	None since 1986	Full	1983		1983	1988	242,647		6,185	2.5%	P	171.9				16,680	1.03%	C
LTG	Wisc. Elec.	WI	Smart Money	Nearly anything that saves energy	Rebates - vary by measure	Full	6/87		6/87	3/89	81,750	3,299	6,577	4.0%	C		46.39	222.81		3,810	1.22%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
LTG	So. Cal. Ed	CA	Hardware Rebate	$3,842			$107	D	Bob Murphy	818-302-1958	Comprehensive multiple end-use program. Breakdowns by end use not available after 1984. Lighting accounted for 36% of savings from rebates during 1982-84 period.
LTG	So. Cal. Ed	CA	Lighten Your Energy Overhead	$169			$159	D	Bob Murphy	818-302-1958	Targeted towards small C&I customer (<50 kW). Promoted via direct mail, trade allies.
LTG	Texas Util.	TX	Efficient Lighting						C.C. Benson	214-954-5647	Rebates eliminated in 1987 because felt that majority of customers would purchase energy-efficient lamps without rebates. Generally lg customers participate. Program promoted thru direct mail, personal contacts w/ trade allies & eligible customers, ads.
LTG	Wisc. Elec.	WI	Smart Money	$25,555			$551	D	Dan Thomas	414-221-3189	Part of comprehensive multiple end-use program. Fluorescent lamp, ballast and fixture measures, and custom lighting measures most common. Billing analysis found that actual savings only 45% of estimated savings but limited end-use metering showed that savings estimates were correct. Utility exploring reasons for the discrepancy. They estimate 50% of program participants were freeriders in the 1st year, but freeriders dropped to 30% in the 2nd yr.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
HVAC	Denton	TX	Appliance Rebate	High efficiency A/C & heat pumps	Customer: $40-75/ton; Dealer:$20	Full	1987		1987	6/89	2,953		~16	0.5%	P					173		
HVAC	Eastern Utl	MA/RI	Efficient Air Conditioning	CAC < 7.5 tons w/ SEER >= 8.5	$50-125/ton, varies w/ SEER	Full	5/88		5/88	12/88	26,681	109		0.4%	C	0.06		0.05		713	0.01%	C
HVAC	Jersey Cen.	NJ	A/C Rebate	Packaged a/c and heat pumps, room a/c	$3-10/kBtu; varies w/ EER	Full	8/83		8/83	11/88	87,534	378 in '88		.4% in '88	C	0.62		0.62		3,766	0.02%	C
HVAC	LA Dept W&P	CA	Heat Pump Cash Rebates	Heat pumps w/ SEER >= 8.3	Rebates - vary w/ size & efficiency	Full	5/87		5/87	12/88	182,907		2,881	1.6%	P					4,922		
HVAC	LILCO	NY	Dollars and Sense	High efficiency RAC & CAC	$30-75/ton, varies with equipment type	Full	10/86		10/86	9/88	95,871		272	0.3%	P	1.07		1.26	FR,T&D	3,576	0.03%	C

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
HVAC	Denton	TX	Appliance Rebate	$42					Richard Foster	817-566-8449	Program also available for residential applications. Promoted thru newspaper, radio, bill stuffer, cable TV, public speeches. A total of 327 rebates have been issued of which ~5% are for C&I applications. Room units account for 57% of applications & 30% of rebate $. Dealer fills out rebate form & receives $20/unit sold.
HVAC	Eastern Utl	MA/RI	Efficient Air Conditioning			$48	$818	T	Carol White	508-559-1000	Marketed via direct mail, contacts w/ a/c contractors, bill inserts, ads. Rebates provided to contractors. Residential installations also eligible & have accounted for an add'l 160 participants. Program has proven popular w/ contractors; as of 8/89 already exceeded 1989 goal.
HVAC	Jersey Cen.	NJ	A/C Rebate	$744			$1,200	D	Robert Jensen	201-455-8325	Program promoted thru direct mail, magazine ads, customer contacts & trade allies. Require minimum EER of 8.4 or SEER of 9.5 for central units, EER of 9.0 for room units. A total of 12,307 tons of a/c installed thru the program.
HVAC	LA Dept W&P	CA	Heat Pump Cash Rebates				$1,094	T	Art Bruce	213-481-3358	Residential installations also eligible. Market thru trade shows, seminars, direct mail, personal contact, word-of-mouth. Totals for '87-88 (including residential) are: 12808 rebates, $3,009,000 spent (~75% for rebates), svgs of 2.75 MW & 4.05 GWh/yr. Estimate reach 80% of available new equipment mkt. Claim heat pumps lowest cost htg & clg system in their area.
HVAC	LILCO	NY	Dollars and Sense	$325			$304	D	Fred Avril	516-364-7707	Part of comprehensive multi-measure program. Promote via direct mail, trade allies, Energy Hotline, personal contacts, audit referals. Three phase central air conditioners account for largest share of savings. Majority of these rebates for units w/ EER >10. In 1989 expanding program to include chillers.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants: Customers	Number of Participants: Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings: Coincident MW	Estimated Savings: Absolute MW	Estimated Savings: GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
HVAC	Madison G&E	WI	Cool Investments	High efficiency a/c, cool storage	Rebates - varies by measure & efficiency	Full	12/87	11/88	12/87	11/88	13,973	15		0.1%	C	0.28				477	0.06%	C
HVAC	Met-Ed/GPU	PA	Energy Mgmnt. Controller	Control sytems which shift load off-pk	$50/kW shifted up to 50%	Full	1984		1/87	12/88	43,959					1.49		0.49		1,673	0.09%	C
HVAC	Met-Ed/GPU	PA	Heat Pump	High efficiency heat pumps	$6-20/kBtu; varies w/ EER	Full	1/88		1/88	12/88	43,959	28		0.1%	C	0.04				1,673	0.00%	C
HVAC	NSP	MN	Chiller Efficiency Improvement	Centrifugal chillers >= .62 kW/ton	$10/ton	Full	4/85		4/85	12/87		44				1.38		1.82	FR	5,543	0.02%	C
HVAC	NSP	MN	Rooftop A/C & Condensing Unit	High efficiency packaged a/c	Rebates - vary by measure	Full	10/86		10/86	12/87	111,751	30	96	0.0%	C	0.10				5,543	0.00%	C
HVAC	Palo Alto	CA	Partners Electric Incentive	Pkgd units, evaporative cooling, any kW reduction	Rebates - varies by measure & yr	Full	1985		1985	7/89	2,409		10	0.4%	P		0.23	0.94		182	0.13%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
HVAC	Madison G&E	WI	Cool Investments	$65	$23	$88	$316	T	Lynn Hobbie	608-252-4760	Program ended in order not to conflict w/ competition pilot. Prompted thru brochures, fact sheets, performance studies, trade allies, personal contacts. Audit & assistance w/ sizing available.
HVAC	Met-Ed/GPU	PA	Energy Mgmnt. Controller			$34	$23	T	Ronald Weitz	215-921-6252	Program promotes time-clocks, interlock controls, time-of-day meter w/ meter controlled relay, demand limiter, EMS, programmable controller, duty cycler & customized systems. Marketed thru field reps, mailings. Provide free load profile service for 2 months. In earlier years of program an additional 1131 kW was saved. Maximum incentive $5000/customer.
HVAC	Met-Ed/GPU	PA	Heat Pump			$33	$817	T	Ronald Weitz	215-921-6252	Primarily a valley-filling program -- data collection emphasizes off-peak load added, not on-peak load saved. Maximum incentive $4000/customer. Rebate increases as EER increases. Promoted thru field reps, mailings.
HVAC	NSP	MN	Chiller Efficiency Improvement	$312	$131	$443	$320	T	Randy Gunn	612-330-7821	Estimate reaching 70% of annual centrifugal chiller sales. Thinking of adding rotary and reciprocating chillers to program. Promote thru trade allies, personal contacts, mailings.
HVAC	NSP	MN	Rooftop A/C & Condensing Unit	$18	$56	$74	$771	T	Randy Gunn	612-330-7821	Promote thru brochures, working closely w/ contractors, some personal contact with owners. Estimate 90% of units purchased by contractors then resold to bldg owners. Rebates revised 7/88 to increase rebate as efficiency increases. Also, rebate split between customer & contractor. These changes have increased participation.
HVAC	Palo Alto	CA	Partners Electric Incentive	$53			$230	D	Jane Siguenza	415-329-2695	Part of comprehensive, multi-measure program. Marketed via personal contacts w/ lg. customers, mailings to all customers.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
HVAC	Puget P&L	WA	Comm'l Conservation Financing	Nearly anything that saves energy	0% loan or 50-80% grant	Full	1/80		1/80	12/88	69,236		381	0.6%	P			55.03		3,528		
HVAC	SDG&E	CA	Coil Cleaning Rebate	Chemically clean a/c condenser coils	40% rebate	Pilot	5/86	7/86	5/86	7/86		461								2,374		
HVAC	So. Cal. Ed	CA	Keep Your Cool	Efficient pkg & thru-wall units	$200-400/ton	Full	3/84	10/84	3/84	10/84	393,754		3,790	1.0%	P		7.20	5.67		14,775	0.05%	A
HVAC	So. Cal. Ed	CA	Hardware Rebate	A/C, heat pumps, chillers, evaporative cooling	Rebates - varies by measure & yr	Full	1978		1/82	12/84	393,754						15.75	140.14		14,775	0.11%	A
HVAC	So. Cal. Ed	CA	A Refreshing Proposal	Efficient A/C, heat pumps, chillers	Rebates - varies by measure	Full	3/87	9/87	3/87	9/87		892					2.60	2.20		14,775	0.02%	A
HVAC	So. Cal. Ed	CA	Its a Breeze	Efficient A/C and heat pumps	$100-200/ton	Full	5/86	10/86	5/86	10/86	393,754		~2500	0.6%	P					14,775		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
HVAC	Puget P&L	WA	Comm'l Conservation Financing	$7,740	$2,129	$9,869			Sid France	206-462-3742	Part of comprehensive, multi-measure program. Market via word-of-mouth which generates sufficient interest to exhaust available resources. Program includes detailed audit, assitance dealing w/ contractors.
HVAC	SDG&E	CA	Coil Cleaning Rebate	$61					Linda Linderman	619-699-5083	Participation in program was double what was expected. Program discontinued because not cost-effective to non-participants. Promoted thru direct mail, press releases, a/c contractors, utility reps.
HVAC	So. Cal. Ed	CA	Keep Your Cool	$2,769			$385	D	Bob Murphy	818-302-1958	Promoted by direct mail to contractors, customers. Avg. rebate was $731/unit at a rate of $229/ton. Rebate accounted for avg of 25% of total cost. Most activity took place in last two months of program.
HVAC	So. Cal. Ed	CA	Hardware Rebate	$3,106			$197	D	Bob Murphy	818-302-1958	Part of comprehensive multi-measure program. Mandatory free audit provided. Optional feasibility study available. Promote rebates thru direct mail, trade allies, rebate coupons given at the time of audit. Breakdowns by end use not available after 1984. HVAC accounted for 25% of savings from rebates during 1982-84 period.
HVAC	So. Cal. Ed	CA	A Refreshing Proposal	$592			$228	D	Bob Murphy	818-302-1958	Dealers & contractors offered points redeemable for merchandise. Promote thru direct mail to dealers and eligible customers. ~400 contractors participated. Avg. 9.7 tons/customer. HVAC dealers were much more responsive than motor dealers to a similar program.
HVAC	So. Cal. Ed	CA	Its a Breeze	$1,200					Bob Murphy	818-302-1958	Incentive varied w/ efficiency of unit purchased. Designed particularly to reach small C&I customers. Promoted thru direct mail to contractors, customers. 70% of rebates went to small customers. Avg. unit ~ 3.5 tons.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
HVAC	Texas Util.	TX	Geothermal Heat Pump	Geothermal heat pumps	Customer: $500/unit; dealer:$100	Full	1/88		1/88	12/88	242,647		0	0.0%	P	0.00				16,680	0.00%	
HVAC	Texas Util.	TX	Existing Non-Residential High Efficiency Equipment	High efficiency central a/c & heat pump dealers	$200/HP +$25 to dealer; $20/AC	Full	1981		1981	1988	242,647		26,215	10.8%	P	34.20				16,680	0.21%	C
HVAC	Texas Util.	TX	Efficient Room Unit	High-efficiency room a/c & heat pumps	$20/unit to customer	Full	1981		1981	1988	242,647		<6000	<2%	P					16,680		
HVAC	Wisc. Elec.	WI	Smart Money	Nearly anything that saves energy	Rebates - vary by measure	Full	6/87		6/87	3/89	81,750	342	681	0.4%	C		2.88	2.49		3,810	0.08%	A
HVAC	W. TX Util.	TX	Energy Saving Plan	Central & room A/C & heat pumps	$50-110/ton or $40-100 ea.	Full	1987		1987	1988	31,868		1,059	3.3%	P			1.59		1,077		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
HVAC	Texas Util.	TX	Geothermal Heat Pump						C.C. Benson	214-954-5647	Program offered to residential. & non-residential. customers. So far no non-residential customers have participated. Market thru ads, personal contacts w/ trade allies.
HVAC	Texas Util.	TX	Existing Non-Residential High Efficiency Equipment						C.C. Benson	214-954-5647	Savings estimate includes customers who purchased efficient equipment but didn't receive rebate (estimated from surveys & manufacturer data). In early yrs incentive varied w/ equipment size until their market research showed this wasn't necessary. Marketed thru direct mail, ads, personal contacts w/ trade allies & eligible customers.
HVAC	Texas Util.	TX	Efficient Room Unit						C.C. Benson	214-954-5647	Program offered to residential & non-residential customers. Non-residential <5% of participants -- exact figures are not readily available. Program marketed via personal contacts w/ trade allies & point of sale brochures.
HVAC	Wisc. Elec.	WI	Smart Money	$574			$200	D	Dan Thomas	414-221-3189	Part of comprehensive multi-measure program. Promote thru mailings, trade allies, direct contact by field reps. Engineers on retainer to provide technical assistance.
HVAC	W. TX Util.	TX	Energy Saving Plan	$162					Carl Piel	915-674-7296	Residential program offered since 1983, expanded to C&I in 1987. For existing bldgs require R-19 ceiling insulation, if attic accessible. For new bldgs generally require R-19 ceilings & R-11 walls. Promote thru TV, radio, newspapers, personal contacts w/ builders, dealers, owners. Provide free heat loss analysis & duct layout.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MOTOR	Bangr Hydro	ME	C/I Motor Efficiency	High efficiency motors, downsizing	Rebates or loans	Pilot	4/86	7/89	4/86	12/88	~1750	24	97	1.4%	C		0.08	0.34	FR	262	0.03%	A
MOTOR	BC Hydro	BC	High Efficiency Motor Rebate	High efficiency motors, 1-5000 hp	$400/kW saved up to 20% of cost	Full	7/88		7/88	6/89	142,779	95	126	0.1%	C	0.57		3.75		6,830	0.01%	C
MOTOR	CMP	ME	Motor Rebate	High efficiency motors	Rebates -- vary by motor size	Pilot	1986		1986	12/88	43,686	232	320	0.5%	C			1.69		1,455		
MOTOR	Jersey Cen.	NJ	Motor Rebate	High efficiency motors	$10/hp	Full	6/87	12/88	6/87	12/88	28,000									3,766		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MOTOR	Bangr Hydro	ME	C/I Motor Efficiency	$20	$3	$23	$305	T	John Hunnefeld	207-945-5621	Estimate free riders at 67-88% based on customer surveys. Approx. 30% of savings due to downsizing of motors. Only ad costs listed under indirect costs -- staff not included. Considering adding other measures to program such as ASDs, belts, capacitors, and efficient rewinds. Most participants are thru 1 dealer who primarily handles efficient motors. Program manager has frequently changed which has reduced promotion efforts. Promoted thru direct mail, trade allies, & newspaper ads, walk-thru & detailed aduits available. Utility also operates informational program to promote adjustable speed drives.
MOTOR	BC Hydro	BC	High Efficiency Motor Rebate	$210	$111	$320	$566	T	Owen Stevens	604-663-3761	Comprehensive marketing package includes info manual on motors, list of participating distributors, & list of all eligible motors sold in Province. They estimate efficient motors have increased from 5% to 15% of motor sales as a result of program. Rebate based on guaranteed efficiency. Promoted thru personal seminars, trade shows & distributors, customers, & engineers. Utility distributes computer program to calculate savings on a per motor basis. Rebates available for motors up to 5000 hp.
MOTOR	CMP	ME	Motor Rebate						Linda Ecker	207-623-3521	Evaluation of 1986 program found 37% freeriders (according to a survey). In '86, 568 MWh were saved (including freeriders) at a cost of $47,156 for rebates & $91,000 for administration. 64% of rebates were to replace a failed motor. 42% of old motors being kept on hand, 16% being sold. Promoted thru trade allies, personal contacts & direct mail.
MOTOR	Jersey Cen.	NJ	Motor Rebate	$43					Robert Jensen	201-455-8325	Did not get as much participation as they had hoped. Most facilities only operate 2000-4000 hrs/yr, so many customers not interested. Program canceled due to budget crunch. Motor dealers helpful. They too were surprised with low response. Program promoted via direct mail, magazine ads, customer contacts & trade allies.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MOTOR	Met-Ed/GPU	PA	High Efficiency Motor	High efficiency motors	$10/hp for complying motors	Pilot	1/86	12/87	1/87	12/87	43,959						0.22	0.77		1,673	0.01%	A
MOTOR	Nevada Pwr	NV	Energy Efficient Electric Motor Rebate	Efficient 3-phase motors	Rebates to customer & dealer	Pilot	4/89		4/89	6/89	32,927	5		0.0%	C					1,740		
MOTOR	NEES	MA/RI	Lg. C&I Custom	Nearly anything that saves energy	$70-460/kW saved w/ high effic. motors	Full	1/88	6/89	1/88	6/89	1890	23		1.2%	C	0.28				3798	0.01%	C
MOTOR	NEES	MA/RI	Energy Initiative	High efficiency motors, ASDs, custom measures	Rebate - varies w/ motor type & size	Full	6/89		6/89	8/89	~6000	10	12	0.2%	C	0.09				3798	0.00%	C

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MOTOR	Met-Ed/GPU	PA	High Efficiency Motor			$27	$122	T	Ronald Weitz	215-921-6252	1 yr. pilot program. Ended program because thought was too expensive for kW saved. Motors between 1-75 hp eligible, up to $5000/acct. New motors not eligible. In 1986 an add'l 145 kW was saved. Promoted thru field reps & mailings. Free motor audit was offered.
MOTOR	Nevada Pwr	NV	Energy Efficient Electric Motor Rebate						Bob Tyre	702-367-5113	Customer rebates vary from $5 for a 1 hp motor to $300 for a 100 hp motor. Dealer rebates of $10/motor. Based on slow response so far, think that dealer rebate should perhaps be increased to $20-25/motor. Intent of dealer rebate is to cover administration & inventory costs. Dealer fills out rebate application & mails to utility. Motors purchased as spares eligible for rebates. Marketed via direct mail & personal contacts w/ motor dealers & users.
MOTOR	NEES	MA/RI	Lg. C&I Custom	$112			$401	D	Tim Stout	508-366-9011	Comprehensive multiple end-use program offered to government agencies, RI customers w/ peak demand >100 kW, and MA customers w/ annual electric bills >$2 million. Rebates varied primarily w/ motor operating hours. Rebates paid for 394 motors. Marketed thru direct mail, personal contacts w/ customers, & efforts of some motor dealers. Utility disappointed in participation rate and created Energy Initiative program to replace it.
MOTOR	NEES	MA/RI	Energy Initiative	$74			$822	D	Tim Stout	508-366-9011	Comprehensive multiple end-use program offered to all customers w/ peak demand >100 kW except MA customers w/ demand >500 kW. Incentives designed to cover full cost of new high efficiency motor assuming a 50% discount off of list price. Customer pays for installation. Also offer pre-calculated incentives for ASDs designed to pay full cost of ASD in many applications. Program promoted thru direct mail, seminars and personal contacts w/ both dealers & eligible customers. Free audit, including free motor audit, available. Program has been very well received by dealers. Results given here only include motors and do not include ASDs.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MOTOR	NiMo	NY	Motor Rebate Pilot	High efficiency motors	$25/hp	Pilot	5/86	12/86	5/86	12/86	24	8		33.3%	C				Meter	5,403		
MOTOR	NSP	MN	C&I Motor Efficiency	Energy-efficient motors	Customer: $2-7/hp; Dealers: $.50/hp	Full	3/86		1/87	12/87	111,751	54		0.0%	C	0.14	0.21	0.86		5,543	0.00%	C
MOTOR	Palo Alto	CA	Partners Electric Incentive	Efficient motors, downsizing	Varies by measure & yr	Full	1985		1985	7/89	2,409		10	0.4%	P		0.16	0.77		182	0.09%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MOTOR	NiMo	NY	Motor Rebate Pilot	$117	$27	$144			Steve Molodetz	315-428-5776	Program open to a select group of large industrial customers. To receive rebate a motor needed to operate 16-24 hrs/day. Rebate helped cover mat'l, labor & monitoring costs. At each facility 1 or 2 motors were metered for 1 week before & after change-out. kWh svgs avg'd 13.7%, kW svgs avg'd 5.3%. Of non-participants, 2 didn't meet eligiblity requirements & 12 were concerned about disruptions to production process caused by downtime to change motors. Program promoted via personal contacts w/ 3 shift industrial customers. Utility provided computer assessment of savings & cost.
MOTOR	NSP	MN	C&I Motor Efficiency	$25	$78	$103	$742	T	Randy Gunn	612-330-7821	Minimum efficiency levels vary w/ motor speed. Rebate of $2/hp for non-working motors & motors in new applications. Rebate $7/hp for working motors. Approx. 75% of rebates have gone for the 1st category. Market program thru trade allies, bill inserts, direct mail, personal contacts & audits. Rebate activity picked up in early '88. Dealer rebates are small & have not significantly increased participation. Based on this experience they recommend giving 50% of the rebate to the dealer. Also, vigorous mktg crucial. Based on customer surveys they estimate 40% of participants are free riders. They are considering adding VSDs to program.
MOTOR	Palo Alto	CA	Partners Electric Incentive	$29			$185	D	Jane Siguenza	415-329-2695	Part of comprehensive multiple end-use program. Promote program thru personal contacts w/ lg customers, & mailings to all customers. Approx. 2/3s of participants were lg customers. Participation rate among lg customers is approx. 30%. In 1988 program made more complex & participation plummeted. 1989 program again simplified but participation still low.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MOTOR	PG&E	CA	Energy-Efficient Motor	High efficiency motors	$10/hp	Full	1983	1983	1983	1983	~25,000		431	1.7%	P					14,142		
MOTOR	So. Cal. Ed	CA	A Rewarding Connection	Efficient motors	$3-5/Hp, varies w/ size	Full	11/86	9/87	11/86	9/87	70,000	177		0.3%	C		0.52	5.20		14,775	0.00%	A
MOTOR	So. Cal. Ed	CA	Hardware Rebate	Energy efficient motors	Rebates - vary by measure & yr	Full	1978		1/82	12/84	393,754						6.62	49.99		14,775	0.04%	A
MOTOR	Wisc. Elec.	WI	Smart Money	Nearly anything that saves energy	Rebates - vary by measure	Full	6/87		6/87	3/89	81,750	64	128	0.1%	C		0.27	1.66		3,810	0.01%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MOTOR	PG&E	CA	Energy-Efficient Motor	$1,273					Diane Calden	415-973-8575	Customers using >100,000 kWh/yr eligible. Allow pre-qualification over the phone when quick replacement required. This program was blended into other rebate program in late 1983. Substantial additional rebates have been issued under these programs. Program promoted thru mailings, trade allies, personal contacts.
MOTOR	So. Cal. Ed	CA	A Rewarding Connection	$41			$79	D	Bruce Mayo	213-491-2263	Dealers offered points toward gifts in exchange for helping customers w/ application. Dealers receptive but didn't have time for paperwork. Marketed via direct mail to dealers and eligible customers. Estimate reached 3% of motor sales during progam. Rebate too small to influence customers. Not all brands eligible due to low efficiency. Dealers of ineligible brands didn't want to add new lines.
MOTOR	So. Cal. Ed	CA	Hardware Rebate	$1,011			$153	D	Bob Murphy	818-302-1958	Part of comprehensive program addressing multiple end-uses. Breakdowns by end use not available after 1984. Motors accounted for 9% of savings from rebates during 1982-84 period. Audit required. Promoted program thru direct mail, trade allies, & coupons distributed during audit.
MOTOR	Wisc. Elec.	WI	Smart Money	$81			$307	D	Dan Thomas	414-221-3189	Part of comprehensive multiple end-use program promoted thru mailings, trade allies, & direct contacts by field reps. In addition to motor rebates, provide incentives for other measures proposed by customers, such as adjustable speed drives. Engineers on retainer to provide technical assistance.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants: Customers	Number of Participants: Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings: Coincident MW	Estimated Savings: Absolute MW	Estimated Savings: GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
IND	BPA	WA/OR	Sponsor-Designed	Process improvements	Full cost beyond 3 yr payback	Pilot	1984	1989	1984	1989	~800	14		1.8%	C		28.30			16,680	0.17%	A
IND	BPA	WA/OR	Alum Smelter Conservation/ Modernization	Nearly anything that saves energy	$.005/kWh for 10 yrs	Full	6/86		6/86	7/89	10	9		90.0%	C		69.00	604.44		16,680	0.41%	A
IND	BPA	WA/OR	Design Wise	Process improvements	Free design assistance	Full	4/89													16,680		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
IND	BPA	WA/OR	Sponsor-Designed			$4,800	$170	T	Joyce Economus	503-230-5327	Competitive solicitation for specific projects & for programs to serve multiple projects. Signed contracts for 12 projects & 1 program. Most projects had been previously considered by firms but placed on back-burner. Participating firms cost-consciousness generally lg. Only 1 free rider. Participation reduced by rigid time periods & requirement that participants finance measures up to a 3 yr payback. Recommend flexibility on payback & that program be open yr-round to fit each customer's schedules. Proposal requirements complex, recommend simplification. Some firms hired engineers to prepare proposals. Promoted thru mail, word-of-mouth, & personal contacts; still many elegible customers were unfamiliar w/ program.
IND	BPA	WA/OR	Alum Smelter Conservation/ Modernization	$30,222			$438	D	Tom von Muller	503-230-3440	Program designed to reduce operating costs of the major industry in the region while saving energy for BPA. All eligible customers were involved in design of program. Projects will be completed by 6/30/91. An add'l 102 MW of projects are under construction. Savings were limited by available budget of $76 million. All savings figures assume plants operate at 75% of capacity (the long-term historical avg). Program has accelerated moderization at plants. Industries all have lg engineering staffs who identify & implement measures.
IND	BPA	WA/OR	Design Wise						Joyce Economus	503-230-5327	For small & medium industrial plants (up to 5 avg MW). Industrial consultants hired by BPA or utility review new construction & expansion plans (up to $10,000/project) and also make on-site service calls to discuss electrotechnologies (up to $2,000/project). Utility & BPA split costs. Individual utilites market program using various approaches.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
IND	BPA	WA/OR	Industrial Test Program	Free audit	Free audit	Pilot	1984	1985	1984	1986		25								16,680		
IND	BPA	WA/OR	Energy $avings Plan	Process improvements	$.05/1st yr kWh up to 80%	Full	12/87		12/87	9/88	~3000	19		0.6%	C		7.82	68.51		16,680	0.05%	A
IND	NU	CT/MA	Customer Initiated	Nearly anything that saves energy	Cut PB to 3 yr, up to 50%	Full	3/89													4,242		
IND	Palo Alto	CA	Partners Electric Incentive	Custom measures, pumping, dishwashers	Generally $250/kW reduced	Full	1985		1985	7/89	2,409		11	0.5%	P		0.82	7.56		182	0.45%	A
IND	PG&E	CA	Industrial Load Shaping	Load shifting measures	$200/kW shifted	Pilot	1986		1986	12/87		5				4.00				14,142	0.03%	C

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
IND	BPA	WA/OR	Industrial Test Program						Greg Gustafson	503-241-0702	Free comprehensive analyses of electricity saving measures provided to plants in the food processing, wood products, and pulp & paper industries. Only a small % of recomendations were adopted due to paybacks exceeding plant investment thresholds (typically 2-3 yrs), limited capital availability, concerns about excess plant downtime, project supervision time or maintenance problems, &/or uncertainty about savings estimates.
IND	BPA	WA/OR	Energy $avings Plan	$1,864			$238	D	Rod Aho	503-230-3631	Industrial firms propose projects, first in an abstract, then, once approved, in a full engineering proposal. Most common products are motors (particularly VSDs) & refrigeration (particularly computer controls). Promoted thru mass mailing by BPA plus individual utility mktg efforts. Activity has dropped in early '89 due to lack of utility mktg. Process evaluation found that simple contract and rapid review process were important. Recommend add'l TA & field visits & further streamlining application forms to encourage participation. BPA thinking of doubling incentive in order to increase participation.
IND	NU	CT/MA	Customer Initiated						Jan Sayko	203-721-2721	Similar to Energy Action but for customers w/ in-house engineering expertise.
IND	Palo Alto	CA	Partners Electric Incentive	$201			$246	D	Jane Siguenza	415-329-2695	Part of comprehensive multiple end-use program. Marketed via personal contacts w/ lg customers, mailings to all customers.
IND	PG&E	CA	Industrial Load Shaping			$5,089	$1,272	T	Diane Calden	415-973-8575	Contracting difficulties have slowed program down. Program has gradually shifted from a load management to a load building focus. No projects were signed in '87 or '88. Promote thru mailings & one-on-one contacts.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
IND	Puget P&L	WA	Comm'l Conservation Financing	Nearly anything that saves energy	0% loan or 50-80% grant	Full	1/80		1980	12/88	69,236		66	0.1%	P			23.88		3,528		
IND	So. Cal. Ed	CA	Hardware Rebate	Process system modifications	Rebates-vary by measure & yr	Full	1978		1/82	12/84	393,754						0.75	7.33		14,775	0.01%	A
IND	TVA	TN+	Industrial Energy Services	Nearly anything that saves energy	Loans @ just below prime	Full	1979		1980	9/86	6,500	317		4.9%	C					19,772		
IND	Wisc. Elec.	WI	Smart Money	Nearly anything that saves energy	Rebates - vary by measure	Full	6/87		6/87	3/89	81,750	47	94	0.1%	C		3.03	20.11		3,810	0.08%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
IND	Puget P&L	WA	Comm'l Conservation Financing	$1,061	$292	$1,353			Sid France	206-462-3742	Part of comprehensive multiple end-use program. Promoted thru word-of-mouth. Utility provides detailed audit, & assistance working w/ contractors.
IND	So. Cal. Ed	CA	Hardware Rebate	$79			$105	D	Bob Murphy	818-302-1958	Part of comprehensive multiple end-use program. Utility provides mandatory free audit. Optional feasibility study available. Breakdowns by end use not available after 1984. Process measures accounted for very few rebates during 1982-84 period.
IND	TVA	TN+	Industrial Energy Services						Jim West	615-751-5103	Program was combined w/ C/I program until 1987. This is a program targeted @ 2400 lg industrial customers (>100 MWh/mo.) in order to retain load. Smaller industrial customers receive limited services. Encourage efficiency improvements, industrial heat pumps & electrotechnologies. Mktg emphasizes building personal relationships w/ targeted customers. TVA engineers provide technical studies.
IND	Wisc. Elec.	WI	Smart Money	$2,532			$837	D	Dan Thomas	414-221-3189	Part of comprehensive multiple end-use program.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
CS	AZ Pub Serv	AZ	STEP	Storage cooling	$115-250/kW shifted	Full	6/85		6/85	3/89		13				~4.5				3,126	0.14%	C
CS	BECo	MA	Cool Storage Incentive	Storage cooling	$200/kW shifted & 50% study	Full	1986		1986	12/88		1				0.60				2,477	0.02%	C
CS	Jersey Central P&L	NJ	Thermal Storage Clg Rebate	Storage cooling	$125-250/kW shifted	Full	1987		1987	12/88		0	0			0.00	0.00	0.00		3,766	0.00%	
CS	LA Dept W&P	CA	Off-Pk Cooling Cash Rebates	Storage cooling	$250/kW shifted up to cap, 50% study	Full	5/87		5/87	12/88		2				0.86				4,922	0.02%	C
CS	LILCO	NY	Dollars and Sense		$300-500/kW shifted	Full	10/86		10/86	9/88		1				0.14			FR,T&D	3,576	0.00%	C
CS	NEES	MA/RI	Storage Cooling	Storage cooling	$160/kW shifted, free study	Full	7/87		7/87	12/88										3,798		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
CS	AZ Pub Serv	AZ	STEP	~$1,000			$222	D	Linda Willoughby	602-250-2417	An additional 15 projects totaling 12-13 MW are under contract. Marketed via personal contacts w/ engineers. Provide free scoping analysis.
CS	BECo	MA	Cool Storage Incentive	$120.00	$382	$502	$837	T	Frank Hendrigan	617-424-2316	8 add'l contracts signed including 5 under construction. These add'l contracts total 2.7 MW. Difficult to sell downtown because storage & parking space can be rented for a premium. Promoted thru personal contacts w/ owners, developers, A&Es, seminars, mailings, trade shows.
CS	Jersey Central P&L	NJ	Thermal Storage Clg Rebate	$0					Robert Jensen	201-455-8325	Promoted via direct mail, magazine ads, customer contacts. Staff engineers review plans, give advice. 7 contracts signed. In addition over 15 customers are interested. If all interested customers install systems, will shift ~15 MW. Have $10/kW peak period demand charge, no off-pk charge.
CS	LA Dept W&P	CA	Off-Pk Cooling Cash Rebates			$640	$743	T	Art Bruce	213-481-3358	Promote thru trade shows, seminars, direct mail, personal contact & word-of-mouth.
CS	LILCO	NY	Dollars and Sense	$41			$288	D	Fred Avril	516-364-7707	No participants in 1988. Market via direct mail, trade allies, Energy Hotline, personal contacts & audit referrals.
CS	NEES	MA/RI	Storage Cooling			$1,435			Michael McAteer	508-366-9011	12 projects totaling 12.9 MW under contract as of 12/31/88 -- much of this is under construction. Incentives increased in 1989 to higher levels than listed here. Promote thru personal contacts w/ A&E's, developers & owners, trade journal ads, & seminars. Provide free scoping & feasibility studies.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
CS	NSP	MN	Cool Storage A/C	Storage cooling	$40-300/ton, up to 75% of study	Full	~1985/86		~85/86	12/87		5				0.38				5,543	0.01%	C
CS	Or. & Rock.	NY	Cool Reserve	Storage cooling	$250/kW shifted	Full	1/89													892		
CS	Palo Alto	CA	New Construction Incentive	Storage cooling	$300/kW shifted, 50% study	Full	1988		1988	7/89		1				0.17				182	0.09%	C
CS	Palo Alto	CA	Partners Electric Incentive	Storage cooling	$300-550/kW shifted, 50% study	Full	1985		1985	12/88		2				0.97				182	0.54%	C
CS	PG&E	CA	Thermal Energy Storage	Storage cooling	$200/kW shifted	Full	1985		1985	12/87		36				8.50				14,142	0.06%	C
CS	PSE&G	NJ	Cool Storage Rebate	Storage cooling	$125-250/kW shifted	Full	1987		1987	7/89										8,137		
CS	Riverside	CA	Thermal Energy Storage	Storage cooling	$200/kW, 1/2 study	Full	1/88		1/88	2/89		0				0.00				318	0.00%	

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
CS	NSP	MN	Cool Storage A/C	$85	$100	$185	$485	T	Randy Gunn	612-330-7821	Pilot program offered 1985-1987. Full-scale program began 1/87. Thru the end of 1987, no rebates had yet been paid in the full-scale program. Have optional TOU rates, but these often don't make economic sense for an office, even w/ cool storage. Market via personal contacts & a seminar w/ vendors & A&E firms.
CS	Or. & Rock.	NY	Cool Reserve						Fred Rella	914-577-2957	Program in start-up phase. Market thru brochure & letter sent to customers, distributors, etc. Sometimes provide a free cost and savings analysis.
CS	Palo Alto	CA	New Construction Incentive	$67			$400	D	Peter Govea	415-329-2695	This program is only for new construction & major renovations. An add'l 3 projects are underway totaling 617 kW & $246,600 in rebates. Promote thru personal contact w/ A&E's, particularly when learn of project. Provide plan review, some engineering assistance.
CS	Palo Alto	CA	Partners Electric Incentive	$536			$550	D	Jane Siguenza	415-329-2695	Since start of new construction program in 1988, this program is only for retrofit installations. Market via personal contacts w/ lg customers, mailings to all customers
CS	PG&E	CA	Thermal Energy Storage	$2,500			$294	D	Diane Calden	415-973-8575	Follow-up program begun in 5/87 has resulted in 48 add'l contracts w/ 6.8 MW of shift and $1.5 million of incentives. "Aggressive" mktg in 1986, "selective" mktg in 1987.
CS	PSE&G	NJ	Cool Storage Rebate						Mark Bowen	201-430-5337	3 projects now under construction totaling 1360 kW. Promote via brochure, technical guide, seminars, mailings, trade allies.
CS	Riverside	CA	Thermal Energy Storage						Michael Vernon	714-782-5485	Only limited mktg so far. Pay 1/2 cost of a feasibility study up to $5000. Have done one of these so far.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
CS	Salt R Proj	AZ	Thermal Energy Storage	Storage cooling	$60-250/kW shifted	Full	1986		1986	2/89		10				2.79				2,785	0.10%	C
CS	SDG&E	CA	Thermal Energy Storage	Storage cooling	$50-200/kW shifted	Full	1985		1985	6/89		32				~6.00				2,374	1.18%	C
CS	SMUD	CA	Thermal Energy Storage	Storage cooling	$250/kW shifted, free study	Pilot	1987	12/88	1987	12/88		1				0.34				1,902	0.02%	C
CS	So. Cal. Ed	CA	Off-Peak Cooling	Storage cooling	Typically $200/kW, 1/2 study	Full	~1981		1981	12/88			~275			89.00				14,775	0.60%	C
CS	Texas Util.	TX	Thermal Cool Storage	Storage cooling	$125-350/kW	Full	1984		1984	1988			73			33.09				16,680	0.20%	C

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
CS	Salt R Proj	AZ	Thermal Energy Storage						Eric Smith	602-236-4448	Two cash incentive options available: (1) $250/kW for 1st 300 kw, $115/kW for next 200 kW, $60/kW thereafter or (2) $150/kW up-front w/ customer paying $1.75/month per kw back to utility in yrs. 4-10. All customers so far have used option 1. Promote program via personal contacts, trade mags, & direct mail. Free scoping analysis provided.
CS	SDG&E	CA	Thermal Energy Storage	$7,200	$1,100	$8,300	$296	T	Linda Linderman	619-699-5083	An additional 45 systems totaling 22 MW are under construction. Incentive varies depending on cost-effectiveness to utility & customers. Program participation has been limited by budget caps imposed by PUC. High demand charge ($14.42/kW) and off-pk discounts ($.032-.039/kWh) provide strong encouragement for storage cooling systems. Promote via personal contacts, trade shows, newsletter, & seminars. Free scoping analysis provided.
CS	SMUD	CA	Thermal Energy Storage	$84	$335	$419	$1,247	T	Bruce Vincent	916-732-5397	3 add'l projects w/ 2160 kW of load are under contract. Over a dozen add'l projects in the works. Lack of TOU rate is holding back participation. Market via multiple mailings to A&E firms & a free design seminar. Free feasibility study provided (up to $5000/project).
CS	So. Cal. Ed	CA	Off-Peak Cooling			$16,604	$187	D	Bob Murphy	818-302-1958	TOU rates were changed in 1988, which reduced attractiveness of off-pk cooling to customers. In 1988 incentive reduced from $200/kW to $100kW shifted. Participation & savings figures include projects under construction. Market program via personal contacts w/ A&E's, developers, & customers; brochures and seminars.
CS	Texas Util.	TX	Thermal Cool Storage	~$8,000	~$1,000	~$9,000	~$250	T	Bob Tackett	214-698-3659	Savings and rebates only for systems already installed -- add'l systems are in the works. As a result of program, most major A&E's, & developers familiar w/ storage cooling. Market via personal contacts w/ architects, engineers, developers & manufacturers. Free scoping analysis provided.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh/yr	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute?
CS	United Illm	CT	Cool Storage	Storage cooling	$150/kW shifted	Full	1988		1988	12/88										1,072		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg. Cost/ kW	Direct or Total	Contact Name	Phone	Notes
CS	United Illm	CT	Cool Storage	$600	~$150	~$750			Tony Vallillo	203-787-7534	Six projects totaling 4MW are under construction -- none completed yet. Have 3 full-time sales engineers dedicated to program who mkt program 1-on-1 and provide economic analyses, plan review, and other technical assistance. Seminars offered.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
TAC	Boston Gas	MA	Gas A/C Rebate	Gas a/c	$100/ton up to $20,000	Full	1988		1988	11/89		4					0.50					
TAC	Con Ed	NY	Steam Space Conditioning	Steam a/c	$100-230 per ton up to 50%	Full	7/87		7/87	12/88	~462	56		12.1%	C	56.00				9,386	0.60%	C
TAC	Con Ed	NY	Gas Space Conditioning	Gas a/c		Full	12/88		12/88	12/88		1				0.40				9,386	0.00%	C
TAC	LILCO	NY	Dollars and Sense	Absorption cooling	$300-500/kW shifted	Full	10/86		10/86	9/88		2				0.37		0.44	FR,T&D	3,576	0.01%	C
TAC	Or. & Rock.	NY	Non-Electric A/C	Thermal a/c (gas & cogen)	$250/kW displaced	Full	1/89													892		
TAC	Peoples Gas	IL	Gas A/C Promotion	Gas a/c	$100-150/ton	Full	1987		1987	2/89			31				2.82					

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
TAC	Boston Gas	MA	Gas A/C Rebate	$52			$105	D	Ken Cheo	617-323-9210	Provide free economic analyses. Program primarily mktd thru personal contacts w/ A&E's, developers. kW savings based on .80 kW/ton for a std. electric chiller.
TAC	Con Ed	NY	Steam Space Conditioning						John Spada	212-460-4600	Program designed to keep existing steam customers from switching to electric cooling. New bldgs using steam cooling are also eligible. $100/ton rebate for replacing existing turbines. $230/ton rebate for new systems or replacing turbine & compressor. These rebates are designed to cover avg incremental costs of steam a/c compared to electric a/c. Evaluation indicates 18% of rebate $ went to free-riders. Program response has been greater than expected due in lg part to extensive mktg efforts by manufacturers.
TAC	Con Ed	NY	Gas Space Conditioning						John Spada	212-460-6549	
TAC	LILCO	NY	Dollars and Sense	$107			$288	D	Fred Avril	516-364-7707	Only 1 small participant in 1988. Promote program via direct mail, trade allies, Energy Hotline, personal contacts, audit referrals.
TAC	Or. & Rock.	NY	Non-Electric A/C						Fred Rella	914-577-2957	Program in start-up phase. Market thru brochure & letter sent to customers, distributors, etc. Provide free scoping analysis.
TAC	Peoples Gas	IL	Gas A/C Promotion						Tom O'Sullivan	312-431-4838	Incentive is $150/ton for firm customers, $100/ton for interuptible customers. Incentive designed to offset 1st cost premium of gas a/c. 25 systems are small systems totaling 90 tons. 6 systems are lg systems totaling 3425 tons. kW svgs based on .80 kW/ton for a std electric chiller. Market thru personal contacts, bill inserts, ads in newspapers, & business publications.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
TAC	SDG&E	CA	Gas A/C	Gas a/c	$50-200/kW shift, TOU rate	Full	1985		1985	6/89		35				13.50				2,374	0.57%	C
TAC	Tenneco	TX	Market Specific Project	Gas a/c	$100/ton up to $15,000	Full	1988		1988	12/88			11				1.58					

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
TAC	SDG&E	CA	Gas A/C	$2,200	$381	$2,581	$191	T	Linda Linderman	619-699-5083	Only 12 systems totaling 2.5 MW are completed, the remainder are under construction. Promote program via personal contacts, trade shows, newsletter & seminars. Provide free scoping analysis. See add'l notes under SDG&E Thermal Energy Storage program.
TAC	Tenneco	TX	Market Specific Project	$112			$71	D	Taylor Sherwood	713-757-4022	Tenneco is a major gas distributor which serves ~100 local gas utilities thruout the US. Tenneco provides rebates, local gas utilities mkt program & may provide add'l incentives or services. In 1989 Tenneco will provide some $ for customer assistance in addition to rebates. Savings estimates based on .80 kW/ton for a std electric chiller. Program also provides incentives for gas-fired cogen systems.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
NEW	BPA	WA/OR	Energy Smart	Nearly anything that saves energy	Awards, free design assistance	Pilot	8/88													16,680		
NEW	BPA	WA/OR	Energy Edge	Nearly anything that saves energy	Design & construction costs	Pilot	1986		1986	9/88		28						13.43	Simul.	16,680		
NEW	Con Ed	NY	C&I New Construction	HVAC, motors, storage cooling	Rebates - vary w/ measure	Pilot	6/88		6/88	12/88		1								9,386		
NEW	Florida P&L	FL	Energy Systems Planning	Technical consultation	Free consultation	Full	1988													12,394		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
NEW	BPA	WA/OR	Energy Smart						Terry Oliver	503-230-5991	First yr was spent signing up utilities to offer program -- have ~65. Many of these are mktg program & providing assistance. BPA mktg to designers & developers scheduled to begin 9/89. Utility mktg primarily mailings and personal contacts. Provide free design assistance including computer modeling & info services.
NEW	BPA	WA/OR	Energy Edge	$3,350	$7,650	$11,000			Nancy Benner	503-248-4636	Avg. savings of 29% compared to std bldg w/ same heating system. Common measures included high efficiency lighting, lighting controls, HVAC improvements, insulation & improved windows. Program includes post construction O&M audits and monitoring. Majority of the costs are due to the research nature of the project. Program paid full design & construction costs to increase efficiency above code levels. Key for success was a good working relationship w/ design team early in design process. Recommend greater construction & commissioning assistance & oversite as have had problems w/ a few bldgs. Participants were winners in design competition - many more people wanted to participate. Program promoted thru personal contacts w/ A&E's developers, mailings, & extensive press coverage. Provide free TA including computer modeling.
NEW	Con Ed	NY	C&I New Construction						John Spada	212-460-6549	Program includes rebates for high efficiency chillers & motors as well as storage cooling. Planning to add lighting efficiency improvements to program in 1989. One application in '88 for chillers. Promoting program thru personal contacts & trade publications. Believe interest in program is picking up.
NEW	Florida P&L	FL	Energy Systems Planning						David Derthick	305-227-4320	New program -- over 300 contacts thru early 1989, but too early for results. Promote thru mailings & personal contacts.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
NEW	NEES	MA/RI	Design 2000	Nearly anything that saves energy	Typically full measure & design cost	Full	4/89		4/89	10/89		22				1.44	2.08			3,798	0.04%	C
NEW	Nevada Pwr	NV	High Effic. Ltg.	Ltg intensity below bldg code	$100-200/kW saved	Full	1988		1988	7/89		5					0.11			1,740	0.01%	A
NEW	NU	CT/MA	Energy Conscious Construction	Nearly anything that saves energy	Incremental cost up to $.036/kWh, $ for design time	Full	7/86		1/89	12/89		130						2.96	Simul.	4,242		
NEW	Palo Alto	CA	New Construction Incentive	Exceed bldg code requirements	Generally $250/kW reduced	Full	1988		1988	7/89			10				0.82	0.07		182	0.45%	A

Pro-gram Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
NEW	NEES	MA/RI	Design 2000	$727			$350	D	Michael McAteer	508-366-9011	Program encourages improvements beyond conventional construction practice (typically bldg code requirements). Incentives designed to pay full-incremental cost of measures, up to utility avoided cost. $ for add'l design time also provided. Comprehensive TA includes computer modeling & assistance from lighting, HVAC and other experts. Precalculated incentives for ~100 measures. Customized and comprehensive incentives also available. Initial response from developers & A&E's has been enthusiastic. Promote via personal contacts w/ A&E's, developers, & owners. Also, seminars & trade journal ads.
NEW	Nevada Pwr	NV	High Effic. Ltg.	$13					Joanne Compton	702-367-5112	Target new retail & office bldgs. Promote program thru brochures & personal contacts. Leads developed from bldg permit & new start data. Requires a lot of footwork to mkt.
NEW	NU	CT/MA	Energy Conscious Construction			$1,660			Fred Wajcs	203-721-2711	Program began as a TA program. In 1988 49 customers received TA, but adoption of energy saving recommendations was limited. Incentives added 10/88 which are based on incremental costs of efficiency measures. Participation rate and savings have climbed sugstantially since then. Number of participants based on signed contracts -- only a few have been completed. Savings based on completed projects. Expenses include only actual expenses -- add'l $ have been committed. Promote via 1-on-1 contacts w/ designers & developers, design awards. Provide free computer simulation plus reimburse project A&E's for extra design time.
NEW	Palo Alto	CA	New Construction Incentive	$319			$390	D	Peter Govea	415-329-2695	Most participants are gut remodeling projects. Only 2 of 10 projects have been completed thru 7/31/89. Over 90% of rebates & kW savings for storage cooling. Program ending 10/31/89 as new generating plant coming on line. Promote thru personal contacts w/ A&E's, particularly when learn of project. Provide free plan review, some engineering assistance.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
NEW	PG&E	CA	New Construction Rebate	Early code compliance, lighting, storage cooling	Early code compliance: $.50/sf; lighting:$.04 -.30/sf	Pilot	4/85	6/86	1985	12/88		175								14,142		
NEW	Puget P&L	WA	Design Assistance	Nearly anything that saves energy	Free design assistance	Full	9/88		9/88	7/89		~35								3,528		
NEW	Snohomish	WA	New Comm'l Construction	Nearly anything that saves energy	Free design assistance	Full	9/88		9/88	12/88	865	22		2.5%	C					1,156		
NEW	So. Cal. Ed	CA	Energy Excellence	Daylighting, efficient HVAC, EMS, envelope measures	Rebates - vary by measure	Full	1987		1/87	12/88			641				15.50	20.78		14,775	0.10%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
NEW	PG&E	CA	New Construction Rebate	$2,621					Diane Calden	415-973-8575	Objective of program was to promote early compliance with California's commercial building standards which took effect in 1987. Program included 3 components: early code compliance in offices, lighting improvements in non-offices, and storage cooling. Promoted via mailings and technical seminars targeted at developers and design professionals. Staff turnover during program resulted in poor tracking of projects, hence no savings estimates were made. Had problems w/ equipment & design changes, making field checks difficult and savings hard to determine. Recommend mkt research on new construction mkt in local area, major training program for utility staff and A&Es, reimbursing designers for extra design time, and carefully reviewing and inspecting each project.
NEW	Puget P&L	WA	Design Assistance						Sid France	206-462-3742	Program tough to mkt because don't provide financial incentives. On a pilot basis they are offering 50-80% grants to 25 bldgs, using same formulas as for their retrofit program. Incentives based on incremental cost of measures used to exceed state bldg code. Based on experience w/this pilot, they may make incentives a regular part of program. Market program thru personal contacts w/ design professionals, seminars, direct mail. Free computer analyses provided.
NEW	Snohomish	WA	New Comm'l Construction						Don Pendleton	206-347-1703	Promote program via brochure mailed to A&E's & bldg owners. Personal contacts begun in '89. Provide free computer analyses, help w/ codes & commissioning.
NEW	So. Cal. Ed	CA	Energy Excellence	$2,864			$185	D	Bob Murphy	818-302-1958	Program promotes measures which exceed state bldg code requirements. Participation high in 1987, lower than expected in 1988 due to customer financing difficulties & delay in design competition. Expect to pick up in '89. Design competition began late 1988. Market thru seminars, literature, personal contacts w/ bldg professionals & developers, design competition.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
NEW	So. Cal. Ed	CA	Daylighting	Daylighting	$50/kWh plus $.04/1st yr kWh saved	Full	1983		1983	12/86			218				9.60	19.19		14,775	0.06%	A
NEW	Texas Util.	TX	New Non-Residential Structure & Equipment	High-efficiency heat pumps <10 tons	$300/unit to builder or owner	Full	1981		1981	1988			1,670			2.14				16,680	0.01%	C
NEW	TVA	TN+	C&I New Construction	Nearly anything that saves energy	Free computer analysis	Full	~1980		10/84	9/86		162					3.90	7.40		19,772	0.00%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
NEW	So. Cal. Ed	CA	Daylighting			$1,660	$173	D	Bob Murphy	818-302-1958	Program promotes daylighting thru seminars, workbooks, design assistance, and incentives for feasibility studies and daylighting system installation. In 1987 program merged into new construction program. Participation and savings figures include project under contract but not completed. Promoted via personal contacts w/ A&E's, developers, & customers; brochures, seminars.
NEW	Texas Util.	TX	New Non-Residential Structure & Equipment						C.C. Benson	214-954-5647	Incentives for efficient equipment. To receive equipment incentive, equipment must meet efficiency minimums & structure, in opinion of field rep, must be at least moderately efficient. In previous yrs, incentives for central a/c also offered. Marketed via personal contacts w/ builders, developers, trade allies, & bldg owners.
NEW	TVA	TN+	C&I New Construction			$3,101	$796	T	Jim West	615-751-5103	Program provides free comprehensive computer analysis on design options. TVA engineers do analyses working closely w/ project A&Es. Seminars and workbooks also provided. In 1986 added awards to provide recognition to participating projects. On avg, TVA analyses id'd potential savings (compared to plans submitted to TVA) of 54%. An avg of 41% of TVA recommendations were adopted. Since program inception 430 bldgs received technical assistance at a total cost of $7.3 million. In late '86 program was cutback (as part of overall cutbacks) to provide limited design assistance for selected end uses that could help build load. Promote via direct mail, seminars, awards, personal contacts w/ design professionals.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
NEW	WA En. Off.	WA	Design Assistance	Nearly anything that saves energy	Free design assistance	Pilot	11/86	6/89	11/86	6/89			~40									
NEW	Wisc. Elec.	WI	Smart Money-New Construction	Nearly anything that saves energy	Rebates - vary by measure	Full	1/88		1/88	3/89			1,234				8.13	31.85		3,810	0.21%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
NEW	WA En. Off.	WA	Design Assistance						Doug Kilpatrick	206-586-5027	Provide free computer modeling & identification of energy saving opportunites. Avg. of 4.3 measures recommended per bldg. According to a survey of participants, 46% of meas. will be installed. Most common measures are HVAC & lighting improvments. Much of the TA provided by private consultants. Fitting into construction schedule critical. In 1988-89, ~20-25 add'l projects received services. Marketed thru mailings, personal contacts w/ A&E's, developers. Program ended due to start of BPA Energy Smart program which provides similar services.
NEW	Wisc. Elec.	WI	Smart Money-New Construction	$2,093			$257	D	Dan Thomas	414-221-3189	Program provides rebates for measures and additional design time. Specific rebates available for lighting, HVAC and other measures. Custom rebates also available. Engineering firm on retainer reviews applications and provides technical assistance. KWh savings break down as follows: 68% ltg, 6% HVAC, 12% process, 13% customized, 1% other. An add'l 500 projects have been approved but are yet to be completed. New mktg mat'ls in '89 for small C&I customers. Architects & designers complain about too much paperwork; as a result, procedures simplified in '89. Promote program thru mailings, trade allies, meetings w/ design professionals & developers.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MISC	CMP	ME	Comm'l Water Heater Insulation	Water heater wrap	Free kit or $5 for install	Full	1985		1985	12/88	21,900		2,374	10.8%	P	0.24		1.14		1,455	0.02%	C
MISC	Florida P&L	FL	Heat Pump Water Heating	Heat pump water heaters	Utility financing available	Full	1987		1988	3/89	324,915	556		0.2%	C			5.71		12,394		
MISC	Iowa El L&P	IO	Comm'l Refrigeration Replacement	High efficiency refrigeratn equipment	Low-interest loan	Pilot	12/85	5/86	12/85	5/86	25,000	5		0.0%	C					978		
MISC	Met-Ed/GPU	PA	Electric Thermal Storage	Electric thermal storage-heating & cooling	$100-250/kW shift + study	Full	1/88		1/88	12/88			1			0.04		0.00		1,673	0.00%	C
MISC	Met-Ed/GPU	PA	Heat Pump Water Heater	Heat pump water heaters	$100/kW +50% of study	Full	1/88		1/88	12/88	43,959	2		0.0%	C		0.06	0.20		1,673	0.00%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MISC	CMP	ME	Comm'l Water Heater Insulation			$147	$620	T	Linda Ecker	207-623-3521	Promote via direct mail, newsletter, telemarketing, TV, & personal contacts.
MISC	Florida P&L	FL	Heat Pump Water Heating						David Derthick	305-227-4320	Mostly medium & large customers have participated. Recommend using good engineers & good equipment to avoid problems. Heat pump distributors have heavily mktd the program. No one has used utility financing yet, all use internal funds or regular line-of-credit. Promote thru mailings, personal contacts & trade allies. Provide free techinical & economic analysis.
MISC	Iowa El L&P	IO	Comm'l Refrigeration Replacement			$33			Robert Holmes	319-398-4411	Utility was ordered to conduct program & was not very enthusiastic about it. Had troubles with engineering consultant who was hired to help implement program. 40 customers reponded to direct mail soliciation which resulted in 7 approved loan applications & 5 installations completed by the program cut-off date.
MISC	Met-Ed/GPU	PA	Electric Thermal Storage			$9	$250	T	Ronald Weitz	215-921-6252	Primarily a valley-filling program -- data collection emphasizes off-pk load added, not on-pk load saved. Maximum incentive $40,000/system plus $1000-5000 for feasibility study. Marketed thru field reps & mailings.
MISC	Met-Ed/GPU	PA	Heat Pump Water Heater			$8	$126	T	Ronald Weitz	215-921-6252	Primarily a valley-filling program -- data collection emphasizes off-peak load added, not on-peak load saved. Maximum incentive $4000/customer plus $250 for feasibility study (up to 50%). Promoted thru field reps & mailings.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants: Customers	Number of Participants: Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings: Coincident MW	Estimated Savings: Absolute MW	GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MISC	NYSEG	NY	Commercial Electric Thermal Storage	Electric thermal storage	$100/kW, TOU rates	Full	1/88		1/88	9/88	67,233	48		0.1%	C		5.22			2,540	0.21%	A
MISC	Palo Alto	CA	Partners Electric Incentive	Windows, refrigeration	Varies by measure & yr	Full	1985		1985	7/89	2,409		66	2.7%	P		0.63	0.57		182	0.35%	A
MISC	PG&E	CA	Refrigeration Strip Curtain/Glass Door	Glass doors & strip curtains	$5/linear ft for curtain, $25/ft for doors	Full	6/83	12/83	6/83	12/83	~500,000		510	0.1%	P			18.00		14,142		
MISC	PG&E	CA	Agricultural Energy Mgmnt	Pump test, audits	Free pump test, analyses	Full	1923		1/83	12/85	~30,000		24,126	80.4%	P		23.22	86.01		14,142	0.16%	A
MISC	Puget P&L	WA	Comm'l Conservation Financing	Nearly anything that saves energy	0% loan or 50-80% grant	Full	1/80		1980	12/88	69,236		620	0.9%	P			20.68		3,528		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MISC	NYSEG	NY	Commercial Electric Thermal Storage	$425			$81	D	Ron Foster	607-729-2551	During research program & pilot promotion programs from 1985-87, an add'l 36 systems were installed. Trying to build up to full-scale program by 1992. Program includes seminars & educational materials for architects, engineers, trade allies & utility reps. Utility reps & trade allies earn points towards gifts for each system sold. Customers generally happy w/ systems. 63% of participants said utility incentive the major reason they chose ETS. Most systems installed in new construction and additions. Promote thru mail, seminars, personal contacts & awards for utility reps & trade allies.
MISC	Palo Alto	CA	Partners Electric Incentive	$100			$158	T	Jane Siguenza	415-329-2695	Part of comprehensive multiple end-use program. Only one refrigeration rebate has been issued. Most of misc. savings & costs due to window films & screens. Promoted thru personal contacts w/ large customers, mailings to all customers.
MISC	PG&E	CA	Refrigeration Strip Curtain/Glass Door	$280					Diane Calden	415-973-8575	Program was combined w/ other programs into a multiple end-use rebate program in 1984. Promoted thru mailings, trade allies & personal contacts.
MISC	PG&E	CA	Agricultural Energy Mgmnt			$5,571	$240	T	Diane Calden	415-973-8575	Provide free pump tests. Since '83 also provide irrigation system survey, pumping system analysis and agricultural facility survey (full energy audit) for larger customers. In 1986 & 1987, an add'l 15,379 customers were served. Many customers receive pump tests on a regular basis. Promote thru mailings, trade allies, & personal contacts.
MISC	Puget P&L	WA	Comm'l Conservation Financing	$4,433	$1,219	$5,652			Sid France	206-462-3742	Part of comprehensive multiple end-use program. Savings & costs listed here for refrigeration, glass, heat recovery and insulation. Refrigeration measures have only been actively promoted since 1986. Program includes audit, TA and incentives. Promoted thru word-of-mouth.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MISC	Seattle C.L	WA	Comm'l Tank Wrap	Tank wraps	Free wraps	Pilot	1982	1983	1982	1983		997						0.50		1,725		
MISC	So. Cal. Ed	CA	Ag. & Water Pump Test	Pump tests and modific-ations	Free pump test, rebate for modifications	Full	1911		1/80	12/87	26,630			~12%/yr				252.17		14,775		
MISC	So. Cal. Ed	CA	Hardware Rebate	Subcooling, controls, doors	Rebates-vary by measure & yr	Full	1978		1/82	12/84	393,754						9.33	48.35		14,775	0.06%	A
MISC	So. Cal. Ed	CA	Hardware Rebate	Multiple	Rebates-vary by measure & yr	Full	1978		1/82	12/84	393,754						12.12	107.94		14,775	0.08%	A
MISC	Texas Util.	TX	Electric Water Heating Assist	Solar, heat pump & heat recovery units	Customer: $50/unit; dealer: $30/unit	Full	1981		1981	1988	242,647		<120	0.0%	P					16,680		
MISC	Wisc. Elec.	WI	Smart Money	Nearly anything that saves energy	Rebates - vary by measure	Full	6/87		6/87	3/89	81,750		2,080	2.5%	P		3.02	27.92		3,810	0.08%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MISC	Seattle C.L	WA	Comm'l Tank Wrap			$65			Brian Coates	206-684-3729	Pilot program sponsored by BPA whose goal was to wrap 1000 water heaters. Program not continued due to BPA power surplus & budget cutbacks.
MISC	So. Cal. Ed	CA	Ag. & Water Pump Test			$8,616			Bob Murphy	818-302-1958	Program for fresh water pumping -includes pump test and rebate for add'l modifications. In some yrs, free adjustments were provided. ~15% of participating customers made modifications. Similar services are available for C&I pumps thru the Energy Mgmnt Survey Program. Market via direct mail & personal contacts.
MISC	So. Cal. Ed	CA	Hardware Rebate	$1,013			$109	D	Bob Murphy	818-302-1958	Part of comprehensive multiple end-use program. Breakdowns by end use not available after 1984. Refrigeration accounted for 9% of savings from rebates during 1982-84 period.
MISC	So. Cal. Ed	CA	Hardware Rebate	$2,181			$180	D	Bob Murphy	818-302-1958	Part of comprehensive multiple end-use program. Misc. measures included water htg, pumping & bldg shell measures. Breakdowns by end use not available after 1984. Misc. measures accounted for 19% of savings from rebates during 1982-84 period.
MISC	Texas Util.	TX	Electric Water Heating Assist						C.C. Benson	214-954-5647	Program offered to residential & non-residential customers. Non-residential <5% of participants -- exact figures are not readily available. Marketed via personal contacts w/ trade allies and point of sale brochures.
MISC	Wisc. Elec.	WI	Smart Money	$2,236			$742	D	Dan Thomas	414-221-3189	Part of commprehensive multiple end-use program. Costs & savings included here are for water heating, refrigeration, farm and custom load management measures. Farm measures account for majority of projects, refrigeration measures for majority of savings.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants: Customers	Number of Participants: Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings: Coincident MW	Estimated Savings: Absolute MW	Estimated Savings: GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MULT	Atlantic El.	NJ	Energy-Efficiency Cash Rebates	Measures recommended in audit	20% rebate up to $5000	Full	9/86		9/86	12/88	1,827	72		3.9%	C					1,609		
MULT	Austin	TX	Commercial Energy Mgmnt	Lighting, a/c, motors, refrig-eration, bldg envelope	Rebates - vary by measure	Full	10/87		10/87	9/88	26,609	182	412	0.7%	C	4.09		10.06		1,391	0.29%	C
MULT	Austin	TX	Commercial Energy Mgmnt	Lighting, a/c, motors, roof & window treatments	Rebates - vary by measure	Pilot	10/86	9/87	10/86	9/87	~5,000	120	247	2.4%	C	1.90		5.08		1,391	0.14%	C
MULT	BECo	MA	Design Plus	Nearly anything that saves energy	50% of cost up to a cap	Pilot	7/87		7/87	7/89	10	7		70.0%	C	4.66		0.03		2,477	0.19%	C

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MULT	Atlantic El.	NJ	Energy-Efficiency Cash Rebates			$92			Edmond Ragazzi	609-965-0155	Program available to small C&I customers who have received CACS audits. Over 90% of participants were in 1988. Increased participation in '88 due to increased personal mktg & packaging of these rebates w/ lighting rebates. Customers resistant to making capital expenditures.
MULT	Austin	TX	Commercial Energy Mgmnt	$1,146			$280	D	Brian Clement	512-441-9240	Mktg expanded to include customers < 20kW. 75% of savings due to lighting measures, 15% to chillers (high chiller participation due to $150/ton rebate, since lowered to $60/ton). For 8.5 mo. in FY '89, ~200 applications: $520,879 paid for 1362 kW of savings. Program operating costs were 48% of direct rebate costs in 1988, 62% in '87, 133% in '86 (start-up period). Provide free walk-thru audit. Promoted thru direct mail, trade allies, & presentations to associations.
MULT	Austin	TX	Commercial Energy Mgmnt	$504			$265	D	Brian Clement	512-441-9240	From 1984-86 lighting & comm'l incentives offered - saved ~3 MW & ~ 8 GWh. Of 86-87 kWh savings: 79% lighting, 9% HVAC, 13% envelope. Free walk-thru audit provided. Marketed via direct mail, trade allies, & presentations to associations.
MULT	BECo	MA	Design Plus			$5,592	$1,200	T	Mark Barry	617-424-3531	Program available to very largest customers. Construction work taking place in '89. Savings range from 13-50% - weighted avg of 22-23%. All customers who were approached agreed to participate, 3 drop-outs due to moving and a take-over fight. ~2 yrs to do a project. Costs break down as follows: 5% audit, 8% plans & specs, 3.5% construction mgmnt., 76.5% construction, 7% utility administration. Just starting to work w/ 2nd round of customers. Will target bldgs being renovated. Customer satisfaction very high. Promoted via CEO to CEO letter, & personal contacts. Intensive engineering audit and design services provided at no charge to customer.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MULT	BECo	MA	Encore	Nearly anything that saves energy	Up to avoided cost	Pilot	11/86	12/88	11/86	12/88	162	24		14.8%	C		3.50	12.00		2,477	0.14%	A
MULT	BECo	MA	Encore	Nearly anything that saves energy	Up to avoided cost	Full	9/88		9/88	12/89	2,400	48		2.0%	C		4.00			2,477	0.16%	A
MULT	BPA	WA/OR	Purchase of Energy Savings Field Test	Measures recommended in audit	Up to $.04/kWh of lifetime savings	Pilot	11/83	1986	11/83	11/86		5						8.93		16,680	0.00%	A
MULT	BPA	WA/OR	Institutional Buildings	Measures recommended in audit	Up to $.292/1st yr kwh	Pilot	10/82	10/87	10/82	9/87	34,852	633		1.8%	C		24.00	126.55		16,680	0.14%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MULT	BECo	MA	Encore	$5,700	$246	$5,946	$1,699	T	Steve Murphy	617-424-2498	Pilot program served small & large customers. Program promoted thru ESCOs who provide audits & financing and arrange measure installation. Had 4 active ESCOs. Program pays avoided costs (~$.033/kWh in '88) for measured lifetime kWh savings. Payments made over life of measures. Participation rate among >150 kW customers ~25%. ESCOs primarily interested in customers w/ demand >500 kW, no interest in customers w/ demand <150 kW. Incentive costs reported are discounted for inflation at 5%. Estimate avg. savings are 15% of pre-program kWh & kW use. Lighting measures most common - usually done at no cost to customer.
MULT	BECo	MA	Encore						Steve Murphy	617-424-2498	Full scale program for C&I customers >150 kW. Currently there are 13 ESCOs who provide the energy audits, up-front financing, installation and on-going savings verification. Customers can participate w/o an ESCO. Data given is for signed contracts. Not all of these projects have been completed. In addition ~400 projects are pending.
MULT	BPA	WA/OR	Purchase of Energy Savings Field Test	$924					Claire Hobson	206-442-4953	Private energy mgmnt. co's were selected thru an RFP to deliver program. Energy mgmnt. co's solicited bldg owners as part of RFP process. Co's made 29 proposals, did 14 audits, & receive $.04/kWh saved over a 5-12 yr period, up to the measure cost. Savings either estimated or measured. Comprehensive audit required. ESCO provides audit, installation & financing.
MULT	BPA	WA/OR	Institutional Buildings			$25,600	$1,067	T	Andy Ekman	503-230-5869	Program complements DOE schools & hospitals program. BPA includes add'l facility types. Program includes audits & financing. Impact evaluation on a sample of institutions found avg savings of 13% but that actual savings avgd ~60% of predicted savings. Poor predictions of savings are likely cause. Program promoted by state energy offices.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MULT	BPA	WA/OR	Comm'l Incentives Pilot	Measures recommended in audit	Rebate for small customers, $/kWh for large	Pilot	1985		1985	12/89			162 lg. 373 sm.					25.79		16,680		
MULT	BPA	WA/OR	Purchase of Energy Savings	Measures recommended in audit	Negotiated- up to avoided cost	Pilot	5/85	3/87	5/85	7/89		15	40 bldgs					7.75		16,680	0.00%	A
MULT	Cen. Hudson	NY	Interim Rebate	Anything in audit	60% of costs	Pilot	11/87	1/88	11/87	1/88	50 w/audit	6	6	12.0%	C					824		
MULT	Cen. Hudson	NY	Dollar Saver's	Ltg, motors, custom measures	Rebates - vary by measure	Pilot	5/88		5/88	12/88	27,904	14	16	0.0%	C		0.15	0.34		824	0.02%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MULT	BPA	WA/OR	Comm'l Incentives Pilot	$5,212	$1,591	$6,803			Jim Dowty	503-230-5873	For customers w/ <150 MWh/yr, rebate provided for ~65% of measure cost or for all costs beyond a 2 yr payback. For larger customers. BPA pays all costs beyond a 2.5 yr payback. Audit required. Large customers must implement all cost-effective measures. 2.5 yr paybk an obstacle until customer realizes that utility typically paying 60-80% of measure cost. Originally payment spread over 5 yrs; as of '88, payments up-front. Program requires a lot of work by customer & handholding by utility. 63% of $ for lighting. 89% of audit recommendations implemented in large bldgs. Avg. large customer uses 738 MWh/yr. Avg. savings for large customer is 12% of pre-program electricity use. Promoted by local utilities via newsletters, bill inserts, personal contacts.
MULT	BPA	WA/OR	Purchase of Energy Savings	$2,170	$640	$2,810			Claire Hobson	206-442-4953	12 private energy mgmnt. co's (out of 850 RFP's mailed) selected to provide audit & installation. Half of these co's dropped out when program cut from 3 yr to 1. Energy mgmnt co's solicited customers: message was capital improvements at low cost. Incentives negotiated up to $.052/kWh for life of measure. Installation of all cost-effective measures required. High incentive led to closing to proposal ratio of 40-90% (varied by contractor). 98% of audit id'd energy savings are actually installed in 1st 21 bldgs completed. In these bldgs, avg savings ~18% of pre-program energy use. 73% of savings for lighting measures.
MULT	Cen. Hudson	NY	Interim Rebate	$7	$2	$9			Frank Congedo	914-486-5655	Short-term pilot program. Marketed thru phone calls, & mailing.
MULT	Cen. Hudson	NY	Dollar Saver's	$22	$4	$27	$183	T	Frank Congedo	914-486-5655	Program in start-up mode. 85% of applications for lighting measures. Surveys show free riders account for 30-60% of savings. Promoted thru bill messages, visits to dealers and large customers.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants: Customers	Number of Participants: Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings: Coincident MW	Estimated Savings: Absolute MW	Estimated Savings: GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MULT	CMP	ME	C&I Energy Mgmnt. Loan	Nearly anything that saves energy	3% loan up to $150,000	Full	1984		1984	12/88	43,686	25	27	0.1%	C			1.96		1,455		
MULT	CMP	ME	Power Partners	Nearly anything that saves energy	Bid process	Pilot	1987		1987	10/89							17.10	91.39		1,455	1.18%	A
MULT	CMP	ME	Shared Savings	Nearly anything that saves energy	Up to 100% financing	Pilot	9/86		9/86	10/89	45	1		2.2%	C	5.50		12.10		1,455	0.38%	C
MULT	CMP	ME	Efficiency Buy-Back	Nearly anything that saves energy	Up to 50%	Pilot	12/86		12/86	6/89	255	6		2.4%	C	5.10		26.03		1,455	0.35%	C
MULT	Comm Ed	IL	Small C&I Audit/Loan	Measures recommended in audit	Loans @65% of prime+2%	Pilot	2/88		2/88	1988	1,500	19		1.3%	C					15,683		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MULT	CMP	ME	C&I Energy Mgmnt. Loan						Linda Ecker	207-623-3521	Loans provided thru comm'l banks. Direct costs ~$.01/kWh saved. Promoted thru newsletter, mailings, & personal contacts.
MULT	CMP	ME	Power Partners						Jonathan Linn	207-623-3521	Customers & ESCOs submit bids up to avoided costs. 13 bids received for 34.5 Mw, 140 GWh. 6 contracts signed; many for multiple customers (including residential). Of 6 contracts, 2 industrial lighting, 1 industrial process, 2 C&I performance contracting, 1 res. performance contracting. 2nd RFP issued 4/89.
MULT	CMP	ME	Shared Savings	$650			$118	D	Jonathan Linn	207-623-3521	Available to 45 of their 300 largest customers. Project must save at least 500 MWh/yr. Utility must recoup investment from savings in no more than 5 yrs. Appeals to customers who lack financing. Promoted thru newsletter, mailings, & personal contacts.
MULT	CMP	ME	Efficiency Buy-Back						Jonathan Linn	207-623-3521	Customer proposes project and requests subsidy -- up to 50%. Project must have a payback of 2 yrs or more & save at least 500 MWh. 1 more contract in negotiation stage. Most projects industrial, many involve motors. Direct costs ~$.02/kWh saved.
MULT	Comm Ed	IL	Small C&I Audit/Loan			$50			Laura Skup	312-917-6634	Audits provided for $50 to customers w/demand <200 kW. Loans for $5-50K provided by participating local banks. In Chicago a non-profit organization facilitates loan packaging. Audit firm will assist w/ specifications & bids as needed. Future mailings will target add'l customers. Participation #'s for audits; no loans thusfar. Marketed via direct mail. Audit required.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Custo-mers	Number of Participants Proj-ects	Cumm. Partici-pation Rate	Custo-mers or Proj-ects?	Estimated Savings Coin-cident MW	Estimated Savings Abso-lute MW	Estimated Savings GWh	Adjust-ments	1987 Peak Demand	Svgs as % of Pk	Coin-cident or Abso-lute
MULT	Comm. Elec.	MA	Energy Efficiency Rebate	Nearly anything that saves energy	Rebate based on avoided cost	Pilot	3/87		3/87	8/88	37,247	50	59	0.1%	C	6.34		25.00		873	0.73%	C
MULT	Con Ed	NY	Incentives for C&I Retrofit	Lighting, motors, HVAC, customer designed measures	Rebates - vary w/ measure	Pilot	9/87		9/87	12/88		24				1.19				9,386	0.01%	C
MULT	Con Ed	NY	Selected Network	Lighting, motors, HVAC, customer designed measures	Rebates - vary w/ measure	Pilot	4/87		4/87	12/88	~2,700		49	1.8%	P	1.10				9,386	0.01%	C
MULT	Detroit Ed	MI	Business Energy Efficiency Finance	Measures id'd in audit w/ <5 yr payback	0% financing	Pilot	3/87	9/88	3/87	9/88	353	11		3.1%	C					8,427		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MULT	Comm. Elec.	MA	Energy Efficiency Rebate	$5,887	~$150	~$6,036	$952	T	Robert Laurita	508-291-0950	Involvement of ESCo or contractor required. Project can be either shared savings (ESCo is paid thru savings) or guaranteed savings (customer pays for measure, but contractor guarantees savings). 90% of jobs are guaranteed savings. Rebate often covers full measure cost. Projects cover ~200 bldgs. Rebate spread over 2 yrs (50% of avoided cost) - 7 yrs (80% of avoided cost). 3/4 of customers chose 2 yr. term. 90% of projects are for single measures. Many measures short payback. Lighting & EMS most common. As of 7/20/89 ~200 projects w/ incentives of ~$10 million committed. Promote via direct mail, personal contacts. Contractors & ESCOs primary mktg mechanism.
MULT	Con Ed	NY	Incentives for C&I Retrofit	$326			$274	D	John Spada	212-460-6549	Program available to customers in Brooklyn & Westchester w/ demand >100 kW. An add'l 4.3 MW are committed & a further 4 MW of applications are pending. A total of 182 applications are active totaling $2.2 million. In 1989 plan to extend HVAC, motor & ballast incentives system-wide.
MULT	Con Ed	NY	Selected Network	$331			$300	D	John Spada	212-460-6549	Program designed to defer T&D upgrade in targeted area. Applications have been received for add'l rebates amounting to over $700,000 for over 2.5 MW of svgs. Program has emphasized personal mktg w/ lg customers. Difficult to get lg landlords who pass on electricity costs to tenants to participate.
MULT	Detroit Ed	MI	Business Energy Efficiency Finance	$42	~$50	~$92			Marsden Murphy	313-237-8000	Program limited to small C&I customers who had previously received audit. Got little response due to customer preference for grants instead of loans, significant amt of paperwork involved, & program restrictions. Only lighting measures were installed by customers. Direct costs listed are for loans which will be repaid by customers.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants: Customers	Number of Participants: Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings: Coincident MW	Estimated Savings: Absolute MW	Estimated Savings: GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MULT	Jersey Cen.	NJ	Comm'l Conservation Incentive Rebate	12 different measures	50% up to $5000	Full	1986		1986	12/88	~85,000		196	0.2%	P					3,766		
MULT	LILCO	NY	Dollars and Sense	Lighting, HVAC, storage cooling, thermal a/c	Rebates - vary by measure	Full	10/86		10/86	9/88	95,871		857	0.9%	P	9.68		56.94	FR,T&D	3,576	0.27%	C
MULT	Met-Ed/GPU	PA	Custom	Load shift & valley filling measures	50% of study & project cost	Pilot	1/88		1/88	12/88	43,959									1,673		
MULT	NEES	MA/RI	Lg C&I Custom Programs	Nearly anything that saves energy	$500 per baseload kW saved	Full	4/88		4/88	12/88	1,890	308		16.3%	C	3.10				3,798	0.08%	C

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MULT	Jersey Cen.	NJ	Comm'l Conservation Incentive Rebate						Robert Jensen	201-455-8325	Only small and medium-sized customers eligible. Oriented towards customers receiving CACS audits. Marketed via direct mail, & customer contacts.
MULT	LILCO	NY	Dollars and Sense	$1,718	$366	$2,084	$215	T	Fred Avril	516-364-7707	A total of 750 customers participated in the first 9 months of 1988 (0.8% of eligible customers). Pre-approval and post-inspection required for rebates above $1000. Approx. 85% of activity in lighting. Adding motors and window film in 1989. Promote via direct mail, trade allies, Energy Hotline, personal contacts, & audit referrals.
MULT	Met-Ed/GPU	PA	Custom						Ronald Weitz	215-921-6252	Primarily a valley-filling program -- measures must add off-peak load or shift load from peak to off-peak. Maximum incentive $25,000/customer plus $5000 for feasibility study. Promoted thru field reps, & mailings.
MULT	NEES	MA/RI	Lg C&I Custom Programs			$1,640	$529	T	Liz Hicks	508-366-9011	Program primarily available to customers w/ peak demand of 100-500 kW. An add'l 7020 kW was under contract as of 12/31/88. Majority of savings for lighting measures. Approx 30% of measures would have been implemented w/o program. Promoted thru mailings & personal contacts, optional energy audit available. In mid-1989 program replaced w/ a new program which expands list of measures, simplifies application procedures, & generally increases rebates for non-lighting measures. New rebates generally based on avg measure cost or utility avoided costs (whichever is less).

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MULT	NEES	MA	Lg C&I Performance Contracting	Nearly anything that saves energy	~$728 per baseload kW saved	Full	7/87		7/87	12/88	563	63		11.2%	C	0.94				3,798	0.02%	C
MULT	NEES	MA	Enterprise Zone - Lg C&I	Nearly anything that saves energy	Up to $.07/kWh for 10 yrs	Pilot	8/85	5/87	8/85	5/87	113	8		7.1%	C	6.60	6.60	50.00	FR	2,502	0.26%	C
MULT	NU	CT	Shared Savings	Nearly anything that saves energy	Avoided cost paid to ESCO	Pilot	1986	12/87												3,865		
MULT	NU	CT/MA	Customer Initiated	Nearly anything that saves energy	Cut payback to 3 yr, up to 50% of measure cost	Full	4/89		4/89	12/89	2,478	5	5	0.2%	C		0.02	1.32		4,242	0.00%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MULT	NEES	MA	Lg C&I Performance Contracting			$1,159	$1,227	T	Liz Hicks	508-366-9011	Program available to customers w/ peak demand >500kW. Incentive paid to ESCOs who bid to participate in program. An add'l 2909 kW was under contract as of 12/31/88. Program started very slowly, but in final months of 1988 participation increased significantly. Much of the participation is for lighting measures which ESCOs provide at no cost to customers. Approx. 34% of measures would have been implemented w/o program. ESCOs market program thru personal contacts w/ help from utility reps. Energy service co's provide detailed engineering analyses if customer commits to pay for study or to implement recommendations.
MULT	NEES	MA	Enterprise Zone - Lg C&I	~$17,650	~$350	~$18,000	$2,727	T	Betty Mystakides	508-366-9011	Program available to customers w/ peak demand >100kW. Free audits provided to 85% of eligible customers. ESCOs submitted bids for 23% of eligible customers. Avg. savings of 36%. Approx. 90% of savings due to cogeneration systems. Multiple energy service co's submitted proposals to each customer who selected one ESCO to work with. ESCO's primarily interested in schools & hospitals or customers using at least 200,000 kWh/yr. Avg. savings of 36%. Program promoted thru personal contacts by ESCO's and utility staff.
MULT	NU	CT	Shared Savings						Jan Sayko	203-721-2721	Program replaced by Energy Action. For shared savings program 25 public facilities were recruited & received technical audits paid for by NU. At end of program, 3 contracts signed w/ ESCOs, 3 were negotiating contracts, 10 had pending federal and state grant requests, & 9 were preparing grant requests. Projects w/o contracts were moved into Energy Action program. ESCOs marketed w/ assistance from utility reps. ESCOs provided audits and TA.
MULT	NU	CT/MA	Customer Initiated			$30	$1,714	T	Jan Sayko	203-721-2721	Similar to Energy Action but for customers w/ in-house engineering expertise. Promoted thru referrals from customer service reps. Savings and expenses for one completed project. Remaining projects in-process.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MULT	NU	MA	Performance Contracting	Nearly anything that saves energy	Avoided cost paid to ESCO	Pilot	2/86	12/87	2/86	12/87	179	3		1.7%	C			3.10		700		
MULT	NU	CT/MA	Energy Action	Nearly anything that saves energy	Up to 50%; cut payback to 3 yr	Full	1/88		1/88	12/89	2,478	150		6.1%	C		22.00			4,242	0.52%	A
MULT	Palo Alto	CA	Partners Electric Incentive	Many	Rebates - vary by measure & yr	Full	1985		1985	7/89	2,409		387	16.1%	P		5.90	22.28		182	3.24%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MULT	NU	MA	Performance Contracting	$448					Don Cameron	413-	ESCOs selected thru a bidding process. Each successful ESCO assigned an exclusive territory. "Cream-skimming" a major problem -- ESCo's focus on biggest customers & easiest savings. Payments up to $.0477/kWh for up to 7 yrs. Most of savings from 1 large hospital -- installation not complete as of 6/89. ESCOs marketed w/ assistance from utility reps. ESCOs provided audits and TA.
MULT	NU	CT/MA	Energy Action			$3,139	$143	T	Jan Sayko	203-721-2721	Marketed primarily to medium & large customers. Avg. 11.3% kWh savings. Expanded program system-wide in 1989. Under program, contractor/arrangers provide conservation assessments, audits & installation assistance. Customers pay 1/2 audit costs (reimbursed if implement recommendations) and cost of measures up to a 3 yr payback. Quality assurance contractor reviews audit & installation. Free riders estimated to be 30%. Savings figures reflect completed projects only, expense figures reflect actual expenditures and do not include committed future costs. Participation figures include projects in-process. Promoted thru referrals from customer service reps.
MULT	Palo Alto	CA	Partners Electric Incentive	$1,432	~$790	~$2,220	$376	T	Jane Siguenza	415-329-2695	Over 90% of projects done in first three yrs of program. In 1988 program made more complex & participation plummeted. In 1989 program simplified but participation remained low due to limited mktg & saturation of mkt. Lighting measures account for ~1/2 kWh savings, process measures for ~1/3. 76% of projects are w/ customers w/ demand >200 kW. Program ending 10/31/89 due to new generating unit coming on-line. Final evaluation of program planned for 1990. Marketed thru personal contacts w/ large customers, & mailings to all customers.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MULT	PG&E	CA	Small Comm'l Direct Rebate	Many - varies by year	Rebates-vary by yr & measure	Full	1983		1983	12/84	~475,000		16,847	3.5%	P			46.96		14,142		
MULT	PG&E	CA	Direct Rebate	Many - varies by year	Rebates-vary by yr & measure	Full	1983		1/85	12/86	511,322		17,282	3.4%	P			145.92		14,142		
MULT	PG&E	CA	Customized Rebates	Many - varies by year	Rebates-vary by yr & measure	Full	1983		1983	12/86	511,322		14,810	2.9%	P			1025.8		14,142		
MULT	PG&E	CA	Direct & Customized Rebate	Many - varies by year	Rebates-vary by yr & measure	Full	1983		1/87	12/88	511,322						16.20	93.70	FR	14,142	0.11%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MULT	PG&E	CA	Small Comm'l Direct Rebate	$9,269					Diane Calden	415-973-8575	Customers using <100,000 kWh/yr eligible. In 1985 program was combined w/ rebates to larger customers. In 1983, over half the rebates went to reflective roof coating. Approx. 1/4 of '83 and 1/2 of '84 savings due to lighting measures. In 1983, 63% of participants were free riders but 70% of the free riders speeded up their purchase decisions as a result of the program. Market program thru mailings, trade allies, & personal contacts w/ all customers over a 5 yr period. Free audits provided.
MULT	PG&E	CA	Direct Rebate	$9,429					Diane Calden	415-973-8575	Program began in 1983 but was expanded to include all C&I customers in 1985. Majority of applicants are small customers. ~1/2 savings from lighting measures. From inception to 1986, total participation rate ~7% including ~25-40% for customers w/ peak demands in excess of 50kW. Program promoted thru mailings, trade allies, and personal contacts w/ all customers over a 5 yr period.
MULT	PG&E	CA	Customized Rebates	$46,067					Diane Calden	415-973-8575	Program includes both pre-calculated rebates and rebates for customized projects. For customized projects, maximum rebates paid for projects w/ payback of 5+ yrs. Program primarily directed at large customers (>100,000 kWh/yr). Participation rate among these customers ~40%. A 1985 survey indicated that 70% of participants would have made improvements w/o rebates, but the rebate induced ~75% of these free riders to install measures sooner. Promoted via mailings, trade allies, & personal contacts w/ all eligible customers. Free audit provided.
MULT	PG&E	CA	Direct & Customized Rebate			$4,962	$306	T	Diane Calden	415-973-8575	Publicity reduced in 1987 compared to prior years. Rebate amounts reduced in 1988 although publicity increased somewhat (limited mailings). ~900 projects were done in 1987. Lighting measures most popular, HVAC & process measures also common. Free walk-thru audit available.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MULT	PSE&G	NJ	CASH Rebate	Measures recommended in CACS audit	20% up to $5000	Full	1986		1/87	12/88	~4000	44		1.1%	C					8,137		
MULT	Puget P&L	WA	Comm'l Conservation Financing	Nearly anything that saves energy	0% loan or 50-80% grant	Full	1/80		1980	12/88	69,236	1,152	1,719	1.7%	C			161.44		3,528		
MULT	Seattle C.L	WA	Comm'l Incentives Pilot	Nearly anything that saves energy	Rebate for small customers, $/kWh for large	Pilot	1986		1986	12/88	31,666	80		0.3%	C			3.25	Bill	1,725		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MULT	PSE&G	NJ	CASH Rebate	~$50					Angela Graham	201-430-7934	Designed for customers who have received CACS surveys. Marketed via bill inserts, & customer contacts.
MULT	Puget P&L	WA	Comm'l Conservation Financing	$22,825	$6,277	$29,101			Sid France	206-462-3742	Program promoted thru word-of-mouth. This has resulted in sufficient interest to exhaust an annual budget of ~$2.5 million & still have a backlog of 6-24 months. Over 90% of customers select grant instead of 10 yr 0% loan (loan is more work because it includes placing a lien on the property). Finance measures w/ lifetime cost <$.03/kWh. Contractor assistance includes preparing specifications & soliciting bids. Interest in program has begun to slacken in recent yrs. Lighting measures account for 38% of savings, HVAC 34%, process 12%. Balance of savings from refrigeration, heat recovery, insulation and glass measures. ~1/2 of measures id'd in audits are actually implemented. Avg savings approx. 10-12% of pre-program electricity use. Grant varies depending on measure life, payback & other factors.
MULT	Seattle C.L	WA	Comm'l Incentives Pilot	$1,458	$944	$2,402			Steve Pool	206-684-3872	Bin analysis for medium customers, hourly simulation for large customers. For small customers, rebate of 65% of cost for ~20 measures. For large customers, incentive of $.05/kwh over measure life minus value of 2.5 yrs savings. Completion of O&M measures required. Participation rate ~11.3% for large customers. ESCo's are allowed to participate - these account for <10 projects. Most common measures, in order, are lighting, controls, HVAC & bldg shell. Billing analysis compared pre- & post-program energy use for participants & a control group. Actual savings were less than estimated savings, indicating presence of free riders. Promote thru word-of-mouth -- this gives them all the jobs they can handle.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MULT	SMUD	CA	Peak Load Rebate	Efficient lamps & motors, equipment modifications	Rebates - vary w/ measure	Pilot	1987	12/88	1987	12/88	26,000	189	351	0.7%	C	5.71		18.49		1,902	0.30%	C
MULT	Snohomish	WA	Comm'l Low Cost	Thermostat, photocells, hot water efficiency package	Rebate for control, free hot water package	Pilot	4/88	12/88	4/88	12/88	15,759		312	2.0%	P			0.38		1,156		
MULT	Snohomish	WA	Comm'l Incentives Pilot	Nearly anything that saves energy	Rebate for small customers, $/kWh for large	Pilot	1986		1/88	12/88	15,759	113		1.1%	C			3.35		1,156		
MULT	Snohomish	WA	Comm'l Non-Profits	Nearly anything that saves energy	Grants & 0% loans	Full	3/88	12/88	3/88	12/88	~35	25		71.4%	C			0.90		1,156		
MULT	Snohomish	WA	Schools & Local Govt.	Nearly anything that saves energy	Rebates for small customers, $/kWh for large	Full	1/88		1/88	12/88	35	7		20.0%	C			0.23		1,156		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MULT	SMUD	CA	Peak Load Rebate	$778			$136	D	Rick Codina	916-732-5428	80% of kW savings from large customers (>200kW). Half of kW savings for 9 large projects. 36-53% of $ spent for free riders; mostly a few large previously planned projects. 64% of MWh svgs for lighting, ~10% each for process & refrigeration improvements. Direct mail & personal contact best mktg approaches.
MULT	Snohomish	WA	Comm'l Low Cost						Don Pendleton	206-347-1703	Rebates for 75% of cost of thermostats & photocell controls. Hot water package included wrap, pipe insulation, bottom-board. Installed 33 thermostats, 30 photocells, 249 hot water packages. Customers work w/ regular contractor on selection & installation of controls. Market program thru newsletter, & personal contacts.
MULT	Snohomish	WA	Comm'l Incentives Pilot	$994	$110	$1,104			Don Pendleton	206-347-1703	Minimal participation in 1986-87 as program just starting. Have only done limited mktg as insufficient $ to handle increased participation. Participation in '89 continuing at '88 rate. High customer satisfaction w/ program. Promote thru newsletter, targeted direct mail, trade allies, & word-of-mouth.
MULT	Snohomish	WA	Comm'l Non-Profits	$171					Don Pendleton	206-347-1703	Combine incentives from WA State Energy Office and comm'l incentives program to pay 100% of measure cost. Program addressed all fuels, not just electricity. Aggressive mktg and TA very important to success. Promoted via personal contact w/ all eligible customers. Audit & full project management provided.
MULT	Snohomish	WA	Schools & Local Govt.						Don Pendleton	206-347-1703	Program combined comm'l incentives pilot program w/ add'l mktg & TA. 7 jurisdictions completed projects on a total of 26 bldgs. Took a lot of hand-holding & staff time/kWh saved. Promoted thru direct mail, expo, personal contacts w/ all eligible customers & conferences. Provided audits, design assistance, staff training & assistance w/ energy accounting.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MULT	So. Cal. Ed	CA	Large Comm'l Plan	Long list of measures - varies by yr	Rebates-vary by measure & yr	Full	1980		1/80	12/83	855	629		73.6%	C		55.00	233.10		14,775	0.37%	A
MULT	So. Cal. Ed	CA	Survey & Hardware Rebate	Long list of measures - varies by yr	Rebates-vary by measure & yr	Full	1973		1/80	12/86	393,754						1134.0	5287.0		14,775	7.68%	A
MULT	So. Cal. Ed	CA	Hardware Rebate	Long list of measures - varies by yr	Rebates-vary by measure & yr	Full	1978		1/81	12/87	393,754			~1%/yr	P		270.01	1437.4		14,775	1.83%	A
MULT	So. Cal. Ed	CA	Conservation Means Business	Cooling, refigeration & lighting equipment	Dealers earn points for gifts	Full	9/81	7/83	9/81	7/83	393,754							89.34		14,775		

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MULT	So. Cal. Ed	CA	Large Comm'l Plan						Bob Murphy	818-302-1958	Program open to all comm'l customers >500 kW. Goal: reduce electricity use by 20% over 5 yrs. Recipients received either a technical engineering audit or a comprehensive non-eng. audit plus cost-sharing on subsequent engineering analysis. After 3 yrs, 88% of goal achieved. Marketed thru personal contacts w/ all eligible customers.
MULT	So. Cal. Ed	CA	Survey & Hardware Rebate			$93,344	$82	T	Bob Murphy	818-302-1958	Costs and savings from rebates & free audits cannot be separated. Figures include only measures which were still in place in 1986. A 1986 study on persistence of measures installed under the program reduced the sum of savings from previous yrs by ~50%. A study on the 1983 program found that ~1/2 savings due to free riders. Prior to 1985, O&M measures included in savings estimates. ~20-25% of customers audited each yr implement something. ~95% of savings achieved by customers w/ demand >50 kW, ~50% of savings by customers >500 kW. Audits conducted for ~4% of small customers (<50 kW) each yr - many due to "cold calls". Market via personal contacts w/ large customers, mailings & some contacts w/ small customers.
MULT	So. Cal. Ed	CA	Hardware Rebate			$40,023	$148	T	Bob Murphy	818-302-1958	A study on the 1982 program found actual savings avgd 95% of auditor estimates. Avg svgs were 7.2% of pre-program use. A study on the 1983 program found 30% of the savings are due to rebate, the rest are either free riders or were induced by the audit alone. Rebates only available to audit recipients. Most rebates pay $.01-.04/1st yr kWh saved, up to 30-40% of measure cost. Avg. rebate ~15% of measure cost. Special unit (e.g. per lamp) rebate for small customers. Participation highest in '84-87 when rebate highest.
MULT	So. Cal. Ed	CA	Conservation Means Business	$318					Bob Murphy	818-302-1958	Only equipment replacing existing equipment eligible. Customers can receive hardware rebates if they get an audit. ~1050 dealers enrolled, but many never submitted any measures. Promoted via direct mail plus 2 full-time staff made personal contacts.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MULT	So. Cal. Ed	CA	Jointly Funded Feasibility Study	Nearly anything that saves energy	1/2 study cost up to $5000	Full	1983		1983	12/86			95							14,775		
MULT	So. Cal. Ed	CA	Hardware Rebate	Long list of measures - varies by yr	Rebates-vary by measure	Full	1978		1/88	12/88	393,754	1,074		0.3%	C		11.80	55.52	FR	14,775	0.08%	A
MULT	TVA	TN+	C&I Energy Mgmnt. Survey	Nearly anything that saves energy	Loans @ just below prime	Full	1979		1979	9/86	360,131	24,485		6.8%	C		155.00	767.00		19,772	0.78%	A
MULT	Wisc. Elec.	WI	Smart Money	Nearly anything that saves energy	Rebates - vary by measure	Full	6/87		6/87	3/89	81,750	5,600	9,932	6.9%	C		61.93	307.77		3,810	1.63%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MULT	So. Cal. Ed	CA	Jointly Funded Feasibility Study	$596					Bob Murphy	818-302-1958	Savings potential of 8.8 MW & 4820 MWh id'd thru 1986. Data on implemented projects blended in w/ other programs. 26 add'l studies done in 1987. Data on 1988 unavailable. Market via direct mail & personal contacts.
MULT	So. Cal. Ed	CA	Hardware Rebate			$2,438	$207	T	Bob Murphy	818-302-1958	In 1988 methods for calculating savings changed (free riders excluded from savings calculations, savings adjusted to be for coincident peak, and audit & rebate results no longer combined) so results not directly comparable to previous yrs. In 1988, customized rebate added; accounted for 34% of $ rebated.
MULT	TVA	TN+	C&I Energy Mgmnt. Survey			$45,800	$295	T	Jim West	615-751-5103	Free walk-thru survey for customers using <50 kW. Free comprehensive survey for customers using >50 kW. For large, complex facilities, comprehensive survey available at cost (free if implement 75% of measures w/ payback <2 yrs). 330 loans made totalling $3.8 million. Loans available for $1000-300,000 for up to 10 yrs. Interest 1% above TVA's cost of borrowing. In recent yrs program focus has been shifted to emphasize increasing kWh sales. Promote thru personal contacts & seminars.
MULT	Wisc. Elec.	WI	Smart Money	$36,305			$586	D	Dan Thomas	414-221-3189	13% of incentives made as loans, not rebates. An add'l 4000 projects have been approved but are yet to be completed. In 1987 72% of projects for lighting, 13-21% for HVAC. In 1988 56% were for lighting, 34% for HVAC. Based on customer surveys, estimate 50% of participants were free riders in 1987, 30% in 1988. Survey showed 2/3 of non-participants were aware of program. 1/4 of participants learned of program from utility employees, 1/4 from trade allies. Trade allies report most participants need to replace equipment (e.g. worn-out or no longer suitable). Marketed via mailings, trade allies, & direct contact by field reps.

Program Code	Utility	State	Program	Measures	Incentive	Pilot or Full Scale	Start Date	End Date	Data Dates Start	Data Dates End	Number Eligible	Number of Participants Customers	Number of Participants Projects	Cumm. Participation Rate	Customers or Projects?	Estimated Savings Coincident MW	Estimated Savings Absolute MW	Estimated Savings GWh	Adjustments	1987 Peak Demand	Svgs as % of Pk	Coincident or Absolute
MULT	Wisc. Elec.	WI	Direct Rebate	Lighting, water heaters, motors, central A/C	Rebates - vary by measure	Full	4/89				81,750									3,810		
MULT	Wisc. P&L	WI	Bright Ideas for Business	Lighting, motors, others	Shared savings	Both	4/87		4/87	5/89	38,516	94		0.2%	C		2.04	8.36		1,634	0.13%	A

Program Code	Utility	State	Program	Expenses (Thousands of Dollars) Direct	Indirect	Total	Avg Cost per kW	Direct or Total	Contact Name	Phone	Notes
MULT	Wisc. Elec.	WI	Direct Rebate						Frank Byrne	414-221-3886	Point of sale brochures containing 1-2 pages of info on program plus an application are left w/ dealers. Customer mails in rebate application. Approximately 2000 rebates issued thru 8/89 -- mostly for lighting measures. Considering offering rebates to salespeople but dealers concerned that salespeople would then be working for 2 masters.
MULT	Wisc. P&L	WI	Bright Ideas for Business				~$500	T	Steve Carlson	608-252-3261	Pilot offered in 1987, became full-scale 3/88. Available to all C&I customers but generally most attractive to large customers. Utility arranges installation, finances improvements over 3-5 yrs (for measure cost plus a service charge), and guarantees 1st yr savings. For pilot program financing was generally at prime plus 2%. For full program financing generally at 3% (interest writedown recovered thru rates). Many add'l proposals to customers still pending, only a few proposals have been rejected by customers. In 7/89 added rebates for customers who do not want shared savings financing. Over half of program participants signed contracts in the first half of 1989. Promoted thru personal contacts and direct mail.