City of Austin, Texas
Gas Technologies Program
Profile #94

Executive Summary

The City of Austin's Gas Technologies program is a unique DSM program for a number of reasons. It not only promotes energy efficiency but also accomplishes societal and environmental objectives. The program is made up of five programs that result in saved natural gas and two programs that promote the use of natural gas. While this may seem contradictory, Austin's dual goals are to promote thermodynamic efficiency of energy consumption by using the most appropriate fuel to fulfill the desired task, and to mitigate emissions using a cradle-to-grave approach from the power plant or well-head to the end-use.

The Gas Technologies program is based on a complicated, but fundamentally effective, organizational design. While the City of Austin has its own municipal electric utility, the investor-owned Southern Union Gas has the franchise to serve natural gas to customers within the City. In 1988 the City allowed Southern Union to slightly raise rates within the City limits to cover the costs of the newly-required Gas Technologies program. Currently the program is administered by the City's Environmental and Conservation Services Department which provides all DSM services for Austin.

The seven Gas Technologies programs provide a range of gas DSM services for the residential and commercial sectors as well as for the transport sector. The program also offers a range of societal, economic, and environmental benefits. For instance, low income households qualify for free weatherization services including free space heaters if necessary. All residential customers can receive hot water heater wraps and pipe insulation, again at no charge. For customers replacing or planning to install gas furnaces, rebates have been available for high efficiency models and for gas combination heaters.

Conversely, the program features two elements that promote gas use, justified through a full fuel cycle analysis. Prescriptive rebates are promoted for gas engine driven commercial chillers and $1,000 rebates are provided for customers and corporate fleets that convert gasoline-powered cars to natural gas, providing operating cost advantages while concurrently alleviating urban smog and other forms of pollution.

Finally, the Gas Technologies program represents a delicate balance between thermodynamic goals and political realities. While Southern Union Gas is willing to cut peak demand through societally-desirable gas saving measures, it is also keen on building baseload demand through the promotion of gas engine chillers and natural gas vehicles. And while the per customer use of natural gas has decreased over time in Austin, overall consumption has increased, fulfilling both the City's goal of increased efficiency and Southern Union's goal of increased use of natural gas. Attaining this delicate balance, ironically in a major oil and gas producing state with among the lowest gas prices in the country, represents a pioneering step in DSM and a model that will likely be carefully analyzed by both single and dual-fueled utilities.

CITY OF AUSTIN ENVIRONMENTAL AND CONSERVATION SERVICES DEPARTMENT
Gas Technologies Program

Sector:	*Residential, Commercial*
Measures:	*Weatherization measures such as insulation, solar screens, caulking, and low flow showerheads; gas combo-heaters; efficient gas furnaces; IIDs; gas engine chillers; water heater wraps; and NGVs*
Mechanism:	*Direct installation of gas efficiency measures; rebates on high efficiency natural gas fueled equipment*
History:	*In a 20-year franchise agreement with Southern Union Gas Company, the ECSD began implementing the programs in 1988.*

1993 PROGRAM DATA

Gas savings:	*8,776 MCF*
Lifecycle gas savings:	*131,640 MCF*
Cost:	*$392,103*

CUMULATIVE DATA (1989 - 1994)

Gas savings:	*185,232 MCF*
Lifecycle gas savings:	*765,210 MCF*
Cost:	*$1,772,664*

CONVENTIONS

For the entire 1994 profile series all dollar values have been adjusted to 1990 U.S. dollar levels unless otherwise specified. Inflation and exchange rates were derived from the U.S. Department of Labor's Consumer Price Index and the U.S. Federal Reserve's foreign exchange rates.

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

The City of Austin is the capital of Texas and is located in the southeast central portion of the state. It is an intellectually-stimulated city with a population of 476,908, with fully 32% of its total labor force having 16 or more years of education. (The City also prides itself as being America's live music capitol!) Austin is home to the University of Texas campus and major corporations such as Motorola, IBM, Advanced Micro Devices, and Texas Instruments.

The City of Austin Electric Utility (City) is a municipal utility that serves customers in Austin as well as the surrounding communities of West Lake Hills and Rollingwood. Its electric service territory encompasses 184 square miles within the City of Austin and 237 square miles of surrounding Travis and Williamson counties. The utility provides electric service to 291,785 customers of whom approximately 256,000 are residential, 34,000 are commercial or industrial, and less than 1,000 are classified as "other."[R#3]

The City is currently in a 20-year franchise agreement with Southern Union Gas Company (referred to hereafter as Southern Union), a full service natural gas supplier. Under the terms of the agreement Southern Union will provide natural gas to the City's customers through the year 2006. Southern Union is allowed to keep all City gas revenues less a franchise fee and state gas rate tax. The City in turn controls rates and requires a certain amount of these revenues to fund the Gas Technologies program, the subject of this profile.

Growing during 1993, Southern Union increased its customer base by 139% by adding 472,000 customers through the acquisition of natural gas distribution systems in Missouri and Texas. Currently Southern Union services 119,705 customers (41% of all City customers) within the city limits of Austin, while marketing and distributing natural gas to more than 958,000 customers in Texas, Oklahoma, and Missouri. The company, measured by number of customers, is now the fourteenth largest gas distribution utility in the United States and with the passage of the North American Free Trade Agreement, manufacturing is expanding on both sides of the Texas and Mexico border. Southern Union has thus strategically positioned itself to take advantage of this by extending service to 34 towns and cities along the border.[R#7]

In 1993 Southern Union had total operating revenues of $209 million, an 9% increase over 1992's $192 million. Austin's customers provided 24% of Southern Union's natural gas revenues, totaling $45.3 million from sales of 9,500 million cubic feet (MMCF) for 1993. In 1991 a gas rate increase of $3.3 million was granted by the City, followed by a $1.95 million rate increase in 1993. While the cost of natural gas in Texas is among the least expensive in the United States at 25.8¢/CCF, residential natural gas customers in the City of Austin service territory pay an average rate of 45¢/CCF. Commercial and industrial customers pay an average of 37¢/CCF and 36¢/CCF, respectively along with a monthly customer service charge that can range from $7.75 to over $150. Large commercial customers use the most gas, averaging 6,250 MCF in 1993. Residential customers use the least at 55 MCF in 1993.[R#7] ■

AUSTIN 1993 GAS STATISTICS

Gas Statistics		
Number of Customers	*119,705*	
Gas Sales Revenue	*$45.29*	*million*
Gas Sales Volume	*9,500*	*MMCF*
Average Cost of Gas	*25.8*	*¢/CCF*
Average Residential Gas Rate	*45*	*¢/CCF*
Average Commercial Gas Rate	*37*	*¢/CCF*
Average Industrial Gas Rate	*36*	*¢/CCF*
Average Usage Per Customer		
Residential	*55*	*MCF*
Small Commercial	*304*	*MCF*
Large Commercial	*6,250*	*MCF*
Industrial	*3,708*	*MCF*

Utility DSM Overview

All energy efficiency and demand-side management (DSM) services for both gas and electricity are provided to the City's customers by the Environmental and Conservation Services Department (ECSD). This municipal department within the City of Austin is a totally separate entity from the City's Electric Department, the municipally-held electricity supplier. The ECSD provides a range of services including information about energy efficiency, provision of financial incentives for installation of energy-efficient equipment, and delivery of both electric and gas and some water efficiency services to utility ratepayers.

The ECSD implements both electrical and gas DSM programs to promote maximum efficiency in the use of the City's energy resources and to provide the lowest overall economic and environmental costs possible to Austin ratepayers. The convenience for customers in dealing with a single agency for energy efficiency gives the City of Austin an opportunity to better serve its residents with optimal cost effectiveness. [R#1]

AUSTIN DSM OVERVIEW	GAS DSM EXPENDITURE	GAS SAVINGS (MCF)
1988	$7,196	NA
1989	$156,007	6,444
1990	$285,924	10,702
1991	$289,252	8,196
1992	$374,086	12,913
1993	$392,103	8,776
1994	$259,201	3,983
Total	$1,763,769	51,014

AUSTIN ELECTRIC AND GAS DSM PROGRAMS

Residential

Energy Audits
Appliance Efficiency Program (AEP)
Whole House Rebates
Home Energy Loan
Free Home Weatherization
Multi Family Audits / Rebates
Green Builder / Energy Star Rating
Trees For Energy

Gas Technologies Program

Direct Weatherization/Heater Wrap/Audit
Furnace / IID Rebate
Door to Door Water Heater Wrap
Gas Combination-Heater Rebate
Gas Engine Chiller Rebate
Natural Gas Vehicle (NGV) Rebate

Commercial

Commercial Energy Management Partnership (CEMP) - Audits / Menu Rebates
New Construction

The ECSD conducts extensive analyses of both its gas and electric DSM programs. For the Gas Technologies programs, ECSD staff work with and report progress to Southern Union. A monthly report which includes data on participation, savings, rebates, and loan distributions is produced and distributed to the City and Southern Union.

Funding for gas DSM initiatives began in October of 1988 when the City of Austin Electric Utility entered into a Conservation Services Agreement with Southern Union with the objective of administering gas conservation programs. Southern Union agreed to fund approximately $1.1 million for the conservation programs to be administered by the ECSD over an unspecified number of years. In August of 1991 the original $1.1 million of funding was depleted and thus an alternative way of funding the gas programs was necessary.[R#1,3]

On June 13, 1991 the City Council approved a rate ordinance for Southern Union including a Conservation Adjustment Clause (CAC) that applies to gas customers in the City's ser-

vice area. The ordinance allows the conservation rate, or surcharge, to be adjusted each October to a level which will generate funds to support the adopted budget for ECSD gas conservation programs. This marginal cost pays for all costs of the program, from implementation and marketing to equipment, rebates, incentives, and staffing. This number was determined, for example in 1993, simply by estimating the program's annual budget ($375,000) and dividing it by the City's annual gas consumption. The ECSD then calculated what the rate increase for its gas customers will be, in this case $0.00631/CCF, or about a half a cent per CCF. Taken another way, the surcharge was equal to 1.4% of average revenues per CCF.[R#4]

The Gas Technologies program expenditures totaled $392,103 in 1993. For that same year the City of Austin spent $8,562,000, or 22 times as much, on electrical demand-side management programs. Over the course of seven years the City of Austin has funded over $43 million in electrical DSM programs while the Gas Technologies program has been allocated $1.76 million over the same time frame. Thus total gas DSM funding has been only 4% of electrical DSM funding.

On a comparative net energy savings basis using British Thermal Units (BTU) for the years 1992 and 1993 combined, the City saved 22.3 billion BTUs from their Gas Technologies program and 767.8 billion BTUs from all their electrical DSM programs. On a BTU basis the Gas Technologies program savings represents 3% of all electrical DSM savings, roughly in line with relative funding levels. Note that increased gas use that results from two of the seven subprograms is not factored into the savings presented in the accompanying table.

Along with the Gas Technologies program the City of Austin Electric Utility has implemented a complementary portfolio of electrical DSM programs. The Energy Star program (see The Results Center Profile #11) promotes the construction and purchase of energy-efficient homes through a rating system. The program rates new residential homes for energy efficiency and assigns a one, two, or three star rating to each home based upon the calculated relative energy efficiency of the home. The program has succeeded in creating home buyer demand for energy-efficient homes and builders have responded enthusiastically.

The ECSD also assists residential customers in arranging home energy audits so that they may then receive low interest loans or rebates for retrofit work from the City. Customers receiving approval for work are eligible for the Whole House Rebate program or Home Energy Loan program.[R#9,12]

The Commercial Energy Management Partnership (CEMP) is the umbrella name for the City's commercial DSM offerings. The ECSD offers technical and financial incentives to electric customers and qualifying Southern Union gas customers. Rebates are offered for efficient lighting, building envelope, motors, refrigeration, air conditioning, gas technologies, and thermal storage.[R#9,12]

The focus of this profile is the Gas Technologies program, the umbrella name for seven separate gas conservation programs administered by the ECSD. These programs include: 1) Direct Weatherization/Heater, 2) Water Heater Wrap/Audit, 3) Gas Furnace/IID Rebate, 4) Door-to-Door Water Heater Wrap, 5) Gas Combo-Heater Rebate, 6) Gas Engine Chiller Rebate, and 7) Natural Gas Vehicle Rebate. ■

The Gas Technologies program is unique in that it consists of seven individual programs with seemingly contradictory objectives. In most cases these programs result in gas savings but in two cases the program's purposeful effect is to increase gas usage. Fundamentally, the Gas Technologies program is one that promotes "the right fuel" for specific applications, providing energy and dollar savings but with an important emphasis on environmental savings as well. Such an orientation is quite progressive and commendable.

From 1988 to 1990 four gas conservation programs were initiated by the City of Austin. These were 1) the Direct Weatherization/Heater program (Weath/Htr.), 2) Water Heater Wrap/ Audit program (Wrap/Audit), 3) Gas Furnace/Intermittent Ignition Device Rebate program (Furnace/IID), and 4) the Door to Door Neighborhood Water Heater Wrap program (Door to Door).[R#11]

In 1993-1994 ECSD continued to administer the programs along with the addition of three new programs: 5) Gas Combo-Heater Rebate program (Combo-Heater), 6) Gas Engine Chiller Rebate program (Gas Chiller), and 7) the Natural Gas Vehicle Rebate program (NGV). These newer programs were mainly aimed to benefit multi-family and commercial customers. In March of 1994, the Gas Furnace/Intermittent Ignition Device Rebate program for residential and commercial customers was phased out.[R#11]

1. DIRECT WEATHERIZATION/HEATER PROGRAM

The Direct Weatherization/Heater program is targeted at low income customers and also provides for the weatherization of single-family houses of elderly and disabled customers. The rational for the program stems from the fact that energy costs comprise a sizable portion of the annual income of households that are dependent upon social security and other governmental assistance programs. For this reason, a weatherization program was designed to lower the share of energy costs in participants' monthly expenses.

The primary objective of the Direct Weatherization/Heater program is to lower customer's utility bills and increase their comfort level by improving the energy efficiency of their homes. Additionally the program aims to provide information to low-income customers about energy efficiency.[R#5]

All work is performed at no cost to the customer, however, clients must meet income eligibility guidelines to qualify for the program. Work is carried out by a contractor selected through the City's competitive bidding process.[R#5]

The energy improvements include the installation of attic and ceiling insulation, solar screens, water heater wraps, low flow shower heads, and air infiltration measures such as caulking and weatherstripping. Energy-related repairs such as duct work and window and door replacement are included to address substandard housing conditions. In addition, vented space or wall heaters are installed for customers who have no heat or have space heaters that are hazardous. If a customer has a central heating or cooling system, then the ECSD staff or contractor perform the Mechanical Air Distribution and Interacting (MAD) air process. This is a process whereby ECSD staff fix leaks in ducts, vents, and around heating and cooling systems.

Eligibility for the Direct Weatherization/Heater program services is based on federally established income guidelines and residency within the Austin Electric Utility service area. In a 1989 marketing study it was estimated that there were approximately 35,000 to 40,000 low-income households in the utility service area that were eligible to receive assistance under this program. Income guidelines are built on a sliding scale to accommodate different sizes of households. This scale is adopted from guidelines established by the U.S. Department of Housing and Urban Development (HUD). Eligible households must have incomes at or below 50% of the median income established for their household sizes. Elderly (60 years and older) and disabled citizens are assigned priority status for participant selection by setting the income threshold at 80% of median income or lower. Eligibility for the program is verified through tax returns, food stamps receipts, and payroll records.[R#5]

Potential participants are recruited through several avenues including the ECSD's established relationships with various community agencies and citizens groups. Such avenues include presentations to community groups, recruitment by au-

ditors and weatherization contractors, and word-of-mouth communications. Limited advertising supplements such as billboards and flyers also play a role. A customer also can call the ECSD customer service center at "499-STAR" to get details about the program.

Once communication with a customer is made a service representative first will go over the income guidelines of the program with the customer and then mail him an application. After the customer fills out the application along with the supporting income documents, eligibility is determined by program staff within one to two weeks. If qualified, a participant receives a visit by an energy representative (auditor). At no charge to the participant, the auditor makes recommendations on what energy improvements are needed. Once the audit is complete, weatherization work is scheduled with one of the Department's weatherization contractors within four to six weeks.

The contractor, determined by a competitive bidding process, then contacts the customer, explains the scope of the work and schedules a convenient time to do the work. Upon completion of the weatherization measures the contractor notifies ECSD and arranges for final inspection. An energy representative from the Department then reviews the work to see if the audit recommendations and the Department's performance standards have been followed. Payment to the contractor is contingent upon customer and inspector approvals. On a per-home basis the average cost for the program has been nearly two thousand dollars.[R#5]

Customers with no heat or hazardous heaters can qualify for a free heater installation. Candidates for this portion of the program are usually referred to ECSD by City of Austin social workers who make home care visits for elderly and also from customers and inspectors who call ECSD and report residents with no heat. The customer must follow the same application procedures as above and qualify through the same HUD income requirements.[R#5]

Once the application has been approved the customer will be placed on a waiting list on a first come first serve basis. Participant homes with no source heating or with broken or malfunctioning units are considered first. Participants with units at least eight years of age and not equipped with an oxygen depletion sensor (ODS) safety device are considered next. When the home is assigned to the contractor a pre-installation site visit is scheduled with the homeowner, contractor, and conservation representative to determine the type of heater best suited for the home. The contractor will then install the heater which is subsequently inspected by a City of Austin inspector for safety.[R#5]

2. WATER HEATER WRAP/AUDIT

For customers participating in the City of Austin's residential energy programs, water heater wraps and pipe insulation are installed in homes that are audited by a registered contractor. Directly after an audit has been performed, the registered contractor will recommend wrapping the water heater or pipes and perform the installation immediately.

This program is an example of automatic program overlap whereby both gas and electric DSM savings interface. The water heater wraps and pipe insulation are provided free of charge courtesy of Southern Union and the ECSD. To be eligible customers must be participants in the City's Low Interest Loan program, Whole House Rebate program, or Direct Weatherization/Heater program.

3. FURNACE/IID REBATE

The Furnace/IID Rebate program ended March 31, 1994. It provided a rebate of $50 to customers who installed high efficiency gas furnaces with at least an 80% Annual Fuel Utilization Efficiency (AFUE). Alternatively, customers were able to retrofit existing furnaces installed between 1977 and 1985 with Intermittent Ignition Devices (IID) and receive the same $50 rebate. IIDs improve the efficiency of existing furnaces and eliminate the need to keep the pilot lights constantly burning.[R#9]

Rebates were offered for gas furnaces and IID retrofits in new and existing residential, multi-family, and commercial construction. To be eligible for the IID rebate, customers' existing furnaces had to have been manufactured between January 1977 and December 1985.☞

All HVAC contractors were aware of the program and when giving an estimate to a homeowner usually promoted the furnace rebates available to the customer. Contractors also mentioned the Furnace/IID Rebate program through their radio advertising. This program was also marketed by ECSD in local papers and billboards.

Several steps were taken to implement this program. ECSD first issued furnace rebate applications to contractors. When a contractor installed a qualifying system he mailed the application to ECSD for a rebate. ECSD reviewed the application to make sure it met the minimum guidelines of the program. Once approved, an inspector was sent to verify the model number.[R#9]

4. DOOR TO DOOR WATER HEATER WRAP PROGRAM

During specific times of the year, water heater wraps and pipe insulation are available at no charge and are installed for free in homes in targeted neighborhoods. Older areas of Austin which have been determined and located by census tracts have received special attention.

The Door to Door program has been marketed via direct mail, door hangers, billboard advertising, and advertisements in the community newspaper. It has also been the focus of a few feature newspaper articles.

First, customers are contacted by a letter from the City of Austin explaining the opportunity for energy savings from water heater wraps and pipe insulation. The letter tells the customer that a City representative will come to his or her home to wrap the water heater and pipes as necessary. This letter is reinforced with the previously mentioned marketing efforts. The contractor installs water heater and pipe wraps using a targeted delivery approach going from house to house, street to street. If no one is home, the installer leaves a door hanger explaining the program. An appointment then is set up for a later date.[R#9]

When a contractor performs an installation, he will also wrap electric water heaters if so needed. This is funded by the City's electric DSM funds.[R#9]

5. GAS COMBO-HEATER REBATE

The Gas Combo-Heater Rebate program provides homeowners, facility managers, and apartment owners who install gas combo-heaters a $125 cash rebate. Commonly in homes and apartments separate sources for space heating and water heating are found. Now small commercial businesses and multi-family complexes may choose an affordable and efficient way to provide both space heating and domestic hot water in one appliance called a gas combo-heater. A gas combo-heater uses one natural gas burner to do two jobs, resulting in saved money and energy.

The water heater operates like any conventional water heater. However, when space heat is needed the wall thermostat activates a small pump which circulates hot water (135-140°F) from the water heater through a coil to the air handler (air exchanger). The air handler extracts heat from the water and uses it to warm the air. A blower moves the warm air (100-110°F) through ductwork into the living space while the cooled water is returned to the water heater to be reheated.[R#9]

Rebates are offered for installations in new and existing residential and commercial construction. In order to qualify an owner must install a gas combo-heater with a minimum recovery efficiency of 76%. The retrofit of an existing water heater does not qualify for a rebate. Applications for four or more units or rebates totaling over $35,000 at one property require pre-approval from the Austin City Council before installation begins.

Implementation of this program follows several simple steps. First, ECSD issues combo-heater rebate applications to contractors. Since all HVAC contractors are aware of the program, they usually promote the gas combo-heater rebate to custom-

ers when providing estimates to homeowners. Contractors also mention the Gas Combo-Heater Rebate program through their radio advertising. When the contractor installs a qualifying system he mails the application to ECSD for a rebate. ECSD reviews the application to make sure it meets the minimum guidelines of the program and once approved an inspector is sent to verify the model number.[R#9]

6. GAS ENGINE CHILLER REBATE

The Gas Engine Chiller Rebate program targets qualifying small and large commercial customers who are usually facility and apartment owners and provides them $100 per ton cash rebate when they install natural gas engine drive chillers. This technology involves the use of natural gas-fired engines as an alternative to electric motors for the source of motive power for reciprocating or centrifugal compressors used for air conditioning. Chiller sizes can range from 30 to 300 tons for a reciprocating type and from 50 to 1,300 tons for a screw type.

Heat released from gas combustion in the engine is removed by coolant circulating in the engine jacket and is either released to the atmosphere through the use of cooling towers or partially captured using heat exchangers. Up to 50% of the heat released can be captured for use to either provide domestic hot water, swimming pool heating, process applications, or hot water for pipe hydronic systems. This in turn displaces natural gas or other fossil fuels that would otherwise have been used in these processes. While the use of gas chillers is increasing, their economic viability lies mainly in large commercial settings whereby the 50% heat recovery produces more significant savings.[R#6]

Rebates are offered for gas engine chiller installations in new and existing construction. Proposed equipment must meet or exceed a minimum Coefficient-of-Performance (COP) efficiency level of 1.5 or above. In existing applications, the gas engine chillers must be replacing an electric air conditioning unit.

Commercial customers initially learn about the Gas Engine Chiller Rebate program through a gas utility representative, a commercial energy program packet, a Department-sponsored gas cooling seminar, or from an ECSD commercial Energy Representative.[R#4]

First the customer must fill out a Commercial Energy Management Partnership "Energy Survey Request" form. Next a commercial Energy Representative schedules an energy survey with the customer to discuss his or her energy needs and the potential for savings. The customer will then fill out a Commercial Energy Program Rebate Application and attach the appropriate existing chiller information consisting of a building load analysis and new gas engine chiller information. If the application is approved, a Letter of Intent (LOI) is issued to the customer for the project. This certifies what amount of rebate the customer is eligible to receive. Finally the rebate is issued.[R#9]

7. NATURAL GAS VEHICLE (NGV) REBATE

The NGV Rebate program provides a $1,000 cash incentive to companies or individuals who convert existing gasoline fueled vehicles to natural gas fueled vehicles. Government agencies, however, are not eligible for the rebate. New original equipment manufacturer (OEM) natural gas vehicles qualify for a rebate for the purchaser, but not the dealer. Diesel-powered and previously-converted vehicles do not qualify for the rebate.

The NGV Rebate program targets local commercial fleet operators, however individuals can also participate in the program. Customers learn about the program through direct mail brochures, newspaper advertising, billboard and radio advertising, press releases, ECSD representative personal contact, local new car dealers, or natural gas vehicle conversion centers.[R#4] ☞

Participants must obtain a Natural Gas Vehicle Rebate Request Application from a local car dealer, a conversion center, or the ECSD customer service center. A vehicle data/inspection form must be filled out for each vehicle being purchased or converted in order to give more detailed information about each vehicle and provide emission readings. The purchase or conversion of six or more vehicles by one applicant must have prior approval to assure funding.[R#9]

If a conversion is to be performed, the customer must then go to the one conversion center in the area licensed according to the rules of the Texas Railroad Commission, a state regulatory body responsible for transportation. The conversion center performs installation of a "conversion system" which meets the California Air Resources Board's standards. A pre-conversion and post-conversion emission reading must be taken on each vehicle converted, recording levels of carbon monoxide, carbon dioxide, and total hydrocarbons. After the conversion, all vehicles are inspected for compliance by ECSD.

If all program guidelines and requirements are met, a vehicle owner will receive a rebate check for $1,000 per vehicle with a limit of 10 vehicles per company per year within four to six weeks from the date that the vehicle passes the final inspection.

STAFFING REQUIREMENTS

The Gas Technologies program is administered by ECSD by three staff who devote their full-time attention to the program. Jerrel Gustafson is the Program Manager who plans and manages the seven Gas Technologies programs. His responsibilities include developing marketing strategies and monitoring participation of current programs while concurrently planning and developing new Gas Technologies programs. He is also the liaison between ECSD and Southern Union Gas Company.

The Gas Conservation Representative, Steve Saenz, provides technical assistance to customers participating in the programs. His responsibilities include explaining program guidelines to customers, reviewing and approving applications for program participants, and promoting the programs by scheduling meetings with potential customers and arranging trade shows with gas technology dealers. He also provides the final inspection of projects participating in the programs.

The Purchasing Technician, Barbara Valentine, is in charge of verification and ensuing payments of rebate applications. She reviews and pays invoices from contractors performing weatherization, heater installation, and water heater wrap installation. She also provides an updated monthly report to Southern Union, tracking the overall program participation, savings, and expenditures for each month.[R#4]

At Southern Union, Pamela Johnson, Public Relations for Central Texas, acts as the liaison to the ECSD and devotes less than one hour per week to the Gas Technologies program. Her responsibilities related to the Gas Technologies program include keeping records of savings and expenditures and reporting this information to the Vice President of Southern Union, David Stevens.[R#4] ■

MONITORING

To confirm savings, monitoring for the Gas Technologies program is done via limited site inspections. After a contractor installs measures an ECSD representative visits the home or business to confirm that the technology has been installed correctly. Due to the large number of inspections to be performed, ECSD inspects roughly 10-20% of the installations performed in the Weath/Htr, Wrap/Audit and Gas Combo-Heater programs. The Furnace/IID Rebate program formerly received inspections on 100% of installations, but due to its rapid growth roughly 50% of installations were inspected during the last year of its implementation. All other programs receive inspections on 100% of installations.

No end-use metering is performed. Savings are determined by ECSD staff by using engineering estimates to calculate an average savings per system installation presented in the next section. Total savings per installation are then tallied and multiplied by the number of installations to determine total savings for each program. However metering is to occur in FY 1995.[R#4]

EVALUATION

Savings for each measure involved in the Gas Technologies program are calculated based upon an average value determined in spreadsheet analyses. In these analyses incremental low, middle, and high estimates for varying parameters ranging from water and ambient air temperatures, tank size, R-values and heat losses, to system SEER, time of operation, and percent of house occupation are used to determine a probable savings per measure installed for each program. So called "best" values are determined from the middle range in these analyses and used to calculate the probable savings from a technology. While actual savings are not determined, ECSD staff believe that these calculations are relatively accurate.

DIRECT WEATHERIZATION EVALUATION

In 1991 the ECSD performed an evaluation of the Direct Weatherization/Heater program. Prior to this evaluation, proof of the effectiveness of the program in providing a higher level of comfort to low-income utility customers was not available.

This evaluation was important in that it determined average savings for homes that had been weatherized through the program. The evaluation found that an average gas-heated home that has been retrofitted saves 143 CCF of natural gas annually. Similarly, an electrically-heated home that has been through the program saves 1,484 kWh of electricity annually. The evaluation found that these savings amount to a combined annual reduction in gas and electric bills of $122 per customer.[R#5]

The evaluation also found that besides saving money the Direct Weatherization/Heater program participants also managed to increase their comfort level while saving money simultaneously. According to calibrated engineering models, participants living in a gas heated home had an average home winter temperature of 71.9°F, 2.1° colder than the 74° average in Austin. After weatherization, these participants increased their average winter thermostat set-points to 73°, closing the gap in half to only one degree. Similarly, all-electric homes changed their average winter temperature from 71 to 73°F.[R#5]

Weatherization also allowed participants to be more comfortable in the summer while lowering their costs. Average temperatures for weatherized homes decreased by 2.6° in hot summer months while saving energy costs.[R#5]

GAS ENGINE DRIVEN CHILLERS ANALYSIS

In August of 1993 an analysis of gas engine driven chillers (referred to herein simply as gas chillers) as an alternative to electric motors for the source of motive power to reciprocating or centrifugal compressors used in air conditioning was conducted in order to establish a baseline for comparative energy consumption data.

An analysis of both electric chillers and gas engine driven chillers was performed to evaluate peak demand and energy consumption reduction as well as natural gas consumption increases and to determine an appropriate rebate level for gas chillers reflecting parity with rebates offered for electric chillers.[R#6]

The analysis was rooted in modelling. A typical mid-sized office building (60,000 square feet with 400 workers) was modeled using the Department of Energy 2.1D energy analysis program. The analysis resulted in some key findings: When converting from an electric reciprocating chiller with an Energy Efficiency Rating (EER) of 12 to a gas chiller with a Coefficient of Performance (COP) of 1.5, an annual reduction of 197,083 kWh of consumption, 108 kW of peak electric demand and $17,847 in total electric bill costs results. This conversion also resulted in an annual increase in gas usage of 13,991 CCF. Based upon an average commercial gas rate of 37¢/CCF ($5,177/year cost increase) the net annual effect on the customer's utility bill is $12,670 in cost savings.[R#6] ■

Program Savings

DATA ALERT: The savings presented are based on fiscal years. For instance; 1993 refers to FY 1993 which runs from September 31, 1992 - October 1, 1993. Data presented for 1994 reflects savings through January.

While the Gas Engine Chiller and NGV Rebate programs result in increased use of natural gas, the other five programs result in saved natural gas. This section focuses only on the natural gas savings resulting from those five programs. ECSD can only estimate the net effect of the seven programs together because gas usage for cars in particular is completely dependent on use patterns. Combined, staff estimate that all seven programs result in a net gas savings but this has never been calculated carefully by ECSD or Southern Union. Full descriptions of Austin's reasons for promoting gas use through the natural gas vehicle program and the gas engine chiller program are presented in the Environmental Benefits section.

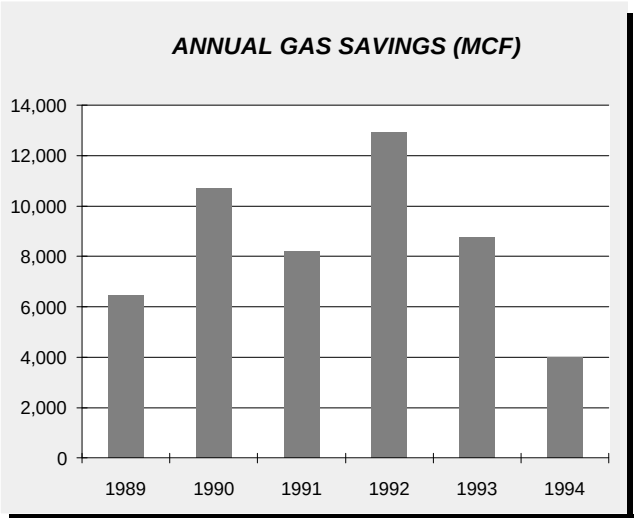
In 1993, the five gas-saving programs combined resulted in 8,776 MCF savings of natural gas which will result in lifecycle gas savings of 131,640 MCF. While annual program savings peaked in 1992 at 12,913 MCF, overall they have remained relatively stable since their first year of recorded savings in 1989.[R#11]

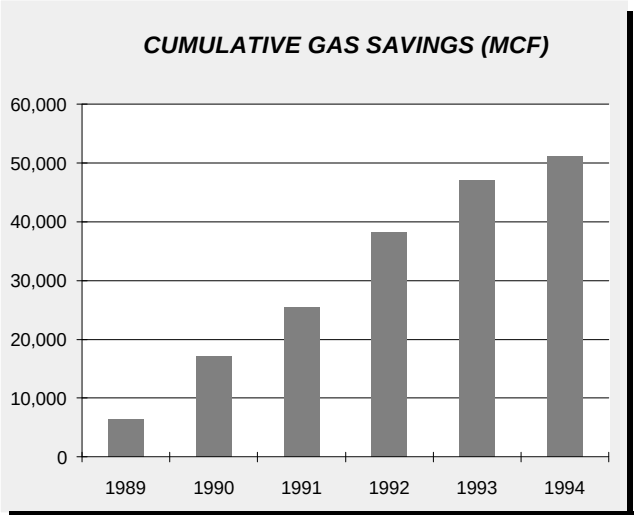
Since its inception, the Gas Technologies program has resulted in 185,232 MCF of total cumulative gas savings. Over the 15-year average life of the measures installed, the program will result in 765,210 MCF of gas savings.

The program with the smallest amount of savings is the Wrap/Audit which had 1993 annual energy savings of 222 MCF. This amount of savings, presented as savings in the most recent year, is not indicative of the program's history. In 1989, 2,392 pipe wraps and 1,308 water heater wraps resulted in 3,171 MCF of savings, and total savings since the program's inception are 5,152 MCF surpassing the savings to date from the Combo-Heater program.[R#11]

The Door to Door program also resulted in 1993 annual energy savings that are not indicative of its past amounts. In 1993, the program resulted in 976 MCF of savings, while just one year before 4,416 MCF of savings accrued. This is due to ECSD's targeting of older neighborhoods and only at specified times of the year resulting in higher savings some years when blanketing of neighborhoods occurred. This has proven to be effective as exemplified by the program's total savings to date of 12,242 MCF, making it the second largest program in terms of cumulative savings.[R#11,12]

SAVINGS OVERVIEW	ANNUAL GAS SAVINGS (MCF)	CUMULATIVE GAS SAVINGS (MCF)	LIFECYCLE GAS SAVINGS (MCF)
1989	6,444	6,444	96,660
1990	10,702	17,146	160,530
1991	8,196	25,342	122,940
1992	12,913	38,255	193,695
1993	8,776	47,031	131,640
1994	3,983	51,014	59,745
Total	51,014	185,232	765,210





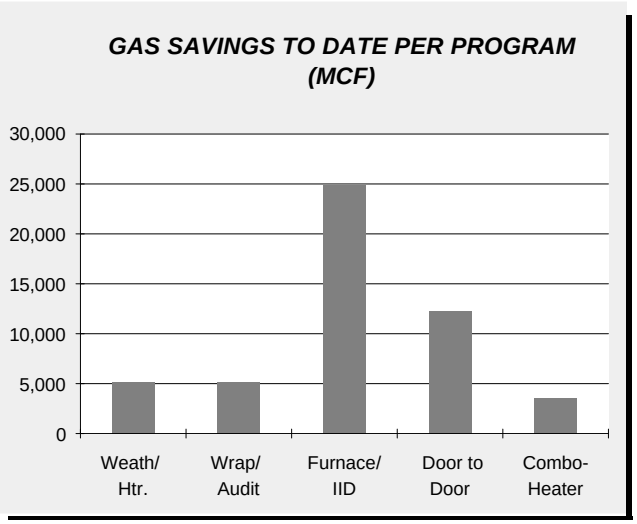
SAVINGS OVERVIEW BY PROGRAM	1993 SAVINGS (MCF)	SAVINGS TO DATE (MCF)	START DATE (FY)	MEASURE LIFE (YRS)	LIFECYCLE SAVINGS (MCF)
1. Weatherization	1,429	5,191	1990	15	21,435
2. Wrap/Audit	222	5,152	1989	10	2,220
3. Furnace/IID	4,576	24,846	1989	18	82,368
4. Door to Door	976	12,242	1990	10	9,760
5. Combo-Heater	1,573	3,583	1993	13	20,449
Total	8,776	51,014			136,232

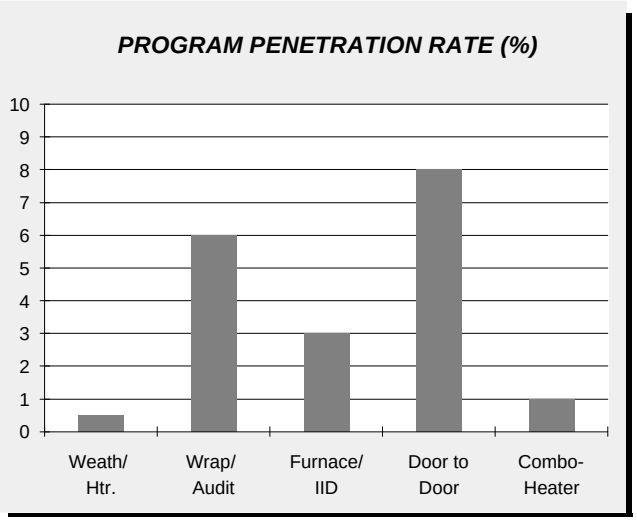
PARTICIPATION RATES

The Direct Weatherization/Heater program defines participation by the number of homes weatherized. In four and a half years of the program 476 homes have been weatherized, averaging 110 homes per year. Additionally, 164 space heaters have been installed, resulting in a combined penetration rate of 0.5%. These have resulted in over 14.29 MCF of gas savings annually per home, by far the largest unit impact of any of the five gas-saving programs.

Participation for the Wrap/Audit and Door to Door programs is defined as the number of water heater and pipe wraps. In 1990, the first year of the Door to Door program, 1,930 hot water heater wraps and 3,782 pipe wraps were installed. While participation for the Door to Door program has been sporadic due to targeting of specific neighborhoods, as high as 1,854 hot water heater and 2,509 pipe wraps in 1992 to as low as 260 hot water heater wraps and 383 pipe wraps in 1991, over 4,960 hot water heater wraps and 8,019 pipe wraps have been installed in the program's five years of implementation to date. This program has seen a penetration rate of 8% of all City of Austin customers.

The Wrap/Audit program has resulted in an additional 2,925 hot water heater and 6,436 pipe wraps being installed in six years. The program had a penetration rate of 6% of all City of Austin customers, however it has progressively decreased in participation. This is due to the increased number of high efficiency water heaters which do not require water heater blankets. Combined, the two programs have resulted in 7,885 hot water heater and 14,455 pipe wraps being installed in the City of Austin service territory resulting in 2.56 MCF of gas savings annually per water heater wrap.[R#11,12] ☞





PARTICIPATION TO DATE	NUMBER TO DATE	SAVINGS PER PARTICIPANT
1. Weath/Htr. (Homes)	476	14.29 MCF/yr
2. Wrap/Audit (Customers)	9,361	1.29 MCF/yr
3. Furnace/IID (Units)	3,391	7.33 MCF/yr
4. Door to Door (Customers)	12,979	1.27 MCF/yr
5. Combo-Heater (Units)	1,383	2.62 MCF/yr
6. Gas Chiller (Tonnage)	724	0.89 kW/ton
7. NGV (Vehicles)	23	NA

Participation for the Furnace/IID Rebate program is defined as the number of rebates issued and has a 3% customer penetration rate. Over 3,391 rebates have been offered for gas furnaces and IID retrofits in existing residential and multi-family commercial construction. Participation for this program has steadily increased, from 282 rebates given in 1989 to 721 given in only part of 1994. These retrofits have resulted in 7.33 MCF of gas savings annually per rebate.[R#12]

Within the Gas Combination-Heater Rebate program participation is defined as the number of housing units that are retrofitted with the technology. The Combo-Heater program has a 1% penetration rate to date and is being installed by contractors primarily in new residential construction. In 1993 119 units were retrofitted with gas combo-heaters. Developers committed to an additional 486 newly-constructed multi-family projects to be completed by the end of the same year. Developers also have committed to another 776 units to be retrofitted with gas combo-heaters by the end of 1994. Present commitments and past installations total 1,383 units and will result in 2.62 MCF gas savings annually for each unit.[R#12]

In the first year of the Gas Engine Chiller program J.C Penney, a large department store chain, installed 270 tons of gas engine driven chillers, saving 240 kW of electricity demand. In 1993 another local commercial business installed 454 tons of gas engine chillers resulting in 395 kW of electricity demand saved.[R#11]

Twenty-three vehicles have been retrofitted in two years of activity for the Natural Gas Vehicle Rebate program. Participating companies include delivery, taxi cab, and food services.

FREE RIDERSHIP

Currently, the ECSD's reported savings do not account for free ridership and Program Manager, Jerrel Gustafson, believes that the percentage for free ridership is exceedingly low if above zero. This is because gas technologies equipment is more expensive than comparable electrical equipment, so most people wouldn't retrofit unless incented first. No plans are currently being made to attempt to account for free ridership either.[R#4]

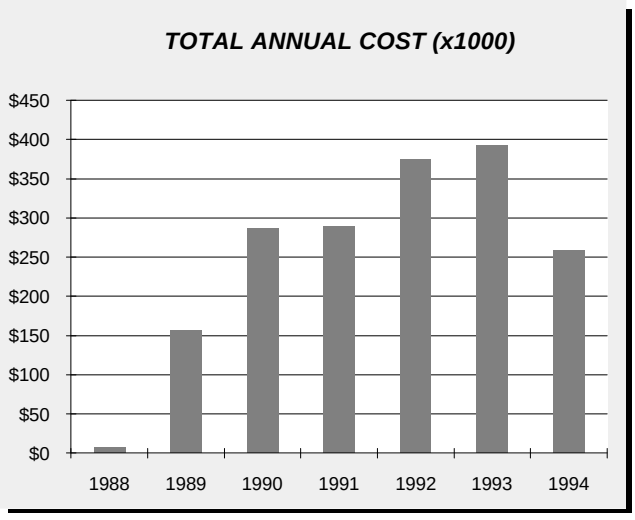
MEASURE LIFETIME

Each technology used in the Gas Technologies program has a different lifetime. Combo-heaters have a 12-year average measure lifetime, while gas chillers have a 23-year average measure life. Gas furnaces generally have an 18-year average life. Such measures as caulking and weatherstripping have a 10-year average measure life, attic insulation: 25-years, and solar screens: 12-years. ECSD staff use an average measure life of 15 years for installed gas technologies for lifecycle savings calculations and to determine the cost of saved energy.[R#4] ■

COSTS OVERVIEW	1988	1989	1990	1991	1992	1993	1994	TOTAL
1. Weath/Htr.	$0	$0	$144,719	$137,952	$135,730	$127,240	$71,446	$617,087
2. Wrap/Audit	$6,237	$24,139	$11,617	$705	$866	$290	$0	$43,854
3. Furnace/lID	$0	$35,668	$43,320	$63,912	$92,871	$38,664	$38,990	$313,427
4. Door to Door	$0	$0	$12,156	$1,320	$19,486	$8,122	$8,905	$49,989
5. Combo-Heater	$0	$0	$0	$0	$0	$69,456	$87,426	$156,882
6. Gas Chiller	$0	$0	$0	$0	$25,085	$40,918	$0	$66,003
7. NGV	$0	$0	$0	$0	$0	$1,244	$17,008	$18,251
Other	$959	$61,771	$1,657	$14,483	$17,717	$21,526	$4,947	$123,060
Staffing	$0	$34,428	$48,534	$52,375	$61,097	$63,820	$31,916	$292,170
Dept. Overhead	$0	$0	$23,921	$18,505	$21,233	$20,822	$7,459	$91,941
Total	$7,196	$156,007	$285,924	$289,252	$374,086	$392,103	$268,097	$1,772,664

DATA ALERT: Annual costs reflect fiscal years; 1994 costs reflect five months of program implementation.

The seven the Gas Technologies program components have cost a total of $1,772,664. Of all the programs the Direct Weatherization has cost the most totaling $617,087 in its four and a half years of operation, while the Wrap/Audit has cost the least, $43,854 in its five and a half years of operation. The Furnace/lID Rebate program has been the second most costly at $313,427 in five and a half years of implementation.[R#4,5]



Total expenditures for all the programs have risen each year, from $7,196 in 1988 to $392,103 in 1993. Currently 1994 expenditures have already totaled $259,201 in just five months of operation. This is well on track for still another increase from the previous year.

Major fluctuations have occurred in three programs. The Wrap/Audit program has steadily decreased in participation and thus costs after a banner year in 1989. With more efficient water heaters, this program has declined due to a lesser need for tank wraps. The Furnace/lID Rebate program was ended March 31, 1994 because ECSD staff believed that they had trained distributors well enough to warrant terminating the program. The Gas Engine Chiller program has incurred no costs in 1994 because no applications have yet been received.[R#10]

COST EFFECTIVENESS

The Results Center calculation of annual costs of saved energy are shown in the accompanying table. This is calculated at various discount rates ranging from 3-9% based upon annual savings and cost figures for the five programs that result in gas savings. Total costs of saved gas for all five programs have ranged from a low 27.3¢/CCF at a 3% discount rate to 40.4¢/CCF at a 9% discount rate. The Direct Weatherization/Heater program resulted in the highest cost of saved gas, $1.54/CCF at a 5% discount rate and the Door to Door program resulted in the lowest, 11.4¢/CCF at a 5% discount rate. ☞

COST OF SAVED ENERGY AT VARIOUS DISCOUNT RATES (¢/CCF)	3%	4%	5%	6%	7%	8%	9%
1. Weath/Htr.	134.67	144.59	154.88	165.53	176.51	187.82	199.44
2. Wrap/Audit	14.79	15.88	17.01	18.18	19.38	20.63	21.90
3. Furnace/IID	13.22	14.20	15.21	16.25	17.33	18.44	19.58
4. Door to Door	9.89	10.62	11.38	12.16	12.96	13.79	14.65
5. Combo-Heater	46.82	50.27	53.85	57.55	61.36	65.30	69.34
Total	27.30	29.31	31.40	33.55	35.78	38.07	40.43

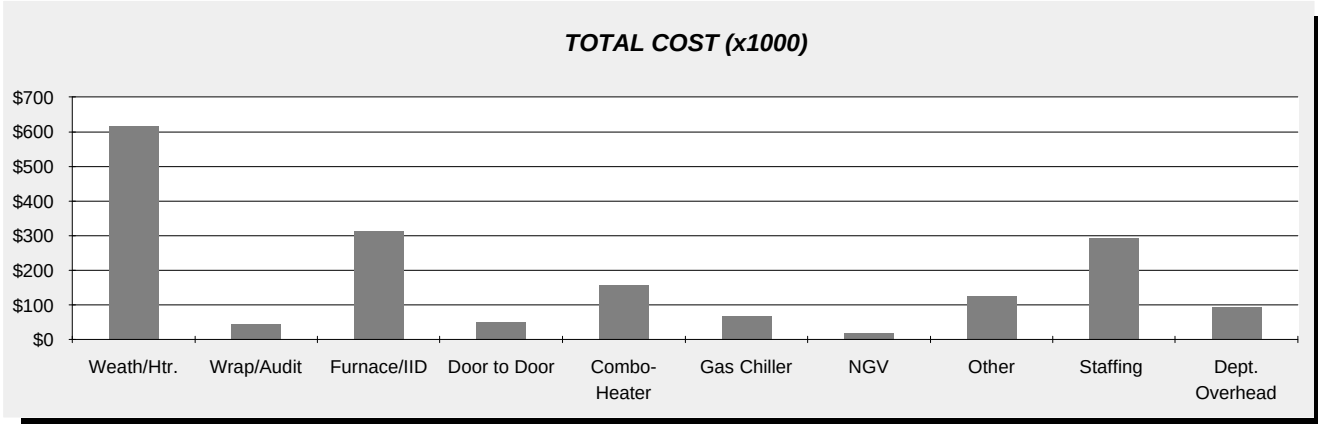
These costs of saved energy are low considering the average cost of natural gas to Austin residential customers of 45¢/CCF coupled with a monthly $7.75 customer charge. While large commercial and industrial customers have a cheaper rate of around 36¢/CCF they also can have monthly customer charges ranging from $40 to $150.

The ECSD determines the cost effectiveness of these programs by using benefit to cost ratios (B/C) and total resource cost (TRC) tests. The Gas Engine Chiller program for instance is currently undergoing these tests. Preliminary results of this program's impact on electric revenue reveal a B/C ratio of 5.73. The impact on gas rates results in a B/C ratio of 1.81, with a participant's perspective of 1.27. The TRC test is still under examination.

Cost effectiveness tests have also been determined for the Direct Weatherization/Heater program. This program's impact on electric revenue to the utility reveals a B/C ratio of 1.10. From a participant's position, a B/C ratio of 3.43 was determined. The total resource cost test resulted in a B/C ratio of 1.10. Thus this program has been determined to be cost effective to the utility and its customers. All other programs are still under examination for cost effectiveness.

UTILITY COST PER PARTICIPANT

The Results Center calculated the utility cost per participant for each program based on total expenditures and specifically defined participation since each program's inception. These figures include administrative costs and all costs to the utility. Dividing the total expenditures for each program by the number of participants reveals that there exists great variation in costs per customer for each program. The disparity ranges from a high of $1,753.20 per home for the Direct Weatherization/Heater program, based on its labor intensive nature, to a low of $14.41 per customer for the Wrap/Audit program. The free heater installation part of the Direct Weatherization/ Heater program increased the cost for some homes. The next most costly program to the utility is the NGV Rebate program. With the $1,000 rebate per vehicle and staffing and administrative costs of $10,800 over two years, this program cost the



COST PER PARTICIPANT	COST
1. Weath/Htr.	$1,753.20 / home
2. Wrap/Audit	$14.41 / customer
3. Furnace/IID	$115.67 / unit
4. Door to Door	$18.29 / customer
5. Combo-Heater	$144.79 / unit
6. Gas Chiller	$112.02 / ton
7. NGV	$1,263.09 / vehicle

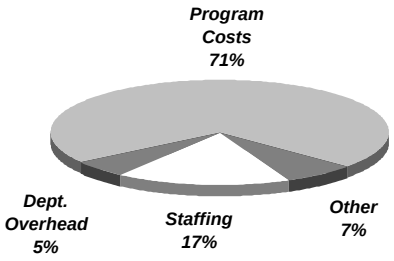
utility $1,263 per vehicle. The Door to Door program cost $18.29 per customer, while the Furnace/IID Rebate program and Gas Combo-Heater Rebate program cost $115.67 and $144.79, respectively, per unit installed. Calculation for the Gas Engine Chiller Rebate program was based upon tonnage. While the program only cost $112.02 per ton of cooling, note that two customers alone accounted for 724 tons in two cooling systems.

CUSTOMER COSTS

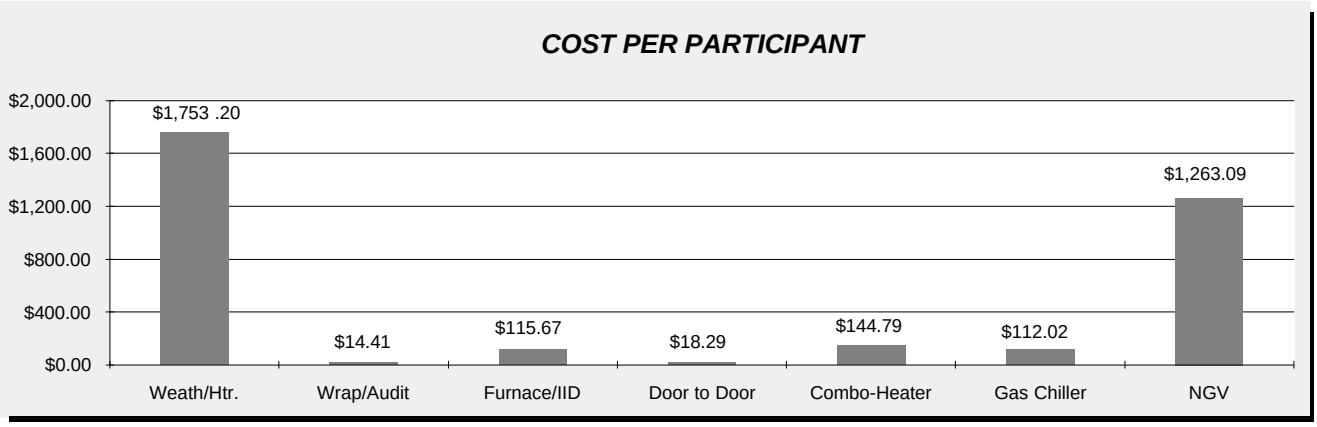
Similarly, customer costs vary greatly with each program. The Direct Weatherization/Heater, Wrap/Audit, and Door to Door programs are free. A typical high efficiency furnace costs the customer between $1,000 and $1,100 including installation less the $50 rebate. A retrofit of an existing furnace with an intermittent ignition device costs roughly $150 with the $50 rebate included. Based upon a 300-unit installation, gas combo-heaters cost the customer roughly $875 when coupled with the $125 cash rebate. A gas engine driven chiller can cost from $380 to $650 per ton of cooling compared to electric chillers which cost between $200-275 per ton. This marginal cost is lowered with a utility-sponsored $100 per ton rebate. So the actual customer cost can ranges from $280 to $550 per ton of cooling. Depending upon the size and type of vehicle a conversion from a gasoline to a natural gas fueled vehicle costs the customer from $2,500 to $4,500 with the $1,000 cash rebate included.[R#4,10]

COST COMPONENTS

The Costs Overview table presents annualized costs for each program including staffing, department overhead, and other expenditures. As shown in the accompanying pie chart, fully 71% of all costs totaling $1.26 million dollars over six and a half years, are for program costs including implementation,



rebates, measure costs, marketing and promotional materials, and evaluations. Staffing accounts for 17% of all costs, totaling $292,170. The Direct Weatherization/Heater program required the most amount of staffing costs, comprising $156,000 (53%) of all staffing costs. Department overhead costs account for 5%, $91,941, and other costs, consisting of advertising, printing, computers, and sundry supplies account for 7% of the total, or $123,060.[R#10] ■



Environmental Benefits

The Gas Technologies program is unique in that it features five programs that result in saved natural gas and two programs that promote the use of natural gas. While this may seem contradictory, Austin's dual goals are to promote thermodynamic efficiency of energy consumption by using the most appropriate fuel to fulfill the desired task, and to mitigate emissions using a cradle-to-grave approach from the power plant or well-head to the end-use. This section presents the environmental benefits of using natural gas for both gas engine chillers and natural gas vehicles and presents the resulting economic benefits of such conversions.

GAS ENGINE DRIVEN CHILLERS

Typically, chillers are driven by electric compressors. However, in terms of "source to end use" efficiency, gas engines enjoy a slight marginal benefit over electric motors when used as a source of rotary power. When heat recovery is factored into the equation, the gas engine enjoys a two-fold advantage in the "source to use" efficiency, concurred by the following two separate analyses used by the ECSD to justify the program.[R#6]

The first analysis of gas engine driven and electric chillers was performed by the ECSD for its Commercial Energy program and concluded the following results. A 1.0 kW/ton of cooling shaft input power for a reciprocating electric compressor with a 28.5% fuel-cycle efficiency converts to a power plant thermal equivalent of 11,975 BTUs per ton of cooling. A comparable gas engine driven compressor with 1.0 kW/ton of cooling shaft input power and a fuel-cycle efficiency of 91.2%, converts to a power plant thermal equivalent of 11,763 BTUs per ton of cooling. When taking into account the potential for 50% heat recovery, the gas chiller converts to a power plant thermal equivalent of 5,881 BTUs per ton of cooling. With an output for one ton of cooling being 12,000 BTUs, the COP (Coefficient of Performance, output/input) is 1.00 for the electric chiller, 1.02 for the gas engine driven chiller, and 2.04 for the gas chiller with 50% heat recovery.[R#6]

A second analysis of fuel cycle efficiency performed by Southern Union compares NOx emissions and source COP's resulting from the use of an electric centrifugal compressor chiller to that of a gas engine driven chiller. A typical electrical centrifugal compressor powered at the source by a coal-fired power plant resulted in a source COP of 1.54, while a comparably-sized gas engine driven compressor had a source COP of 1.82, and when 50% of the heat was recovered the source COP jumped to 3.65.

Emissions of NOx were based on a grams of NOx per ton-hour of cooling. The electrical compressor resulted in 3.32 grams of NOx per ton-hour of cooling while the gas engine compressor resulted in 1.50 grams of NOx per ton-hour of cooling, and 0.70 grams with 50% heat recovery.[R#17]

Economically, the use of gas engine chillers versus electric chillers results in significant societal advantages. Based on 1 kW per ton for commercial cooling, an electric chiller cost roughly $300/ton and a gas chiller cost $500/ton. However, this disparity is insignificant when considering the infrastructure costs to provide the electricity to power the chiller, roughly $2,000/kW for an electric chiller and virtually nothing, other than a one-time cost of $200/ton for the gas chiller, because gas pipes are already in place throughout Austin. Thus, the overall societal costs are much lower for the gas engine chiller.[R#17]

The ECSD plans a more detailed analysis of gas engine efficiency in fiscal year 1994. This analysis will include the societal effects and total resource cost tests.

NATURAL GAS VEHICLES

In the ongoing alternative fuels revolution, natural gas has emerged as the fuel of choice for many private and public sector automotive fleets. Recently 13 natural gas powered vehicles made a 5,000-mile promotional cross-country tour of the United States to show their viability. The fuel costs for the trip were approximately 30% less than gasoline would have cost and the vehicles emitted about 500 fewer pounds of pollutants.

America's big three auto manufacturers are also showing support of NGVs through their manufacture. Chrysler is offering its mini-van and Dodge B-Series Ram pickup with a compressed natural gas option. Ford is currently undergoing final testing of a natural gas Crown Victoria and plans other models such as a pickup and a van scheduled to reach dealers in 1995. General Motors is producing natural gas versions of the Sierra pickup (also sold as the Chevrolet C20), a van, and other models.

Natural gas is often referred to as "the prince of the hydrocarbons." As nature's cleanest burning fossil fuel, when burned instead of gasoline or diesel it significantly reduces the emissions associate with global warming and it completely eliminates emissions of particulate matter which contributes to urban smog. Burning natural gas in NGVs results in less hydro-

NATURAL GAS VEHICLE PROGRAM PAYBACK ANALYSIS	CONVERSION COST	FUEL COST SAVINGS/YR	SIMPLE PAYBACK (YRS)	PAYBACK WITH $1,000 REBATE (YRS)
Light Duty Vehicles	$3,580	$590	6.1	4.3
Light Duty Trucks	$4,320	$646	6.7	5.1
Light Duty Vans	$4,150	$859	4.8	3.6
Medium Duty Trucks	$4,590	$1,110	4.1	3.2
Heavy Duty Trucks	$5,670	$2,362	2.4	1.9
New OEM Vehicles	$4,800	$792	6.1	4.7

carbon and carbon monoxide emissions than vehicles powered by gasoline, again improving the air quality. In addition with much of the nation's natural gas reserves located in Texas, a higher production efficiency is attained and the nation's dependence on foreign petroleum reserves is reduced.

To support the ECSD's programs that promote natural gas use, two private consulting firms conducted emission reduction estimates of natural gas vehicles compared to gasoline-fueled vehicles. The analysis considered three categories of natural gas: NMOG (non-methane organic gas), CO (carbon monoxide), and NOx (nitrogen oxides). It also compared three different types of vehicles: light duty vehicles, light duty trucks 1, and light duty trucks 2 (larger, heavier trucks).

When switching from gasoline powered vehicles to NGVs emissions reductions were significant. Non-methane organic gas emissions were reduced 96% for all three vehicle types. Carbon monoxide was reduced by an average of 85% for all three vehicle types, and nitrogen oxides were reduced by a factor ranging from 60 to 72% for the three vehicle types.[R#15]

In addition to the environmental benefits of using natural gas vehicles, the ECSD's NGV rebate program can prove to be an economic asset. Running a vehicle on natural gas can be more economical since the current price for natural gas is about 65¢ per equivalent gallon of gasoline. Engine maintenance cost is also reduced when using natural gas. These cost reductions, coupled with the $1,000 rebate and a federal tax deduction ranging from $2,000 up to $50,000 for fleets mandated under the Energy Policy Act of 1992, make natural gas fueled vehicles economically viable.

The use of natural gas vehicles provides a cost savings opportunity, especially for commercial fleet owners and operators. As shown in the NGV Payback Analysis table, the conversion of heavy duty trucks represents the best case scenario and has a simple payback of 2.4 years. With the $1,000 rebate the payback is under two years, saving $2,362 in fuel costs per year. Light duty vehicles such as sedans will save $590 per year in fuel costs, yielding a 6.1 year simple payback for a $3,580 conversion cost. This payback is cut 30% to 4.3 years when the $1,000 rebate is added. Of course when the conversion costs have been fully paid, owners will continue to benefit and the operating savings will flow directly to the owner in the form of profit.[R#13] ■

LESSONS LEARNED

The City of Austin's Environmental and Conservation Services Department is an outstanding example of a municipal utility offering a full range of both gas and electrical demand-side management programs in a service territory marked by a municipal electric utility and an investor-owned gas utility. The organizational structure of DSM in Austin allows customers to consult with just one central department, the ECSD, when considering electric and natural gas energy efficiency and environmental retrofits.

The dynamic between of the City of Austin, Southern Union, and the ECSD is somewhat interesting, if not precarious. The City not only wants to save capacity to avoid building costly power plants and peaking units, but also "to do the right thing" by using resources wisely to protect its customers and the environment. Southern Union also wants to improve its load profile not only by conserving natural gas during peak periods, but also by concurrently promoting natural gas use during other periods to fill in the "valleys" in its load profile in order to maximize revenues while providing environmentally-sound services for its customers. This is more difficult in a state with a residential natural gas rate of 45¢/CCF, one of the least costly natural gas rates in the country. This diminutive rate is due to the fact that all natural gas consumed in Texas is also extracted there, with Texas alone accounting for 27.5% of all the continental U.S. reserves.

The City and Southern Union are using the ECSD to facilitate both goals. By the ECSD saving customers electricity via gas technologies, they are in turn promoting wise use of energy via natural gas as the fuel source. Hot water heater wraps, weatherization, efficient furnaces, and combo-heaters all help reduce the natural gas peaks in Southern Union's load profile, while NGV's and gas engine driven chillers help fill the valleys providing not only a cleaner burning fuel but also economic benefits to the company and society.[R#17]

From 1973 to 1989 Texas has seen a decline in average annual natural gas consumption per customer. Commercial consumption per customer has declined from 743 MCF to 397 MCF, a 47% reduction over that time period. Average residential consumption per customer has also declined from 94 MCF to 58 MCF, a 38% reduction. These decreases are attributed to a combination of energy conservation and more efficient appliances required under the National Appliance Energy Conservation Act. While the per customer use of natural gas has decreased, overall consumption has increased, fulfilling both the City's goal of decreased electricity use and concurrently Southern Union's goal of increased promotion and overall usage of natural gas.[R#7,9,17]

LESSONS LEARNED WITHIN THE PROGRAM

According to Gas Technologies Program Manager, Jerrel Gustafson, in order to develop successful Gas Technology programs it is important to have extensive planning prior to implementation. Specific goals and objectives must be defined, a survey of customers and contractors for market acceptability must be conducted, and the program must be developed with flexibility and be user-friendly.[R#4,9]

Over the past several years the customers' two main concerns when purchasing gas equipment were first, the cost, and second, how much energy (electric or gas) it will save. Mr. Gustafson has found that first costs for the customer have been one of the major barriers. He suggests that subsequent programs squarely address this first-cost hurdle.

According to Mr. Gustafson, the ECSD looks out for the best interest of the customer whether it be electric or natural gas equipment installed. He believes that his Department needs to continue to educate customers on the environmental and economic value of using natural gas equipment. He also feels that it is very important that his Department continue to be a good partner in the community by offering quality programs.

Overall the program has been successful at using resources wisely. This might mean replacing an electric chiller with a natural gas driven chiller. This can result in increased use of natural gas via switching from electricity driven motors to natural gas driven motors. However, this can also result in gas savings by upgrading a natural gas chiller to a more efficient one, resulting in a cleaner burning more efficient use of source fuel.

Future changes in the program include trying to focus more on commercial programs. Mr. Gustafson believes that there is large potential for gas efficiency and savings when dealing with commercial customers with large water heating needs. He also wants to start a few pilot programs in the area of commercial gas cooking. He hopes to offer these programs as a

package deal whereby commercial audits, surveys of equipment, and recommendations for new equipment can be incorporated into one package-type deal offered by ECSD. While Mr. Gustafson foresees minor problems in dealing with restaurants due to high turnover rates and low amounts of capital to invest in new equipment he sees the sector for large commercial water heating for businesses such as laundries as holding a high potential for gas savings and quick paybacks.

Major goals of the program are to increase participation especially in the Gas Engine Chiller program and to begin pilot programs in the large commercial sector. The main problem with increasing participation in the Gas Engine Chiller program is that many customers fear the new technology and want to see it installed in other businesses first. Customers seem to want a new technology to "stand the test of time" before they install it in their businesses.

TRANSFERABILITY

The field of gas demand-side management is growing. Many regulatory commissions are beginning to require that their gas utilities prepare integrated resource plans, a process that forces gas utilities to consider alternatives including the promotion of customer energy efficiency. Several gas companies including Wisconsin Gas, Southern California Gas, Boston Gas, and Washington Gas now implement DSM programs. None, however, provide the range of programs offered in Austin and none utilize the organizational design proven effective in Austin.

For those areas of the United States with higher rates for natural gas than in Texas, energy efficiency efforts have the potential for even greater savings to the customer. This is coupled with the fact that natural gas, predominantly used for heating, has more deeply penetrated communities in colder climates resulting in a higher potential for extensive savings in both energy and dollars for customers.

When considering the transferability of the Gas Technologies program, its uniqueness becomes exemplary. First, no other gas conservation programs like this exist anywhere in Texas, or virtually anywhere in the southeastern United States. Even the towns of Westlake Hills and Rollingwood that are City of Austin and Southern Union customers decided not to be involved in the Gas Technologies program. While Southern Union promotes and implements fuel switching to all of its customers, only the City of Austin's ECSD implements gas conservation, or more appropriately called "primary energy conservation." Promoting natural gas conservation in the state with the cheapest natural gas might seem contradictory, but perhaps ECSD is simply ahead of its time. Their seven programs combine to save customers money, save the state a finite primary fossil fuel source, reduce the country's dependence upon imported oil, and promote a cleaner environment. ■

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