
Pacific Gas & Electric Commercial New Construction Profile #33, 1992

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Executive Summary

PG&E first offered its Commercial New Construction program in May 1990 in an effort to encourage the design and construction of new nonresidential buildings that exceed the California Energy Commission's Title 24 standards by 10% or more. (Note that under the California energy code major remodels qualify as "new" construction.) The program is designed to supplement Title 24 standards, increase market acceptance of advanced energy-efficient building technologies and materials, and prevent lost opportunities in new building construction. PG&E provides information assistance to help builders, architects, engineers, and developers early in the planning and design stages of new commercial buildings to maximize the level of achievable savings. In addition, PG&E provides financial incentives to program participants. Rebates of up to 100% of the incremental cost for demonstrated improvements over Title 24 standards are available in the following building categories: lighting, high performance glazing with daylighting, motors and adjustable speed drives, cooling, and energy-efficient refrigeration.

Given the time lag between building design and actual construction, savings are presented each year in terms of "actual" for which rebates are paid, and "committed." In 1991, the program's first full year, PG&E attributed 6.8 MW in actual demand savings and 19.4 MW in committed demand savings to the Commercial New Construction program. Actual energy savings in 1991 were 24.3 GWh and committed energy savings were 72.3 GWh. Incentive payments totalling \$1,460,900 were paid out in 1991, while committed payments topped \$6 million.

In July of 1992, the California energy code was revised and clarified and allows for prescriptive and performance-based methods of compliance. To match the new energy code requirements, PG&E introduced three new program tracks that parallel the new code compliance requirements and which offer cash incentives for exceeding Title 24 efficiency standards for new construction. The new programs represent an evolution of the PG&E's original Large and Small Commercial New Construction Incentive Programs which started in 1990. Two of the three new program tracks are prescriptive methods, the "Prescriptive Express Program" and "Prescriptive Plus", both of which require installation of specific energy-efficient technologies. The third track is a performance method called the "Performance by Design Program", and requires using California Energy Commission computer modeling to establish an allowed energy budget for a new building from which PG&E can determine the incentive appropriate for marginal improvements above the California Energy Code.

Commercial New Construction Program

Utility: Pacific Gas and Electric Company

Sector: Commercial

Measures: Lighting, high performance glazing with daylighting, efficient motors and adjustable speed drives, energy efficient cooling and refrigeration.

Mechanism: Rebates and technical assistance

History: Began May 1990, modified in 1992.

1991 Program Data

Energy savings: 24.3 GWh

Lifecycle energy savings: 413 GWh

Capacity savings: 6.78 MW

Cost: \$3,281,900

Cumulative Data (1990-1991)

Energy savings: 25.4 GWh

Lifecycle energy savings: 419 GWh

Capacity savings: 6.86 MW

Cost: \$4,142,900

Participation rate: ~ 20 - 30%

Conventions

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

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

Utility Overview

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

Electric sales exceed gas sales and represent 75% and 25% respectively of the company's total operating revenues. In 1991, PG&E's electric sales volume increased slightly compared to 1990, to 74,195,890 MWh. During the same year, as a result of the restructuring of the gas industry whereby large customers can purchase from any source they want, gas sales dropped, though throughput remained essentially constant, as PG&E began shifting its focus from gas sales to expanding its gas transmission capability.

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

1991 PG&E SOURCES OF ELECTRICAL ENERGY

PG&E Owned

Hydro	7.6%
Natural Gas	22.5%
Oil	0.2%
Geothermal	7.2%
Nuclear	15.5%
subtotal	53.0%

Qualifying Facilities

Gas Cogeneration	12.0%
Hydro	1.0%
Geothermal	0.6%
Solar	0.2%
Wind	3.6%
Biomass	2.6%
subtotal	20.0%
Other purchases	27.0%

PG&E 1991 ELECTRIC STATISTICS

Number of Customers	4,257,145
Electricity Sales	74,196 GWh
Revenue from Electricity Sales	\$7.059 billion
Summer Peak Demand	16,630 MW
Generating Capacity	20,312 MW
Average Electric Rates	
Residential	11.11 ¢/kWh
Commercial	10.21 ¢/kWh
Industrial	6.90 ¢/kWh
Agricultural	9.66 ¢/kWh

In 1991 PG&E's electricity supply came from three general sources: 53% from PG&E owned and operated facilities, 20% from Qualifying Facilities (QF), and 27% from a variety of purchases and other production. A 20% contribution from QFs is relatively large compared to most other utilities and is the result of a deliberate effort by PG&E to diversify its electricity supply and expand the role of renewable energy. The table at left contains a breakdown of the contributions from PG&E-owned facilities and its Qualifying Facilities. The 27% that is mostly purchased power is not broken down by energy source because of the complicated nature of these purchases. [R#1,2]

Utility DSM Overview

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

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

CURRENT DSM PROGRAMS AT PG&E

RESIDENTIAL

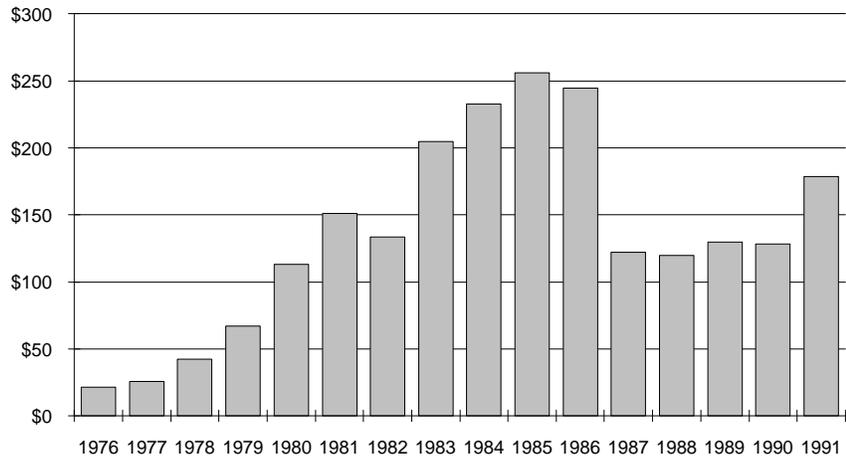
- New Construction Program
- Appliance Efficiency Incentives Programs
- Direct Assistance for Low-income Customers
- Energy Management Services
- Information Programs

NONRESIDENTIAL

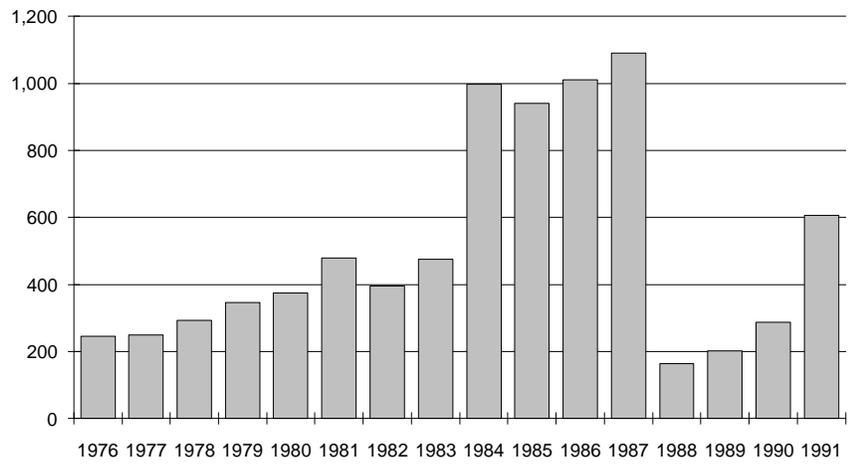
- Commercial New Construction Program
- Nonresidential Energy Efficiency Incentive Retrofit Program
- Customized Electric Rebates
- Customized Gas Rebates
- Commercial Market Sector Pilot Projects
- CIA Energy Management Services
- Load Management Programs
- Fuel Substitution
- Load Retention and Load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

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

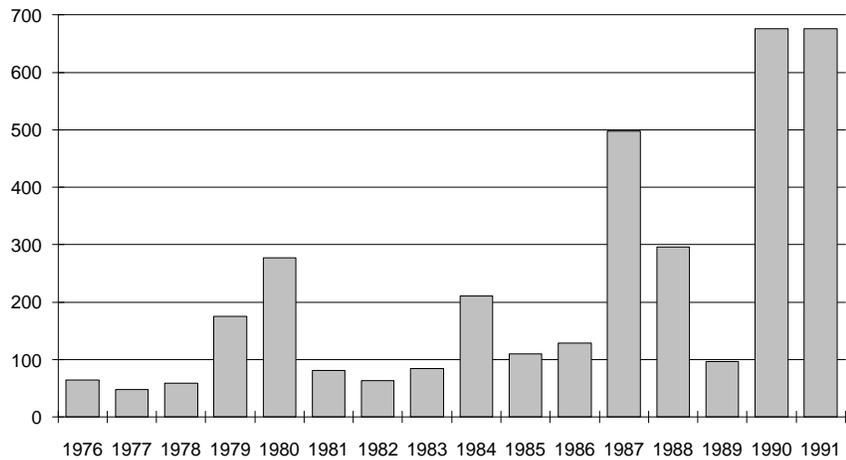
**ANNUAL DSM
EXPENDITURE
(\$1,000,000)**



**ANNUAL ENERGY
SAVINGS (GWH)**



**ANNUAL CAPACITY
SAVINGS (MW)**



Program Overview

PG&E first offered its Commercial New Construction program in May 1990 in an effort to encourage the design and construction of new or remodelled nonresidential buildings that exceed the California Energy Commission's Title 24 standards by 10% or more. PG&E provides financial incentives and technical and information assistance to program participants. The program's goals are multifold: It is designed to supplement Title 24 standards, increase market acceptance of advanced energy-efficient building technologies and materials, and prevent lost opportunities in new building construction. PG&E provides information and technical assistance to help builders, architects, engineers, and developers early in the planning and design stages of new commercial buildings to maximize the level of achievable savings.

While the program appears to be focused primarily on new construction, in practice a large fraction of the projects completed and committed through the program are "major" remodels, as defined by the code. In several of California's cities, notably San Francisco, the commercial real estate market is overbuilt and thus much of the "new construction" involves complete overhauls of existing structures. For 1993, for example, Peter Turnbull, the program's Sales Manager, estimates that there may be a half a million square feet of new commercial construction in San Francisco, while tenant remodels may account for about 3.5 million square feet of activity. Thus CNC has been necessarily focused on the remodel market as well as more traditionally-defined new construction. In other parts of PG&E's service territory these percentages are different. Overall, about 40% of the program's activity is related to remodels. [R#6]

The CNC provides rebates for demonstrated improvements over Title 24 standards for the following building categories: lighting, high performance glazings, daylighting, motors and adjustable speed drives, cooling, and energy-efficient refrigeration. PG&E's guideline for determining rebate levels is not to exceed 100% of marginal costs, though this sometimes occurs. Typical rebate levels, however, are on the order of 50% of the marginal cost of the energy-efficient equipment. [R#6]

Program savings, which began in earnest in 1991 though the program began in 1990, for the Commercial New Construction program are reported in two ways. First, are actual savings. Second are savings that will result from "committed" projects. (Committed projects are those projects

that have applied for rebates and have been sent a letter of confirmation by PG&E. Naturally, with new construction delays result in actual savings over time.) In 1990 a mere \$21,715 was paid out in incentives for actual savings, though over \$2.2 million was committed and the funds for these projects "encumbered" for future payment.

There is a lag time up to several years between the time PG&E commits (encumbers) the incentive to the customer and when the customer is paid. This lag time is dictated by construction or remodel of the building. Typical lag time is one year for a small retail store and up to four years for a large high-rise office building. Funds encumbered in 1990 will be carried forward to pay the customer upon completion of the project.

In 1991 PG&E attributed 6.8 MW in actual demand savings and 19.4 MW in committed demand savings to the Commercial New Construction program. Actual energy savings in 1991 were 24.3 GWh and committed energy savings were 72.3 GWh. Incentive payments totalling \$1,460,900 were paid out in 1991. For 1992 a market penetration of 32% of new commercial square footage, and 30% of refrigerated warehouses built each year was projected for the Commercial program. [R#3,6]

In July of 1992, PG&E refocused the CNC program to parallel the modifications to the California State Energy Code. (The code was primarily changed to facilitate compliance; in most cases standards were not quantitatively changed.) As a result of the changes in compliance methods, CNC introduced three new programs that offer cash incentives for exceeding Title 24 efficiency standards for new construction. (The new programs, which are planned to run through 1995, supersede the original Large and Small Commercial New Construction Incentive Programs which were introduced in 1990.) Two of the three programs are prescriptive methods: the "Prescriptive Express Program" and "Prescriptive Plus." Prescriptive methods require the installation of specific energy-efficient technologies. The third program track is a performance-based method called the "Performance by Design Program." This method requires using California Energy Commission (CEC) computer modeling to establish an allowed energy budget for a new building.

Implementation

MARKETING

PG&E uses a variety of means of marketing the Commercial New Construction Program. The most successful are selective marketing tactics that leverage the utility's credibility and financial position with its customer base. Overall, the direct contact approach has been the most successful and provides the best chance of getting to the facility designers before completed plans are drawn.

- Wherever possible PG&E use existing relationships with customers to promote the program. PG&E's field representatives can track any new construction being considered or carried out by an existing customer and get these customers into the CNC process right away.

- PG&E's CNC staff have focused their attention on leveraging their efforts to market CNC through the local design community. They routinely attend ASHRAE and BOMA and IES meetings where they make presentations and engage in information discussions with potential targets for the program. By making architects, engineers, lighting designers, and interior designers aware of the program, these "trade allies" that constitute the local design community can assist in promoting the program to the ultimate customers. In 1992, PG&E staff conducted seminars for their customers on how to comply with the modified Title 24 construction standards which will be mandatory for commercial buildings starting in January 1, 1993.

- Perhaps the most sophisticated means of contacting the developers of new construction projects is by using services like the F.W. Dodge reports that document new construction activity. These national services provide leads

for PG&E's corporate headquarters staff. The staff then make direct contacts and inform the developers of the program's incentives. Currently PG&E has a staff of eight devoted to chasing leads by geographic region and types of businesses. (Staff note that finding the right reports from these national services is challenging. The reports typically contain too much data – a problem nearly as vexing as too little data.)

- PG&E also get leads from service hookup applications as customers must apply for new electrical service well in advance of construction. Unfortunately this is usually too late to influence the design of a new building and the equipment specified for the building.

- The CNC program has also benefitted from its interface with another PG&E program: the Pacific Energy Center located in San Francisco. CNC, as well as other programs, offer the use of the auditorium there to relevant trade associations as a no-cost, central meeting space. Once architects and developers and the like meet there, they are influenced by materials on display at the Center and are able to get materials that outline the incentives offered by all PG&E programs.

- PG&E has also developed several attractive brochures which describe the program's three tracks and present compelling case studies. The case studies specifically mention the designers of the facilities presented. Designers have been particularly attracted to these glossy materials and use them as marketing tools for their own services. The brochures provide a value-added element to the designers. One design firm recently requested 300 copies of one brochure. PG&E willingly fulfilled the request as a means of promoting the program. Two case studies are complete at the time of this writing; a set of six will be complete by the end of the year.

- PG&E has also established an 800 telephone number for customer requests for information for all of its DSM programs. By using different extensions for the various

Implementation (continued)

programs, knowledgeable staff will respond to these incoming phone calls and are able to send further information and follow-up accordingly.

- Based on its experience with other commercial and industrial programs, PG&E has found that conventional marketing strategies such as direct mail and advertisements have been much less successful than more aggressive, one-on-one techniques. For residential programs, advertisements, bill stuffers, and the like are effective, but for the larger customers they are not and thus are generally not pursued. PG&E does use these techniques periodically, since they are quick and easy to implement, but certainly does not rely on them to market the program. [R#6]

DELIVERY

Once leads are generated and contacts are made there are a number of ways that PG&E can assist developers in building efficiently. Often CNC staff sit down with developers and discuss generic technical options for lighting and HVAC efficiency. During these discussions specific classes of technologies are considered, but the staff must stop short of specifying specific products as this has proven to be an area plagued by claims of conflict of interest.

There are currently three program tracks for PG&E's customers to participate in the Commercial New Construction Program:

1. The Prescriptive Express Program, as its name implies, is the quickest and most simple incentive program for buildings that are less than or equal to 30,000 square feet in size and that pays up to \$15,000 in cash incentives for specific lighting and air conditioning equipment.

The incentive levels for lighting are based on reducing the lighting power density (LPD) below Title 24's allowed level. LPD is calculated by dividing actual lighting power wattage by the square footage of the area. The two levels of cash incentives for lighting correspond to LPD reductions of 20 and 30 percent. (Note that while PG&E recognizes the efficacy of T-10 fluorescent lamps, for example, the utility gives rebates only for T-8 lamps under Prescriptive Express. Customers can use Prescriptive Plus for more complex technology options.)

Air Conditioning equipment that qualifies for the program is specified by PG&E and can be identified by installers through a toll-free number. Incentives are determined by cooling design output in tons, system type, and system efficiency. Thus, cash incentives vary from \$25 to \$110 per ton depending on the air conditioning system installed. [R#9]

2. Prescriptive Plus is designed for new commercial buildings of any size and pays cash incentives for a wide variety of energy-efficient technologies on a component by component basis. Incentives vary depending on the measures installed, which include exterior glazings, mechanical upgrades, lighting efficiency, and refrigeration efficiency. [R#8]

3. The Performance by Design Program offers cash incentives for commercial buildings of any size that reduce annual energy use 10% or more below the Title 24 Energy Budget. The method requires using a CEC-certified computer program to demonstrate compliance. The computer analysis compares proposed design to the standard design and creates an output report and identifies two numbers: the Energy Budget and the estimated annual energy use for the building. The two numbers are compared to determine the percentage by which a given building's energy use will be reduced below the Energy Budget. That percentage determines the incentive level achieved through energy savings. The total incentive amount is based on the rebates available as well as the time of use: on-peak, partial peak, or off-peak. [R#7]

Of the three tracks available for new construction projects PG&E projects that the prescriptive programs will account for 80-90% of the activity and 70% of the program's dollars spent and committed. Larger projects will likely be the ones that take advantage of the Performance by Design Program. [R#6]

PG&E COMMERCIAL NEW CONSTRUCTION PROGRAM 1992 REBATE AMOUNTS (IN 1992\$)

Prescriptive Express

Air Conditioning	
Air-cooled A/C system	\$25 - \$ 70/ton
Water-cooled A/C system	\$35 - \$110/ton
Air-source heat pump	\$25 - \$ 70/ton
Water-source heat pump	\$35 - \$105/ton
Lighting	
Fluorescent fixtures	\$6 - \$40/fixture
Hardwired compact fluorescent fixtures	\$3 - \$15/fixture
Compact and standard HID fixtures	\$15 - \$60/fixture
LED and electroluminescent exit signs	\$25 - \$35/fixture

Prescriptive Plus

Mechanical	
High performance glazing	\$1/sq. ft. of glazing area
Electronic adjustable speed drives	\$20 - \$50/hp
Carbon dioxide sensors	\$150 each
Package unitary and split-system A/C	\$22 - \$178/ton
Built-up air conditioning systems	
Cooling towers	\$5 - \$80/ton
Evaporative condensers	\$50 - \$130/ton
Chillers	\$40 - \$137/ton
Air distribution systems	\$0.07 - \$0.30 watt/CFM
Energy-efficient motors	\$10 - \$800
Low-loss transformers	\$3/KVA
Lighting	
Energy-efficient lighting	\$0.03 - \$0.75/sq. ft.
Lighting controls	\$0.03/controlled watt
Energy-efficient exit signs	\$25 - \$35/fixture
Refrigeration	
Evaporative condensers	\$60 - \$230 / 12,000 Btu of THR load
Air-cooled condensers	\$40 - \$90 / 12,000 Btu of THR load
Floating head pressure	\$20 - \$34/ton
Electronic ASD compressors	\$20/ton
High eff. evaporator fan / PSC motors	\$4/linear foot of case
Multiplexed compressor systems	\$30/ton
Energy-efficient display lighting	\$ 5 - \$ 6/linear foot
Medium-temperature reach-in doors	\$15 - \$30/linear foot
Low-temperature reach-in doors	\$10 - \$20/linear foot

[R#8,9]

Implementation (continued)

MEASURES INSTALLED

Under the Prescriptive Express Program, the most popular of the tracks due to the large number of smaller commercial buildings built and remodelled each year, incentives can be received for the installation of lighting and HVAC measures outlined in the following rebate schedule table. Most of the activity to date has been with lighting measures. HVAC measures have been limited to packaged HVAC systems.

The Prescriptive Plus Program, whose rebates are also outlined in the table, offers a host of incentives for a wide variety of measures that fit under the following categories: building envelope, mechanical systems, lighting components, and supermarket refrigeration. Envelope measures eligible for rebates include high performance glazings with low shading coefficients and high visible light transmittance. For mechanical systems rebates are available for adjustable speed drives (ASDs) installed on HVAC fans and pumps; carbon dioxide sensors that control fan system operations; cooling towers and evaporative condensers for air and water-cooled systems; energy-efficient air distribution systems; energy-efficient motors; and low-loss transformers. To improve lighting efficiency PG&E offers rebates for a variety of types of energy-efficient lighting systems including exit signs and lighting controls. For supermarket refrigeration rebates

are available for evaporative and air-cooled condensers, floating head pressure reduction, electronic adjustable speed driven compressors, high efficiency evaporator/fan permanent split capacitor motors, multiplexed compressor systems, energy-efficient cases and box display lighting, medium-temperature reach-in doors, and low-temperature reach-in doors for display cases. [R#7]

Currently no gas saving measures are available for rebates.

STAFFING REQUIREMENTS

According to Peter Turnbull, the Commercial New Construction Program depends on approximately 15 staff at the corporate offices and another 20 full-time equivalents in the field.

In addition to the program manager there are eight employees who actively promote the program and track marketing leads to enjoin participants. The program also has administrative support staff and benefits from PG&E's program planning unit and monitoring and evaluation unit.

In terms of field staff, each of PG&E's twenty-five regional division offices has one commercial and industrial contact representative who deals with service aspects of the program. [R#6]

Monitoring and Evaluation

MONITORING

Pacific Gas and Electric has a five part measurement and evaluation procedure which it applies to all of its DSM programs: 1. Program evaluation includes implementation of the 1990-92 measurement plans adopted by the California Public Utilities Commission to validate and/or refine energy savings estimates of Conservation and Energy Efficiency (CEE) programs. 2. Load metering consists of end-use and whole building load metering activities. The majority of those activities supports PG&E's plan to meet the California Energy Commission's data collection and reporting requirements. 3. New technology assessment includes both shared new-technology development efforts and special purpose data collection projects. 4. Customer surveys involve market research activities that support PG&E's plan to meet the California Energy Commission's data collection and reporting requirements. 5. Additional activities refers to forecasting, CPUC compliance, and economic analysis.

In 1991, PG&E spent a total of \$18.6 million on the above measurement and evaluation activities. Expenditures for each activity were: \$3.9 million for program evaluation; \$5.5 million for load metering; \$2.9 million for new technical assessments; 5.3 million for customer surveys; \$1.0 million for additional activities. For 1993, PG&E has filed plans that are likely to be approved for its company-wide monitoring and evaluation activities to cost \$27 million. [R#6]

EVALUATION

For the Commercial New Construction program PG&E has completed a scoping study to define a detailed action plan and methodology for estimating kW and kWh savings and the net-to-gross impacts of the CNC program. A Comprehensive CNC Evaluation based on the action plan developed in the scoping study is due out in June of 1993. [R#13] The study will provide on-site assessments of completed buildings as well as an integrated analysis of the metering, survey and billing data. [R#3]

DATA QUALITY

In June of 1991, PG&E completed what it called a Phase I Engineering Study for the CNC program. The study reviewed the engineering assumptions underlying estimates of energy savings for the CNC programs. Several activities were performed:

1. Determination of those measures and parameter estimates that have the largest impacts on energy-savings calculations and that are most uncertain. The study found that high potential energy-savings measures with high uncertainty for savings included adjustable speed drives, chiller reset controls, air cooled air conditioning units, and oversized condensers and cooling towers.

2. A detailed review of published sources of engineering assumptions, along with recommendations as to the most appropriate values to be used.

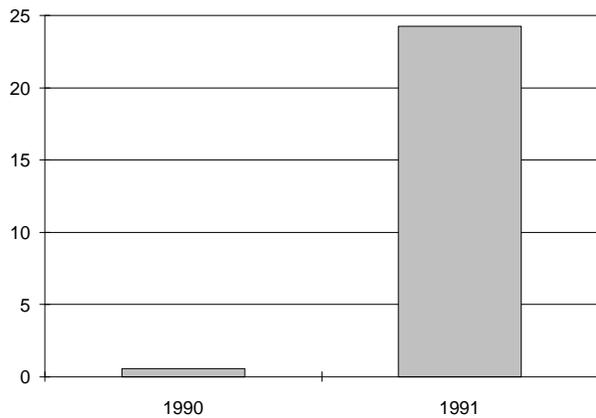
3. The sensitivity of assumptions about energy savings to variations in occupancy type and climate region were refined through simulation of prototype buildings. This sensitivity analysis is useful to program planners who must determine whether the variation in savings estimates between climate zones and/or occupancies are substantial enough to influence their calculations.

The study showed that overall, PG&E's engineering assumptions are conservative. The exceptions were that hours of operation were overestimated for cooling and lighting fixtures. As a result, PG&E has revised the hours of operations for energy savings estimates for several building types. [R#3]

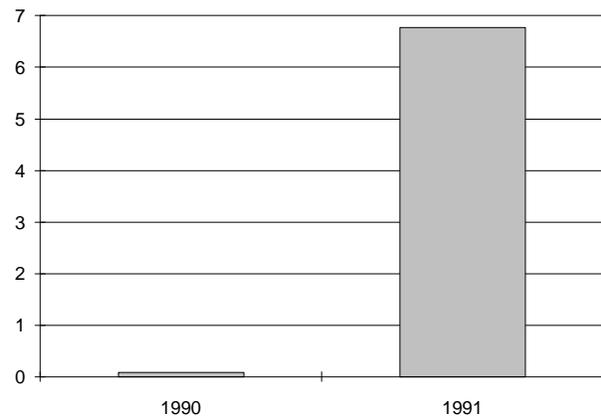
Program Savings

Savings Overview Table	Annual Energy Savings (MWh)	Cumulative Energy Savings (MWh)	Lifecycle Energy Savings (MWh)	Annual Capacity Savings (MW)	Cumulative Capacity Savings (MW)
1990	551	551	5,403	0.80	0.80
1991	24,276	24,827	413,297	6.78	6.86
Total	24,827	25,378	418,700	6.9	

ANNUAL ENERGY SAVINGS (GWH)



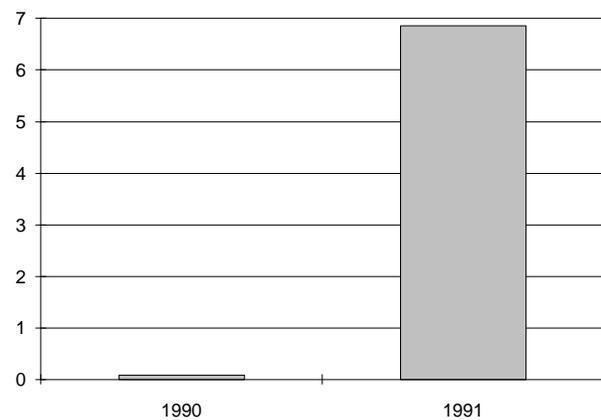
ANNUAL CAPACITY SAVINGS (MW)



CUMULATIVE ENERGY SAVINGS (GWH)



CUMULATIVE CAPACITY SAVINGS (MW)



Savings for the CNC program are presented in this profile for completed projects and for committed projects. Committed savings represent savings for customers with signed commitments to improve energy efficiency, but who did not complete all planned activities in the given year and thus had not received the PG&E incentive during that particular year. Incidentally, PG&E pays rebates for equipment as it is installed. Thus HVAC system rebates, for example, are typically paid in advance of lighting retrofits.

To date the CNC program has resulted in paid total annual energy savings of 24,827 MWh and total lifecycle energy savings of 418,700 MWh. In terms of capacity the program has resulted in savings of 6.9 MW. For committed projects, the program has resulted in 118.5 GWh of total annual energy savings, total lifecycle savings of 1,622.8 GWh, and 31.4 MW. [R#6]

In 1990 the Commercial New Construction program's paid projects, of which there were only three, resulted in energy savings of 551 MWh and lifecycle energy savings of 5,403 MWh. In terms of capacity the program accounted for 0.1 MW in savings, though the committed level was 12.1 MW. [R#6]

In 1991 actual energy savings were 24.276 GWh and committed energy savings were 72.3 GWh. Paid lifecycle energy savings for the CNC program in 1991 were 413.3 GWh. In 1991 CNC provided 6.8 MW in actual demand savings and 19.4 MW in committed demand savings to the Commercial New Construction program. Two weeks prior to year end 1992, PG&E estimates actual energy savings of 53 GWh, and 13.5 MW in demand reductions, based on about 155 projects though PG&E expects to award rebates for some 165 projects in 1992. In addition, PG&E expects to sign up about an equal number of committed projects for 1992. [R#6]

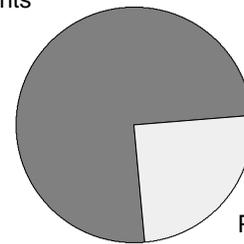
PARTICIPATION RATES

Commercial new construction programs are necessarily front-loaded. At the onset participation is low and costs are high; later participation grows making the program look highly cost-effective. The New Construction Program had only three projects that were complete and paid for in 1990,

Customer Participation Table	Applications Paid	Annual Energy Savings per Application (kWh)
1990	3	183,667
1991	72	337,167
Total	75	

but 60 additional projects were committed that year. In 1991 there were 72 paid projects and 137 committed projects. According to Peter Turnbull, for 1992 and subsequent years, PG&E expects to increase actual rebates by 50% each year, representing a significant "ramping up" of program participation. [R#6]

Non-Participants (~75%)



Participants (~25%)

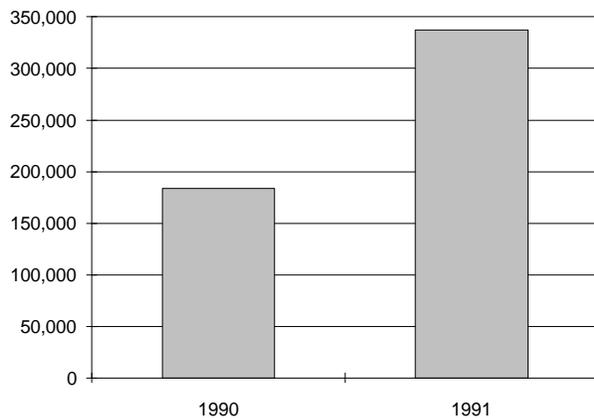
There are at least two ways to define the participation rate for a new construction program such as CNC. The first is highly qualitative. How many customers have made decisions to improve the efficiency of their new facilities based on discussions with PG&E representatives or because of the mere existence of the program? This is hard to tell without detailed survey work that PG&E has not completed for the program though it is likely that upwards of 50% of all new commercial construction is directly or indirectly influenced by CNC and other PG&E efficiency initiatives.

Second, and most accurate, would be an assessment of the square footage of new commercial construction that has been awarded incentives as a fraction of the total square footage of commercial construction within PG&E's service

Program Savings (continued)

territory in the same year. Although PG&E can access tax valuation documents for new construction, without a detailed survey and analysis getting the total square footages is impossible. Peter Turnbull suspects that the program currently provides incentives for 20-30% of all new commercial square footage. The program's goal for 1995 and beyond is to provide incentives for 50% of all new commercial space in its service territory.

SAVINGS PER PARTICIPANT (KWH)



SAVINGS PER PARTICIPANT

In terms of energy savings per participant, or more accurately per application paid, the 1990 value was 183 MWh and the 1991 value was 337 MWh. These numbers, however, must be used with a great deal of caution since some projects are very large, and others quite small.

MEASURE LIFETIME

The PG&E New Construction Program offers a wide variety of installed measures with varying lifespans. For 1990 PG&E assumes a 9.61 year weighted lifetime, for 1991 the average lifetime for installed measures was 16.18 years. These average lifetimes are used to calculate lifecycle savings and the cost of saved energy for their respective years.

PROJECTED SAVINGS

For each year subsequent to 1991, PG&E expects to increase the costs, savings, and participation of the program by about 50%. In 1992, PG&E projects that it will spend a total of just under \$4 million for rebates and reap 13-14 MW in demand savings and about 50 GWh in energy savings. The same proportional increase is expected in 1994 and 1995. [R#6]

Cost of the Program

To date the CNC program has resulted in incentive expenditures of \$1,482,600, of which only \$21,715 was expended in 1990 and the balance, \$1,460,900, was awarded in 1991. The total program cost for 1990 was \$861,000, though committed projects accounted for an additional \$2,251,100. Note that administrative costs were \$839,300 of the total program cost of \$861,000 in 1990, or 95% of the total.

In 1991 the program cost a total of \$3,281,900 with \$1,821,000 paid for administration and \$1,460,900, or 45%, being paid as rebates. In 1991, an additional \$6,161,100 was committed. [R#2]

COST EFFECTIVENESS

PG&E calculates the total resource cost test value for CNC at 4.73 for 1991, and the rate impact measure test of 0.83.

The Results Center calculates the cost of saved energy for each program profiled using a range of discount rates. For the startup year, 1990, the cost of saved energy at a 5% real discount rate was just over 20 ¢/kWh. As anticipated, this fell dramatically to 1.24 ¢/kWh in 1991 and will likely level off, or even decrease, for the next several years.

COST PER PARTICIPANT

Since the New Construction Program had only three paid projects in 1990, the average total cost per participant was

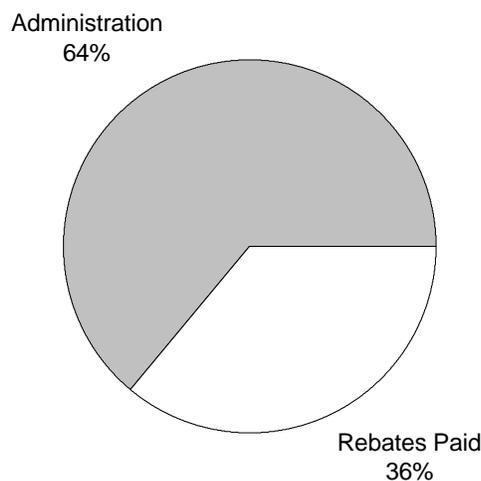
a whopping \$287,000! By 1991 this value had fallen to \$45,582. [R#2] (The largest incentive awarded was to Pacific Bell, \$411,000, for a data processing center. [R#6])

FREE RIDERSHIP

PG&E reports that it is very difficult to address free ridership for the CNC program, but that it might be negative! Since PG&E has designed the program to track and even promote California's Title 24 building standards, it may be true that the program has created a phenomenon that is the opposite of free ridership: free drivership. In other words, the program has driven the market, has driven awareness of the potentials for energy efficiency, to such an extent that developers and architects are designing to higher levels of efficiency that they would have in the absence of the program, even without incentives available! [R#6]

COST COMPONENTS

While our norm is to present program costs as disaggregated as possible, PG&E's database allows us a quick look at incentive costs and all other costs associated with the program including overhead, marketing, evaluation, and other associated costs. To date 64% of the program's costs have been expended to administer the program while 36% have been expended for rebates paid. Ultimately, Peter Turnbull expects the ratio of overhead to incentives to level off at about 50:50. [R#6,14]

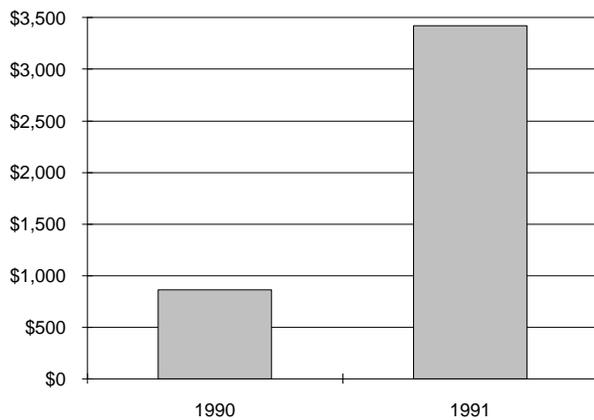


Cost of the Program (continued)

Costs Overview Table	Administration (x1000)	Rebates Paid (x1000)	Rebates Committed (x1000)	Total Program Cost (x1000)	Total Spent and Committed (x1000)	Cost per Application
1990	\$839.3	\$21.7	\$2,251.1	\$861.0	\$3,112.1	\$287,000
1991	\$1,821.0	\$1,460.9	\$6,161.1	\$3,281.9	\$9,443.1	\$45,582
Total	\$2,660.3	\$1,482.6	\$8,412.3	\$4,142.9	\$12,555.2	

[R#2]

TOTAL PROGRAM COST (x1,000)



COST PER PARTICIPANT



Cost of Saved Energy Table (¢/kWh)	Discount Rates						
	3%	4%	5%	6%	7%	8%	9%
1990	18.62	19.57	20.54	21.53	22.55	23.59	24.65
1991	1.07	1.15	1.24	1.33	1.42	1.52	1.62

INSTALLATION CASE STUDY: THE BEL AIR MARKET

The case of the Bel Air Market in Rocklin, California offers some convincing reasons to incorporate energy efficiency into new construction. One of these reasons was the \$18,280 cash incentive that PG&E provided to the market's developer. Another is the benefit to the environment as a result of saved energy and reduced emission of greenhouse gases. A third reason, and perhaps the most compelling reason, are the annual energy bill savings of \$47,000 that support the company's bottom line.

The Bel Air Market achieved these benefits by using energy-efficient lighting, motors, cooling, and refrigeration equipment. The market is fitted with skylights to provide shoppers with natural light. When the weather is overcast, photosensors automatically turn on fluorescent lighting systems to compensate for decreased daylighting. Because cool air spills from refrigerated cases in a market, Bel Air's space cooler air returns are located under the floor. Combined with efficient, oversized condensers, the air conditioning system for the coolers have a low overall energy demand. [R#10]

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%	54,715,000	1,298,000	262,000	26,000
B	10,000	1.20%	58,344,000	502,000	169,000	126,000

Controlled Emissions

A	9,400	2.50%	54,715,000	130,000	262,000	2,000
B	10,000	1.20%	58,344,000	50,000	169,000	8,000
C	10,000		58,344,000	335,000	167,000	8,000

Atmospheric Fluidized Bed Combustion

A	10,000	1.10%	58,344,000	154,000	84,000	42,000
B	9,400	2.50%	54,715,000	130,000	105,000	8,000

Integrated Gasification Combined Cycle

A	10,000	0.45%	58,344,000	103,000	17,000	42,000
B	9,010		52,482,000	37,000	13,000	3,000

Gas Steam

A	10,400		31,824,000	0	73,000	0
B	9,224		27,637,000	0	173,000	8,000

Combined Cycle

1. Existing	9,000		27,637,000	0	106,000	0
2. NSPS*	9,000		27,637,000	0	50,000	0
3. BACT*	9,000		27,637,000	0	7,000	0

Oil Steam--#6 Oil

A	9,840	2.00%	46,061,000	698,000	82,000	78,000
B	10,400	2.20%	48,853,000	692,000	104,000	50,000
C	10,400	1.00%	48,853,000	99,000	83,000	26,000
D	10,400	0.50%	48,853,000	290,000	104,000	16,000

Combustion Turbine

#2 Diesel	13,600	0.30%	61,136,000	122,000	189,000	10,000
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Refuse Derived Fuel

Conventional	15,000	0.20%	72,581,000	187,000	246,000	55,000
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Avoided Emissions Based on 25,378,000 kWh Saved (1990-1991)

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

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

HOW TO USE THE TABLE

1. The purpose of the previous page is to allow any user of this profile to apply PG&E's level of avoided emissions saved through its Commercial New Construction 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.

* Acronyms used in the table

TSP = Total Suspended Particulates

NSPS = New Source Performance Standards

BACT = Best Available Control Technology

Lessons Learned / Transferability

LESSONS LEARNED

The key lessons learned at PG&E for the CNC program are already embedded in this profile. Since the CNC program is young, its program managers have been able to allow it to evolve quickly to maximize its effectiveness. For example, when the program began it did not exactly parallel the state energy code. This was quickly changed. In addition, the three program tracks discussed in this profile represent an important evolution of the program based on a key lesson learned in the program's early months: PG&E must make it clear and as easy as possible to participate in the program.

Peter Turnbull, who has been involved in the program's design since its inception in 1990, notes that program planners need to allow time for the design community to become informed about any program and particularly a new construction program. Planners need to realize what a difficult task this is despite a range of marketing and promotion efforts. Convincing a customer to participate not only requires PG&E's representatives to be in the right place at the right time, but also may require thousands of dollars worth of staff time just to convince the customer to do something.

Turnbull has found that it takes at least three years for a program such as CNC to mature and become institutionalized in the design community. The program's costs are front-loaded, as high startup costs are paid in advance of savings. He notes that costs and savings are countervailing trends, and that a "steady-state" will likely be achieved after 3-5 years of program implementation. Thus as startup costs decline, program savings rise.

Another key lesson learned is that mass marketing is basically ineffective for this type of program. Unlike attracting residential customers, commercial accounts need one-on-one contact, and this is a challenging task for utilities, especially for new construction projects of companies that are not already located in a utility's service territory. Marketers must chase leads and work the network, giving talks and "rubbing shoulders", and this requires diligent and persistent effort that is timely and costly.

TRANSFERABILITY

Since the CNC program has been designed to work in parallel with California's state energy code, Title 24, a fundamental element of its transferability is whether a utility that plans to offer such a program has an energy code to work with. If it does, a program quite similar to PG&E's can be transferred. Without an energy code, the program would have to be designed differently. Without a code the design community may not be as able to deal with the levels of efficiency that PG&E has been able to put in place. However, there is no reason that a program could not be put in place without a code. This would necessitate developing a baseline of efficiency above which incentives would be provided.

Regulatory Incentives and Shareholder Returns

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

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

In 1991 PG&E CEE resource programs generated actual first-year energy savings of 104 MW, 518 GWh, and 23 million therms. As a result these programs generated net benefits which would result in \$58 million in shareholder earnings. PG&E, however, claimed \$47.4 million, slightly less than the earnings cap established for the year by the CPUC. [R#3]

For the Commercial New Construction Program in 1991 the total recorded utility expense was \$3,484,000 with \$30,000 in reallocated administrative cost for an adjusted utility program expense of \$3,514,000. The utility claimed an incentive for the program of \$2,974,000 while the total program benefit (over time) is estimated to be \$19,827,000. [R#3]

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Special thanks to Peter Turnbull for his help in the development of this profile.