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# Consolidated Edison Company Enlightened Energy C&I Rebate Profile #8, 1992

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# Executive Summary

Consolidated Edison's Enlightened Energy C&I Rebate Program for commercial and industrial customers provides rebates to eligible customers who install efficient lights, HVAC equipment, and motors. Con Edison drew much attention to the program in its early stages, which was previously referred to as the Applepower Program, when its rebate levels for summer peak coincident demand were \$500/kW -- far above average national rebate levels. Con Edison's interest was straightforward: to eliminate the need for expensive upgrades of midtown (New York City) substations. Now the program has a broader agenda and incentive mechanisms in New York have made it possible for Con Edison to embrace DSM as a profitable corporate strategy.

One of the most interesting aspects of the Enlightened Energy C&I Rebate Program is its use of fuel substitution as a tool for capturing energy efficiency. Because Con Edison provides electricity, gas, and steam service, the utility has found cost effective means of encouraging customer fuel switching without the threat of lost revenues. (Con Edison does, however, provide rebates for gas air conditioning installations to its electric customers who reside in the Brooklyn Union Gas service territory.) Significant electricity savings are realized by the utility as a result of the steam and gas air conditioning rebate components. The steam and gas air conditioning programs take advantage of the fact that steam and gas demands peak during the winter, and excess capacity is available during the summer.

The measures included in the Enlightened Energy C&I Rebate Program have been implemented on a smaller scale for several years. The program expanded significantly in 1991 due to a shift in the focus of the utility's DSM efforts from peak demand reduction to a total energy savings approach. This shift in emphasis brought increased spending for the rebate program, and resulted in significant overall program growth. Lighting design and service companies have promoted the availability of rebates for efficient lighting projects, and the lighting rebate measures have experienced a large expansion due in part to this activity.

In 1991 Con Edison spent over \$40 million to achieve summer peak capacity savings of 72 MW and energy savings of 184 GWh. One of the celebrated examples of the program's effect is the campuswide lighting retrofit that is underway at Columbia University. A third party energy service company is financing the 42-building retrofit, and is using Con Edison's \$1 million rebate as an impetus to realize fast and highly cost effective savings for the cash-strapped university.

## Enlightened Energy C&I Rebate Program

Utility: Consolidated Edison Company of New York (Con Edison)

Sector: Commercial and Industrial

Measures: Lighting, HVAC, and Motors

Mechanism: Rebates up to 100% of the equipment cost of the measures

History: Pilot in 1987, Systemwide program 1990-present

### 1991 Program Data

Annual energy savings: 184,684,000 kWh  
Lifecycle energy savings: 2,032 GWh  
Peak capacity savings: 36.36 MW winter  
72.05 MW summer  
Cost: \$40,367,000

### 1989 - 1991 Program Data

Energy savings: 362,350,866 kWh  
Lifecycle energy Savings: 3,201 GWh  
Peak capacity savings: 41.65 MW winter  
122.26 MW summer  
Cost: \$55,582,000

## Conventions

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

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

# Utility Overview

Consolidated Edison Company of New York, Inc., herein referred to as Con Edison, provides power to nearly 3 million customers in the New York City and Westchester County areas. While electricity comprises the majority of sales, (83.4% in 1991), Con Edison also provides gas to customers in Manhattan, the Bronx, and parts of Queens and Westchester, and steam to part of Manhattan.

Electricity is generated at several Con Edison power plants and at the facilities of independent power producers. Furthermore, Con Edison is a member of the New York Power Pool, which dispatches power for the seven major investor-owned utilities in New York State and the New York Power Authority. In 1991, nuclear power and natural gas produced most of the electricity used in the Con Edison service area, with 29% and 28% of the total generation coming from those sources, respectively. The other sources of electric power during 1991 were oil (24%), coal (13%), hydroelectric power (5%), and refuse (1%). Con Edison has made a commitment to provide all customer electricity needs over the next 20 years through existing facilities, purchases, and demand reductions. [R#2]

Con Edison's customer base is comprised of residential customers (including religious institutions), commercial and industrial customers, certain electrified railroads, and municipal and other governmental authorities. Con Edison also distributes electricity supplied by the New York Power Authority to NYPA customers; similarly, electricity supplied by the New York City Public Utility Service and the County of Westchester Public Utility Service Agency is distributed by Con Edison to municipal agencies. The distribution-only service categories are not included in the data presented in the statistics table. [R#2]

Con Edison electric customers used 35.9 billion kWh in 1991, with most of this use by commercial and industrial customers. Electricity sales in 1991 increased over the 1990 level by 2.0%, while steam sales remained fairly flat, with only a 0.1% increase, and gas sales were down 0.9% from the previous year. Con Edison has expanded marketing for natural gas, encouraging conversions to gas heating and air conditioning systems. [R#2]

## CON EDISON 1991 STATISTICS

<b>Electric Statistics</b>	
Number of Customers	2,938,201
Electricity Sales *	35,890 GWh
Sales Revenue*	\$4,307 million
Peak Demand	9,242 MW
Generating Capacity	9,294 MW
Firm Purchases	1,539 MW
Total Capacity	10,887 MW
Reserve Margin	18 %
<b>Average Electric Rates</b>	
Residential	13.9 ¢/kWh
Commercial	11.3 ¢/kWh
Industrial	11.3 ¢/kWh
<b>Gas Statistics</b>	
Number of Customers	1,027,933
Gas Sales **	92,551,954 dekatherm
Sales Revenue**	\$623 million
<b>Average Gas Rates***</b>	
Residential	82.9 ¢/therm
Commercial	57.4 ¢/therm
<b>Steam Statistics</b>	
Number of Customers	1,975
Steam Sales	28,531,067 1000 lbs
Sales Revenue	\$282 million
<b>Average Steam Rate</b>	9.89 \$/1000 lbs

[R#2,9] \*Sales to Con Edison customers only -- does not include service to NYPA, municipal agencies, or other electric utilities

\*\* Sales to Con Edison customers only -- does not include transportation of customer-owned gas

\*\*\* does not include interruptible service

# Utility DSM Overview

In 1971, Con Edison began its energy conservation program with the "Save-A-Watt" program. Since then, Con Edison has developed a variety of programs and techniques in a successful effort to decrease power demands by encouraging efficiency in the residential and commercial/industrial sectors.

Con Edison's projected demand for 2008 is more than 48 billion kWh without DSM. The long range DSM plan includes a number of programs expected to reduce that projected demand to 41 billion kWh. The decreased projections are also expected to compensate for plant retirements, thus eliminating the need for new facilities. In its 1991 Annual Report, Con Edison explicitly makes the commitment to fulfill its resource requirements through DSM.

Between 1985 and 1990, more than 75 pilot DSM programs were tested by Con Edison. The early commercial and industrial customer rebate program was limited to larger customers in the mid-town area, with a primary goal of reducing peak demand. Con Edison's DSM programs evolved from these initial efforts, and expansion to a wider customer base followed, a result of the implementation of the New

## CON EDISON DSM PROGRAMS

<b>Enlightened Energy C&amp;I Rebate Program</b>
Efficient lighting
High-efficiency electric air conditioning
Steam air conditioning
Gas air conditioning
High-efficiency motors
Commercial and Industrial Energy Audits
Curtable Electric Service
Not-for-profit Organizations Conservation
Residential Compact Fluorescent Lighting
Residential Sub-Metering
Refrigerator and Air Conditioner Dealer Incentives
Consumer Energy Information Programs
Innovative Rate Programs
DSM Development and Support Projects

<b>Utility DSM Overview Table</b>	<b>Annual DSM Expenditure (x \$1,000)</b>	<b>Annual Energy Savings (GWh)</b>	<b>Annual Summer Capacity Savings (MW)</b>
1989	\$18,241	39.17	60
1990	\$29,226	55.37	76
1991	\$72,480	240.39	87

[R#4,5,8]

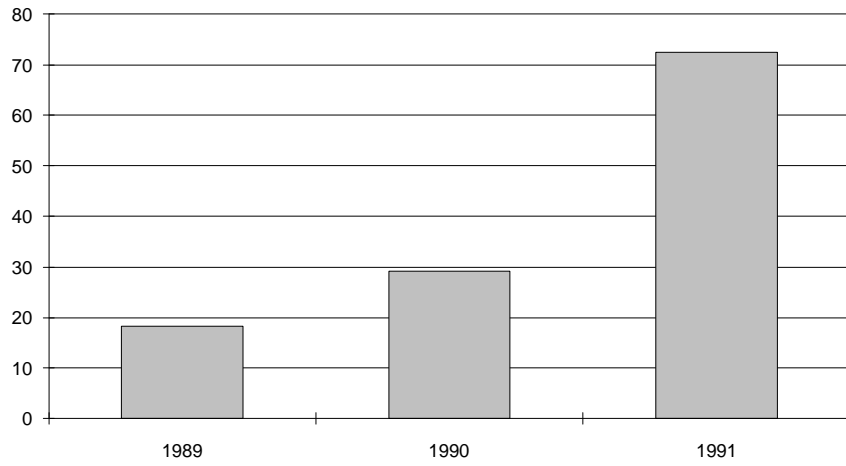
York State Energy Plan, the enforcement of new regulatory guidelines for DSM programs, and the revision and implementation of incentive plans.

In 1990 the most successful energy efficiency programs were combined under the title Enlightened Energy. The Enlightened Energy programs now include a variety of programs for commercial, industrial, and residential customers, including those listed on this page. The total DSM portfolio cost for 1991 represented 1.4% of the gross energy revenues.

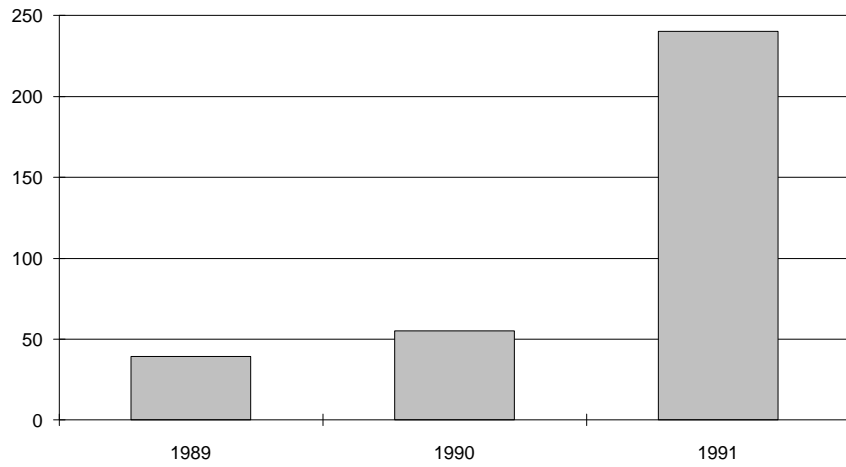
Commercial and industrial customers, who account for more than 70% of Con Edison's electricity sales, are the focus of the Enlightened Energy C&I Rebate Program, the subject of this profile. Other DSM programs of particular note include the dealer incentive program for high-efficiency air conditioners and refrigerators and the discount compact fluorescents mail-order program for residential customers. Con Edison also realizes significant capacity savings from its curtable electric-service program; savings from this program are included only in the 1989 and 1990 data in the above overview table.

Under the Customer Information category, the company offers seminars for commercial and industrial customers, an energy management course for building operations personnel, videos, and newsletters. Additionally, demonstration projects and pilot programs include a residential-builder program, a residential low-income conservation program, a small-customer service package, and an office lighting demonstration.

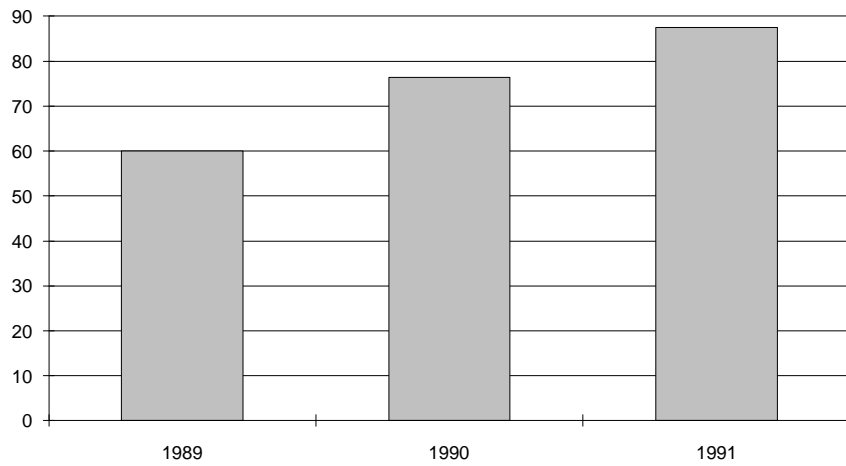
**ANNUAL DSM  
EXPENDITURE  
(\$1,000,000)**



**ANNUAL DSM  
ENERGY SAVINGS  
(GWH)**



**ANNUAL DSM  
CAPACITY SAVINGS  
(MW)**



# Program Overview

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The Enlightened Energy C&I Rebate Program provides rebates to commercial and industrial customers who invest in efficiency. The program pays up to 100% of the equipment cost of new lighting, HVAC, and motors. Program brochures detail the rebate amounts for particular equipment. There is no limit on the number of rebates for which any individual project may be eligible, but all products purchased and installed must meet program requirements as specified in the brochures. Customers must apply to the program and receive approval from Con Edison prior to purchase and installation of new equipment.

What now comprises the Enlightened Energy C&I Rebate Program was introduced in 1987 as part of the ApplePower Programs. The first rebate program, called the Selected Network Rebate Program, was aimed at larger commercial and industrial customers in the Brooklyn area. Initially, the program had a specific goal of reducing demand on one substation where demand was expected to exceed capacity by 1992. The Selected Network Rebate Program was subsequently expanded and refined into the Enlightened Energy C&I Rebate Program for all commercial and industrial customers.

The ApplePower program was designed to reduce summer peak electric demand on weekday afternoons in June, July, August, and September. Although the focus of Enlightened Energy C&I Rebate Program is now broader, until the beginning of the 1992 program the lighting rebate programs still required the customer to demonstrate that summer peak load reductions would be a result of a qualifying lighting retrofit. This requirement was softened for the 1992 program year when lighting equipment providing a minimum of 1,500 full load hours of annual electricity reduction also qualified for rebates.

The Enlightened Energy C&I Rebate Program has an indefinite lifetime, and expectations are that the program will continue. The current program plan has been approved through the end of 1992, and Con Edison is now finalizing program plans for 1993-1994.

# Implementation

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## MARKETING AND DELIVERY

The Enlightened Energy C&I Rebate Program's promotion, information, and application materials form an attractive, convenient, and professional package designed to be appealing to target customers. Con Edison has undertaken several projects to identify the best marketing strategies for its DSM programs. The result is a comprehensive marketing program that identifies and then promotes the program to customers most likely to benefit from the rebates.

Most marketing efforts for the Enlightened Energy C&I Rebate Program are focused on larger customers with billing demand greater than 50 kilowatts. Approximately 18,000 customers fall into that category, many of whom are contacted personally with information about the rebate program for which they are eligible. Additionally, new construction projects and trade allies are targeted in all marketing efforts. [R#4]

Prospective applicants are informed of the program in a variety of ways. Direct mail, advertisements, energy audits, telemarketing, and bill inserts are all utilized. Additionally, Con Edison reaches prospective applicants through energy audits, the utility publication EnergyNews, seminars, and technical literature distribution.

Program managers have found that many customers decide to participate as a result of solicitation by lighting design and service companies. Additionally, personnel in the department of economic development ensure that prospective customers are aware of the Enlightened Energy C&I Rebate Programs.

The Enlightened Energy C&I Rebate Program brochure includes technical specifications that detail qualifying purchases. A worksheet package allows customers to easily calculate the amount of rebate they can expect for their demand reduction project. Both retrofits and new construction projects can qualify for rebates. Projects involving high-efficiency lighting, motors, and gas, steam, or electric air conditioning are all included in the program.

The rebate procedure is streamlined, consisting of an application process, followed by project review and acceptance (or rejection with an explanation). Con Edison determines a time limit within which the project must be completed, conducts a post installation inspection, and issues a rebate check based on the results of the inspection.

## APPLICATION AND REBATE PROCESS

- 1) The customer must first complete and return worksheets and an application form for the proposed projects before purchasing equipment. The only rebate allowed without an application prior to purchase and installation is emergency replacement of failed motors. Con Edison provides assistance in completing application forms as necessary.
- 2) Con Edison reviews each application, and conducts an on-site inspection of the proposed project.
- 3) Con Edison sends a letter to each qualifying customer accepted for the program, specifying the estimated rebate amount and installation time requirements. If any proposed project does not meet the program requirements, Con Edison will notify the customer in writing, specifying the basis for rejection of the application.

## Implementation (continued)

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- 4) The installation time limit for most projects is one year from the date of the acceptance letter to the completion of the project. Additional time may be allowed for projects requiring longer lead times for purchase or installation, if requested in writing and approved by Con Edison in writing.
- 5) When installation is complete, customers must notify Con Edison in writing, and submit photocopies of the invoices specifying the quantity and price of all materials purchased and the installation costs.
- 6) Con Edison then schedules and conducts a post-installation inspection, which may include spot checking of closed-in areas.
- 7) The actual rebate amount is determined based on the inspection. Rebate checks are sent approximately six weeks after receipt of invoices and verification of installation.

### FEASIBILITY STUDIES

To determine if gas, steam, or cool storage air conditioning installations are economically practical for the customer application, the Enlightened Energy C&I Rebate program will also pay 50% of costs, up to \$15,000, for feasibility studies. The feasibility study must be performed by a licensed New York State Professional Engineer, and the study must evaluate and identify the electric peak demand reduction that would result from installation of the air conditioning system being considered.

The feasibility study can show costs and savings of gas and steam installations as compared to any electric air conditioning system, however cool storage systems must be compared to a qualifying high-efficiency electric air conditioning system.

Feasibility studies are required for cool storage systems, but are optional for other air conditioning projects. Feasibility studies may also be used by customers to support a request for higher rebate levels for certain air conditioning projects. If the standard rebate levels do not significantly offset the first-cost difference between electric and steam or gas air conditioning systems, Con Edison may allow higher rebate levels depending on the customer's needs and the results of a feasibility study.

### INSTALLED MEASURES

The following equipment will generally qualify for rebates under the Enlightened Energy C&I Rebate Program.

#### LIGHTING

Lighting equipment must either be in normal operation during daytime working hours from June through September or provide at least 1,500 full load hours of annual electricity reduction in order to qualify for rebates. (A full load hour is a conversion from partial use of a technology to 100% usage during the time of operation.)

- Replacement of standard fluorescent lamps with high-efficiency fluorescent lamps.
- Installation of high-efficiency ballasts.
- Replacement of incandescent bulbs with compact fluorescent lamps.
- Installation of lighting control devices.
- Modification of existing fixtures through approved and appropriate methods.
- Fixture replacement.



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## HIGH-EFFICIENCY SPACE CONDITIONING

- Installation of electric air conditioning systems that meet specified minimum efficiencies.
- Cost sharing for a feasibility study. Feasibility studies are required for cool storage installations to qualify for rebates.
- Installation (after successful feasibility study) of cool storage systems for operation in conjunction with electrically-driven cooling equipment.

## GAS AIR CONDITIONING

- Installation of gas air conditioning systems, if displacing Con Edison-supplied electricity.
- Cost sharing for a feasibility study.

## STEAM AIR CONDITIONING

- Cost sharing for a feasibility study.
- Installation of steam air conditioning systems, if the installation displaces Con Edison-supplied electricity. Con Edison will rebate a maximum of 50% of equipment costs for replacements.

## MOTORS

- Replacement of motors or new installation of "Design A, B, and C" AC polyphase motors rated at or above 5 horsepower. Motors must meet specified minimum nominal efficiency ratings.

- Application of variable frequency drives to existing or new motor installations.
- Emergency replacements for failed motors even when no application has been made.

## STAFFING REQUIREMENTS

The Enlightened Energy C&I Rebate Program is administered through six distinct "energy services groups", defined by the 5 boroughs of New York City, plus Westchester. In addition to the field offices, there are approximately 10 personnel based at the main Con Edison office who are involved in the rebate programs.

A number of field personnel work in the six field offices. Each group receives applications for its service area and processes them completely from receipt to issuance of the rebate check. Staff evaluate applications, set up and perform pre- and post-project inspections, and handle other administrative and clerical duties.

With these staff levels, a backlog of about one month can be maintained. Turnaround time between receipt of the customer application and issuance of an acceptance letter is usually between 4 and 6 weeks. Project completion times then vary by project, and as soon as Con Edison is notified that a project has been completed, another 4 to 6 weeks is needed to schedule and perform the post-project field inspection and issue the rebate check. In situations where installation is complex, or where Con Edison can not readily gain access to installed equipment, turnaround time can be longer.

# Implementation (continued)

## SAMPLE REBATE AMOUNTS

### Lighting

Fluorescent Lamps	
F40	\$1.80
F32T8	\$3.50
F96T12	\$5.00
Compact fluorescents	\$12.00
Core-coil ballasts	\$12.00
Electronic Ballasts - 2 lamp	\$25.00
Electronic Ballasts - 3 or 4 lamps	\$35.00
Fixture modification	30¢/W saved
Fixture replacement	\$1.00/W saved
Photoelectric controls	\$200/kW connected
Occupancy sensors	\$200/kW connected

### High Efficiency Space Conditioning

Air-cooled packaged air conditioning	\$160/ton
Air-cooled condensing units	
10.2 minimum EER	\$40/ton
10.6 minimum EER	\$70/ton
Packaged terminal air conditioning units	\$80/ton
Packaged water chillers	\$40 to \$80/ton
Cool storage systems*	\$600/kW shifted demand

### Gas Air Conditioning

Replacement or installation in an existing building	\$100 to \$300/ton
New gas load	\$400/ton

### Steam Air Conditioning

Replacement or installation in an existing building	\$100 to \$250/ton
New steam load	\$400/ton

### Motors

High efficiency motors	\$12/HP
Adjustable speed drives -- more than 5000 hrs/year	
Up to 30 HP	\$160/HP
31 to 60 HP	\$140/HP
More than 61 HP	\$125/HP
Adjustable speed drives -- less than 5000 hrs/year	
All motors	\$100/HP

# Monitoring and Evaluation

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## MONITORING

The Enlightened Energy C&I Rebate program is set up to include routine monitoring of program results through pre- and post-project inspections. Before any project is approved for a rebate, a Con Edison field person makes a personal inspection to verify the status of equipment to be replaced. Following installation of the approved retrofit, a field person again makes an on-site inspection, confirming the installation of approved equipment. In this manner, Con Edison can be confident of load reduction estimates, as verified records of pre- and post-project equipment are well maintained.

In 1991, Con Edison established the Data Control and Support Services section within its Conservation Services Department. This group is responsible for processing, controlling, and tracking rebate applications, and assuring customer rebates are issued in an expedient manner.

## EVALUATION

Con Edison performs a considerable amount of program evaluation as part of the customer application and acceptance process. Before a retrofit activity is approved for a rebate, program staff analyze the project and estimate savings and costs based on observations and engineering estimates. After the retrofit is completed, a staff member performs a post-project inspection, and, if appropriate, makes the necessary changes to the savings calculations.

All of the data generated by the pre- and post-project inspections are entered into the Con Edison Rebate Tracking (CERT) system, a personal computer database product. The database is comprised of three main file types: customer applications; project tracking history; and measures, identifications, and impacts. CERT is used to determine the actual

installed wattage of base and replacement technologies. [R#8]

Con Edison has developed program-specific algorithms to determine program savings. These formulae incorporate several factors. Many of these factors are based on the results of detailed energy audits of approximately 800 commercial and industrial customers. The starting point for the algorithms, the change in watts used, comes directly from the CERT database.

The algorithms used in 1991 included the following factors:

- Delta watts: the wattage difference between the installed efficiency measure and the equipment it replaces, as determined from field inspections and/or engineering estimates;
- Full load hours: for measures not always operated at 100%, an equivalent amount of time for 100% operation is determined, based on annual operating hours with a load shape adjustment specific to each measure;
- Coincidence: a measure of the relation between a customer's peak demand and the system peak, as determined by two studies of representative commercial and industrial customers;
- Demand: a ratio of maximum demand to total connected load;
- Free ridership: a measure of customers who would have implemented efficiency measures in the absence of the rebate program;
- Snapback: a measure of customers usage pattern changes

## Monitoring and Evaluation (continued)

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that result from implementation of energy efficient technology;

- Interaction: a measure of the relation among different end-use consumption patterns (e.g. cooling bonuses result from lighting changes), as determined by detailed energy audit analyses;
- Transmission and distribution loss factor: the factor used is 0.118 and is based on Electric Rate Case 28211. [R#8]

The evaluation plans for all of the Enlightened Energy C&I Rebate Programs were included in the 1990 DSM Program Plan dated September, 1989, but are not available at this time. Evaluations for 1991-1992 include review of the program application procedures and assessment of incentive levels. Preliminary impact evaluation reports were developed for each program after the Fall of 1991, however these were not available. [R#4]

Results of all DSM programs are compiled in Bi-monthly Status Reports submitted to the Public Service Commission. These documents present cumulative results of program savings, segmented by program.

### DATA QUALITY

Savings estimates are computed by the CERT program using data input from pre- and post-project inspections. Due to the personal site visits by program staff, there is considerable confidence in the data generated regarding program implementation and savings. Nonetheless, Con Edison is constantly improving data and reevaluating assumptions used in calculations. The continual revision of figures, while making data more accurate, sometimes makes data analysis difficult, as the changes and corrections are not always noted in published documents.

The CERT database was recently revised to include information on customer type for predicting annual saving estimates and reductions to peak demands. The data for jobs paid prior to incorporation of this information into the database had to be updated to include customer type. If customer type is not identified correctly, or if a customer's usage pattern differs significantly from the average, then savings predictions may be in error. The database is routinely checked to identify such problems.

Additionally, the algorithms used to calculate savings predictions were revised in 1991, which may have an effect on the comparability to figures from previous years.

The Enlightened Energy C&I Rebate program has changed in the years since its inception, and as a result some of the data generated may be subject to a variety of interpretations. In this profile, analysis has been presented for the program as a whole, as well as for each of the five program measures whenever possible.

Data for each of the years 1989, 1990, and 1991 was based on published results from the following documents: 1989 data as reported in the "Demand Side Management Plan: 1991-1992 Annual Plan and Long Range Plan" [R#4]; 1990 data as reported in the "Rate Incentive and Lost Revenue Report: 1990 Demand Side Management Programs" [R#8], with participation figures and rebate amounts for program measures provided directly by Con Edison [R#12]; 1991 data as reported in the "Enlightened Energy Bi-monthly Status Report of DSM Programs for the period of January 1 through December 31, 1991" [R#5]. As data are reported in various formats and breakdowns in each of the document sources, some comparisons are more appropriate than others. Thus, the tables and charts in the Cost of the Program section are slightly different from those that appear in other Results Center profiles.

# Program Savings

The Enlightened Energy C&I Rebate Program had resulted in total cumulative energy savings of 362,350,866 kWh by the end of 1991. Cumulative peak demand savings at the end of 1991 were 122 MW of summer peak, and 42 MW of winter peak. In 1990, most of the savings resulted from the lighting and steam air conditioning measures. In 1991, savings due to lighting retrofits were the principle portion of total program savings.

The program has changed since 1989, when a few air-conditioning retrofits resulted in high annual savings. Participation has increased significantly since then, with a larger number of smaller projects contributing to the 1991 annual savings of 184,684,000 kWh. Analysis of program savings by measure reveal the huge increase in savings attributed to the lighting measure from 1990 to 1991. However, because most lighting projects carry a shorter lifetime than air-conditioning and motor projects, the cost of saved energy for the lighting measure is higher.

## MEASURE LIFETIME

Each of the five program measures have expected lifetimes from 3 to 20 years, as shown below. [R#8]

### MEASURE LIFETIME (YEARS)

Lighting measures	3 - 15
High-efficiency electric space conditioning and cool storage	16 - 20
Gas air conditioning	20
Steam air conditioning	20
High-efficiency motors	14

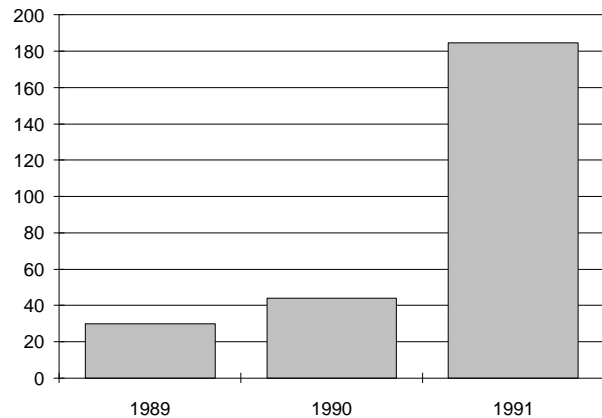
Average lifetimes of measures implemented in the three years 1989, 1990, and 1991 were determined based on weighted averages of energy savings resulting from each of the five measures in each year. For the lighting measure, a lifetime of 8 years was assumed, while for high-efficiency space conditioning a lifetime of 16 years was assumed. The latter assumption was based on the lifetime of high-efficiency electric space conditioners. Even though cool thermal storage has a lifetime of 20 years, it is assumed that all of the high-

efficiency space conditioning measure savings resulted from the installation of electric space conditioners. Using these assumptions and the above lifetimes for the gas, steam, and motors measures, the following yearly average lifetimes were determined. These figures are used for calculating lifecycle savings and to determine the cost of saved energy in the Cost

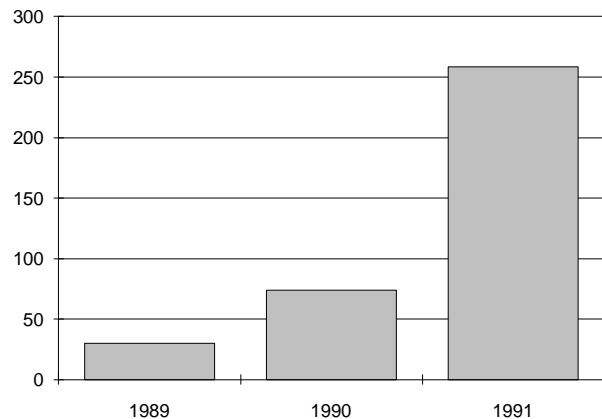
### AVERAGE MEASURE LIFETIME

1989	20 years
1990	13 years
1991	11 years

### ANNUAL ENERGY SAVINGS (GWH)



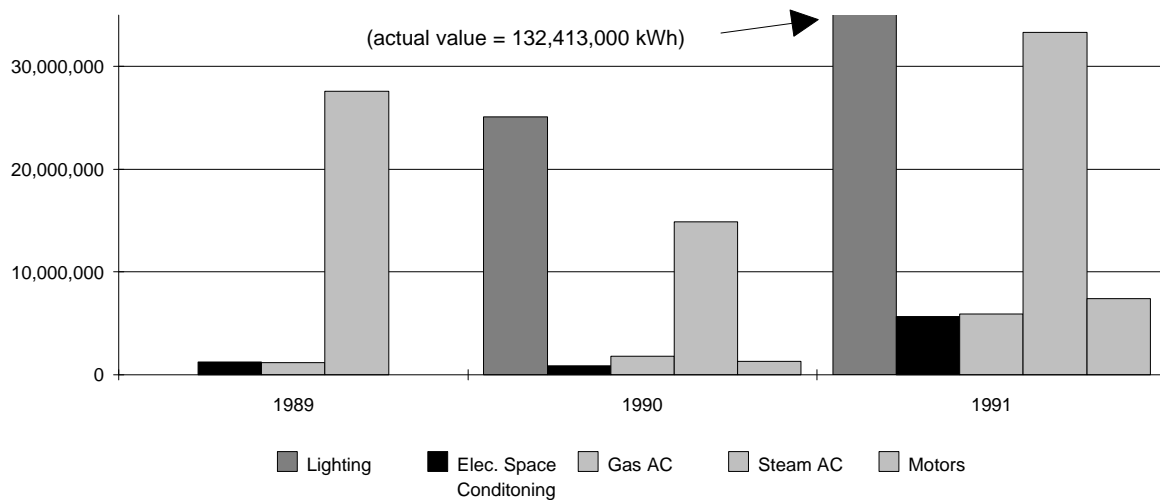
### CUMULATIVE ENERGY SAVINGS (GWH)



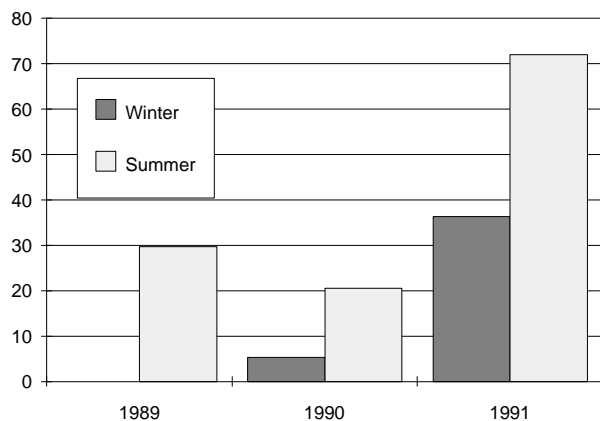
# Program Savings (continued)

Savings Overview Table	Annual Energy Savings (kWh)	Cumulative Energy Savings (kWh)	Lifecycle Energy Savings (kWh)	Annual Winter Capacity Savings (MW)	Cum. Winter Capacity Savings (MW)	Annual Summer Capacity Savings (MW)	Cum. Summer Capacity Savings (MW)
1989	29,985,000	29,985,000	599,700,00	0.00	0.00	29.72	29.72
1990	43,855,933	73,840,933	570,127,12	5.29	5.29	20.49	50.21
1991	184,684,00	258,524,93	2,031,524,	36.36	41.65	72.05	122.26
Total	258,524,93	362,350,86	3,201,351,	41.65		122.26	

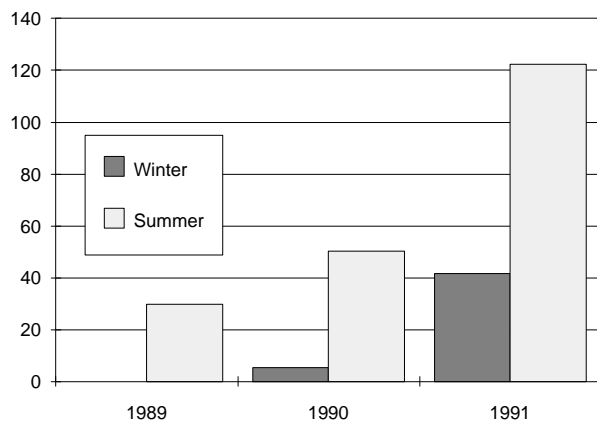
**ANNUAL ENERGY SAVINGS BY MEASURE TYPE (KWH)**



**ANNUAL PEAK CAPACITY SAVINGS (MW)**



**CUMULATIVE PEAK CAPACITY SAVINGS (MW)**



of the Program section.

## PARTICIPATION

When the rebate program was initiated as a pilot project in 1987, approximately 40 applications were approved for rebates for lighting, air conditioning, and motors. [R#3] Participation rates rose each year, and by the end of 1991, 14,000 applications had been received for the five program measures. Many (almost 10,000) of these applications have been approved but not paid out, some were not approved, and 2,744 were paid in 1991. [R#5] Any customer may apply for rebates for any number of projects, thus the number of applications does not necessarily reflect the actual number of customers participating in the program.

The size of each project has decreased since 1989, when the average rebate paid was 18 times the average for 1991. See

the Cost of the Program section for further discussion.

## PROJECTED SAVINGS

The Con Edison 1991-1992 Annual Plan and Long Range Plan contains projections for savings to the year 2008. The long range plan will be updated with a new filing in 1992. The current Long Range Plan estimates cumulative DSM savings to be 7,122 GWh by the year 2008. The plan does not contain a breakdown of savings by program.

Con Edison projects that annual energy savings resulting from all DSM programs will peak at 455 GWh in 2001, and then level off, with annual energy savings in 2008 projected at 438 GWh. Similarly, winter peak reduction is expected to be highest in 2001, at 70 MW. Summer peak reductions are expected to be greatest in 1994, with summer peak reduction of 240 MW projected. Cumulative summer peak and winter peak reductions expected by 2008 are 2,509 MW and 1,123 MW, respectively. [R#4]

	1989		1990			1991		
	Annual Energy Savings (kWh)	Summer Peak Capacity Savings (MW)	Annual Energy Savings (kWh)	Winter Peak Capacity Savings (MW)	Summer Peak Capacity Savings (MW)	Annual Energy Savings (kWh)	Winter Peak Capacity Savings (MW)	Summer Peak Capacity Savings (MW)
Lights	N/A	N/A	25,093,246	5.07	6.08	132,413,000	36.36	36.36
Space	1,205,000	0.938	827,104	0	1.21	5,668,000	0	4.73
Gas	1,180,000	1.18	1,806,845	0	1.41	5,899,000	0	4.6
Steam	27,600,000	27.6	14,868,848	0	11.58	33,333,000	0	25.96
Motors	N/A	N/A	1,259,890	0.22	0.22	7,371,000	0	0.4

[R#4,5,8] N/A = Not Applicable

# Cost of the Program

Total program costs increased significantly between 1990 and 1991, from \$7.6 million to \$40.4 million. Program participation also increased in that time period, bringing the average rebate paid down, even though the cost of saved energy increased. The average savings per dollar of rebate were highest in 1990.

## FREE RIDERSHIP

Free-ridership factors, which indicate the number of customers that would have implemented qualifying retrofits in the absence of utility incentives have been added to the algorithms used by Con Edison for calculating energy and demand savings. The free-ridership factor was not determined for 1990. [R#8]

The factors used in 1991 ranged from 1 to 5% for lighting measures, 15% for electric space conditioning, 1% for gas air conditioning, 4% for steam, and 1% for motors. These factors will be adjusted pursuant to ongoing negotiations between Con Edison and the PSC. The factors currently being

considered range from 1% to 10% for lighting, 19% for electric space conditioning, 5% for gas air conditioning, 10% for steam, and 1% for motors. [R#13]

## COST PER PARTICIPANT

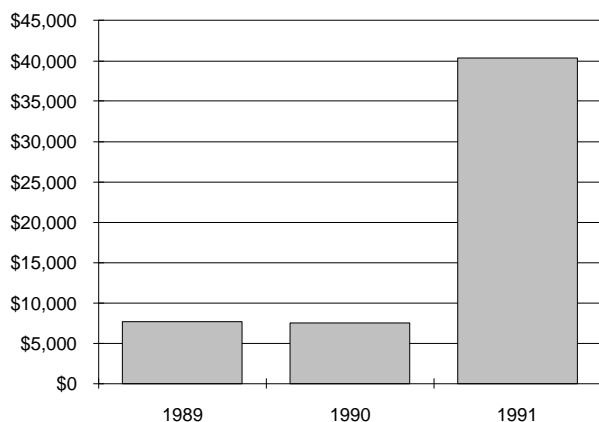
In 1989, the majority of expenditures were dedicated to the steam air conditioning measure. The total of about \$6.1 million in costs resulted in 27,600,000 kWh of saving, with only 22 participants. Thus, though the total costs and the cost per applicant were high, the savings were significant. With a new emphasis on lighting programs, participation rates have increased, and the average rebate paid in 1991 was \$9,951, about 5.5% of the 1989 average.

## COST COMPONENTS

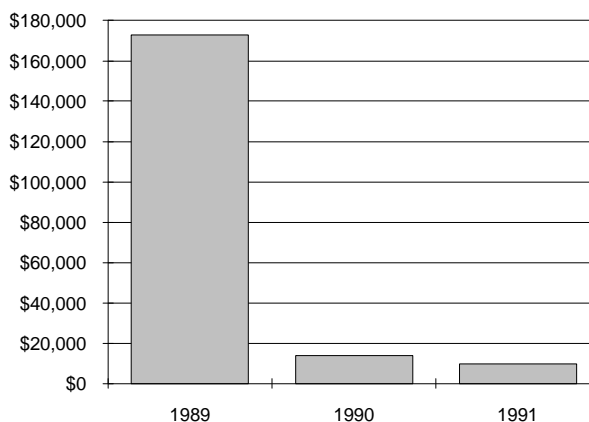
The Enlightened Energy C&I Rebate Program is comprised of five separate rebate programs, each of which had corresponding program expenditures. Of the Enlightened Energy C&I Rebate Program 1990 total expenditures, the

Cost Overview Table	Total Program Cost	Non-Rebate Costs	Rebates	Number of Rebates	Average Rebate Paid	Annual Savings (kWh)	Savings per Rebate (kWh/\$)
1989	\$7,659,652	\$915,954	\$6,743,69	39	\$172,915	29,985,000	4.45
1990	\$7,555,000	\$3,468,347	\$4,086,65	293	\$13,948	43,855,933	10.73
1991	\$40,367,28	\$14,048,83	\$26,318,4	2744	\$9,591	184,684,00	7.02
Total	\$55,581,93	\$18,433,13	\$37,148,8				

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



**AVERAGE REBATE PAID**





lighting and steam air conditioning measures saw the largest outlays, at \$2.1 million and \$3.2 million, respectively. [R#8] In 1991, more emphasis was placed on the lighting program, and the lighting expenditure leaped to \$29.7 million. [R#5] Advertising averaged 14% for 1989 and 1990. In 1989, space conditioning had the most advertising costs, at 37% of measure budget, while the highest advertising budget in 1990 was for the motor program, at 31% of the motor budget. [R#4]

Rebate costs represent approximately 67% of the total expenditure over the three years 1989 to 1991. All other costs, including advertising, labor, outside services, administration, and program evaluation, comprised, on average, 33% of expenditures over the three years. [R#4,5,12]

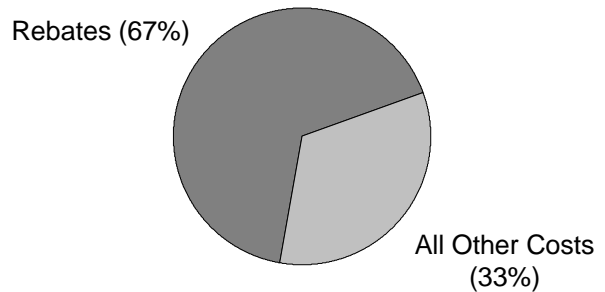
## COST EFFECTIVENESS

In the 1991-1992 DSM Plan, Con Edison presents results of studies performed to predict the cost effectiveness of each efficiency measure. Previously, Con Edison had used the Unit Cost test, however, the PSC directed companies to include the following specific cost-effectiveness tests: Total Resource Cost, Utility Revenue Requirements, and Rate Impact Measure. The results of these tests are presented in the company's plan.

A calculation of the cost of saved energy reveals a cost of 2.63 ¢/kWh for 1991, based on a 5% real discount rate. However, when cost of saved energy is computed for each of the five measures, a wide range of costs become apparent. In 1990, the high-efficiency space conditioning measure carried a very high cost of 16.6 ¢/kWh. It should be noted that

this measure includes a cool storage component; cool storage is actually a peak-clipping measure which, rather than saving energy actually resulted in a net energy loss of 52,050 kWh in 1990. The high cost of the savings from the high-efficiency space conditioning measure may be explained by the fact that cool storage is included in the calculations. In 1991, the cost of that measure dropped down to 5.4 ¢/kWh.

The lighting measure has become exceptionally popular among customers, with 2,501 rebates paid in 1991, and 9,550 had been approved by the end of 1991. However, savings due to approved but not paid projects are not included in the savings estimates. Thus, savings for applications processed in 1991, but completed in 1992 are not incorporated into the cost of saved energy calculations for 1991, even though some of the money spent in 1991 went toward processing those applications. This situation applies to all five program measures, and may explain why the cost of saved energy seems to have risen as the Enlightened Energy C&I Program has evolved.



Cost of Saved Energy (¢/kWh)	Discount Rates						
	3%	4%	5%	6%	7%	8%	9%
1989	1.72	1.88	2.05	2.23	2.41	2.60	2.80
1990	1.62	1.73	1.83	1.95	2.06	2.18	2.30
1991	2.36	2.50	2.63	2.77	2.91	3.06	3.21

# Environmental Benefit Statement

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

A	9,400	2.50%	781,228,000	18,534,000	3,747,000	375,000
B	10,000	1.20%	833,045,000	7,175,000	2,419,000	1,794,000

## Controlled Emissions

A	9,400	2.50%	781,228,000	1,853,000	3,747,000	30,000
B	10,000	1.20%	833,045,000	717,000	2,419,000	120,000
C	10,000		833,045,000	4,783,000	2,392,000	120,000

## Atmospheric Fluidized Bed Combustion

A	10,000	1.10%	833,045,000	2,192,000	1,196,000	598,000
B	9,400	2.50%	781,228,000	1,853,000	1,499,000	112,000

## Integrated Gasification Combined Cycle

A	10,000	0.45%	833,045,000	1,475,000	239,000	598,000
B	9,010		749,342,000	534,000	180,000	36,000

## Gas Steam

A	10,400		454,388,000	0	1,036,000	0
B	9,224		394,600,000	0	2,471,000	117,000

## Combined Cycle

1. Existing	9,000		394,600,000	0	1,515,000	0
2. NSPS*	9,000		394,600,000	0	717,000	0
3. BACT*	9,000		394,600,000	0	100,000	0

## Oil Steam--#6 Oil

A	9,840	2.00%	657,667,000	9,965,000	1,176,000	1,116,000
B	10,400	2.20%	697,525,000	9,885,000	1,479,000	717,000
C	10,400	1.00%	697,525,000	1,411,000	1,188,000	375,000
D	10,400	0.50%	697,525,000	4,145,000	1,479,000	228,000

## Combustion Turbine

#2 Diesel	13,600	0.30%	872,903,000	1,738,000	2,698,000	147,000
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## Refuse Derived Fuel

Conventional	15,000	0.20%	1,036,323,000	2,671,000	3,516,000	781,000
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**Avoided Emissions Based on 362,350,866 kWh Saved (1989 - 1991)**

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

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

## HOW TO USE THE TABLE

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

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

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

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

## CON EDISON'S AVOIDED EMISSIONS

Con Edison is part of the New York Power Pool which uses economic priority for determining dispatches. Because Con Edison's oil- and gas-fired generation is more costly than most other New York Power Pool sources, it is likely that savings that are accrued from Con Edison's DSM programs effectively result in reduced emissions at these types of power plants.

### \* Acronyms used in the table

TSP = Total Suspended Particulates

NSPS = New Source Performance Standards

BACT = Best Available Control Technology

# Lessons Learned/Transferability

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## LESSONS LEARNED

The success of the Enlightened Energy C&I Rebate Program demonstrates that a major urban utility such as Con Edison, which had a deeply rooted supply-side orientation, can redefine its course and quickly develop an ambitious and successful DSM program. Con Edison entered DSM because there were acute constraints on substations in the mid-town area and improvements would have been extremely costly. Starting with a load management program aimed specifically at avoiding the expense of providing for increased peak demand, the utility moved quickly into a much broader array of DSM programs with a wider range of objectives.

The Enlightened Energy C&I Rebate Program evolved from a peak demand reduction program into a comprehensive demand reduction strategy. The changes were facilitated by the regulatory adoption of the Electric Revenue Adjustment Mechanism (ERAM), which segregates customer energy consumption from company profitability. Through the ERAM and other aspects of the 1992 Electric Rate Settlement Agreement, Con Edison has forged a pragmatic financial path to energy efficiency.

The Enlightened Energy C&I Rebate Program has benefitted dramatically from the involvement of lighting service companies and other energy service groups. These companies have promoted the rebate program by offering their services to Con Edison customers who may not

otherwise have participated. While there is no direct link between Con Edison and these service companies, it is believed that the aggressive and attractive incentive scale cultivated their involvement.

The fuel substitution components of the Enlightened Energy C&I Rebate Program have been particularly successful in saving electricity. The steam measure has provided consistent energy and capacity savings over the three years 1989 to 1991. Con Edison cogenerates about 80% of the steam demand, and the steam substitution measure makes appropriate use of the available capacity. When the Enlightened Energy C&I Rebate Program was initiated in 1989, the vast majority of the program savings were attributed to the steam air conditioning measure.

## TRANSFERABILITY

Naturally the use of fuel substitution may be less straightforward for utilities that provide only electricity. In implementing a fuel substitution program, utilities that provide single fuel service have more complex regulatory and incentive requirements than multi-fuel utilities like Con Edison.

All other aspects of the program, however, are transferable, and other utilities, be they electric, gas, or steam, could easily and most likely beneficially incorporate some aspect of the Enlightened Energy C&I Rebate Program into their DSM plan.

# Regulatory Incentives and Shareholder Returns

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On April 19, 1991 the Public Service Commission of the State of New York (NYPSC) issued an order approving revisions to Con Edison's DSM rate incentive plan for the 1991 and 1992 program years. The previous plan compensated Con Edison for DSM program expenditures and net lost revenues due to DSM-related sales reductions. The plan also allowed Con Edison to earn an incentive bonus equal to 5% of the net resource savings produced by its DSM activities each year. The revised plan provides an incentive representing an adjustment to Con Edison's overall return on equity.

Under the revised incentive plan, "net resource savings" is defined as the net present value (NPV) to the utility of the cumulative lifetime effects of DSM measures installed during a single program year. The value is determined by adding the avoided capacity costs, the avoided energy costs, and the value of the environmental benefits which are attributable to the utility's DSM program, and subtracting the annual DSM program cost. A 9.8% discount rate is used to calculate the NPV.

The revised DSM rate incentive plan includes both incentives and penalties which are based on energy savings as well as net resource savings achievements. The plan sets goals for the cumulative energy and cumulative net resource savings for Con Edison's DSM programs. The value of the incentive or penalty is based on Con Edison's ability to meet these goals. The achieved energy and capacity savings are based on predetermined, measure-specific savings levels and actual customer participation in DSM programs. Post-installation evaluations of actual savings are used to adjust the measurement criteria for the following program year.

The value of the incentive is expressed in terms of "basis points." Basis points are calculated by a matrix which expresses the relationship between the percentage of the cumulative energy savings goal achieved and the percentage of the cumulative net resource savings goal achieved. The matrix is arranged in such a way as to yield positive basis points, and thus an incentive, when Con Edison achieves at

least 40% of its cumulative DSM energy savings goal and to yield negative basis points, and thus a penalty, when Con Edison achieves less.

Both the incentive and the penalty are capped. Con Edison earns its maximum incentive of 48 basis points if it achieves 110%, or greater, of both goals. Con Edison is assessed its maximum penalty of -25 basis points if it achieves 0% of both goals. At 100% of both goals, Con Edison earns 40 basis points. For DSM programs conducted in 1991, 40 basis points is equivalent to \$22 million [R#11], or 13.8% of the projected NPV of the net resource savings. For programs conducted in 1992, this performance level will earn Con Edison 11.8% of the NPV of the net resource savings.

Accurate and timely DSM program evaluations form an important aspect of this incentive plan. They provide the means by which Con Edison increases the accuracy of its estimates of achieved savings for each upcoming program year. For this reason, the continued application of this plan is dependent upon Con Edison conducting the appropriate evaluations of its programs. Con Edison is required to submit detailed schedules for evaluating its DSM programs as well as evaluation progress reports to the NYPSC and to hold evaluation progress meetings with NYPSC staff twice each year.

Note: Shortly before publication of this profile, the NYPSC approved a revised DSM rate incentive plan for the 1993-1994 program years. This revision eliminates the matrix structure and bases the incentive or penalty only on net resource savings achievements. It is expected that the new plan will be more simply administered than the one for 1991-1992 discussed above.

All of the above from [R#10], except where otherwise noted.

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