MEASURES AND INVESTMENT OPTIONS FOR COMMUNITY ENERGY CONSERVATION

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ABSTRACT

Municipalities and electric and gas utilities have for the past decade offered ratepayers incentives for conserving energy. The energy conservation strategies used have varied depending on the goals of the local utility. The cost-effectiveness of these strategies, however, has been debated because of the limited activity in producing quantifiable data and the lack of documentation of methodologies. Because the cost-effectiveness and the reach of current energy programs is often unknown, the return on investment to the utility, city, or the ratepayer is often without quantifiable documentation.

The development of municipal or utility energy conservation programs centers principally on economic and social issues. Utilities look at energy efficiency and demand management as a cheaper option than the construction of a new power plant. Municipalities consider energy efficiency because it promotes awareness and therefore helps keep utility bills low for its citizens. The two viewpoints may combine as in the case of the City of San Antonio and its municipally owned utility, City Public Service. A dilemma, therefore, arises when a municipally owned utility has excess capacity. The municipality demands that its utility provide for growth and maintain rates, two goals which may conflict.

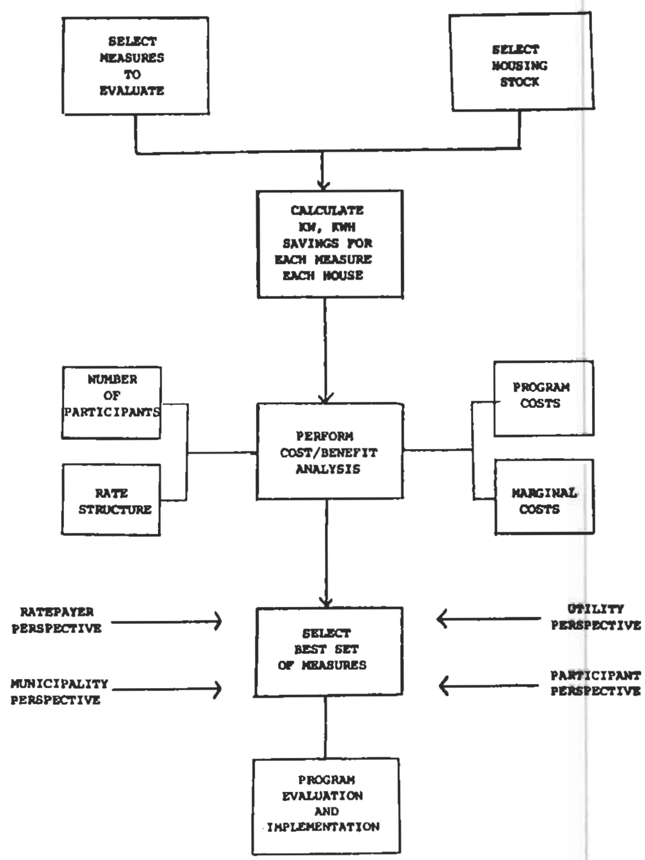
In this project, the City of San Antonio's Office of Public Utilities assessed the potential for energy conservation and its relationship to meeting the community's economic growth objectives. The project evaluated the municipally owned utility's energy conservation goals and objectives, current and future programs, and its forecasting and generation plans. Emphasis was placed on evaluating and developing cost-effective residential energy conservation programs designed for the San Antonio area and determining a "best-set" of programs based on a detailed economic analysis.

THE METHODOLOGY

This section addresses the potential for future electric and gas savings through implementation of various energy conservation measures within residential structures. This assessment depends on the development of a cost-effectiveness methodology that evaluates energy conservation programs from four perspectives: the participant, non-participant, City Public Service, and the City of San Antonio.

The cost-effectiveness methodology centers on the utilization of two micro-computer programs, Predesign Energy Simulation Program (PREP), and Demand Side Planner (DSP). PREP was used to evaluate individual changes in energy consumption in four typical residential units found in the San Antonio area by simulating changes in electric and gas consumption due to different energy conservation measures. The DSP model analyzed the relationship between the benefits and costs of specific conservation and load management program investment alternatives. Figure 1 illustrates the methodology used to determine the "best set" of energy conservation measures/strategies for residential structures. The following will discuss each step performed in determining the cost-effectiveness of each program considered.

FIGURE 1
PROGRAM METHODOLOGY



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RESIDENTIAL UNITS' DESIGN ANALYSIS

The first step of the methodology considered the goals and objectives of the city and local utility. These goals dictated the type of energy conservation strategies that should be considered for the service area. To discover the various conservation programs available, this study conducted a survey of existing and proposed energy strategies employed by the City of San Antonio and the Texas region. Mainly, Texas utilities' Energy Efficiency Plans were reviewed. A final list of measures was then selected for detailed cost/benefit analysis as shown in Table 1.

Housing Stock Selection and Analysis

The second step selected residential housing units to use in calculating KWH, KW, and MCF savings associated with different energy conservation strategies appropriate for the service area. The potential for energy conservation in each of these units was then tested.

To accurately assess residential energy conservation, it was decided that PREP should evaluate energy usage for a range of residential housing that would represent the San Antonio area. Justified simply, not all housing is the same; therefore, it is appropriate to analyze energy usage for several sizes of housing units rather than one average housing unit. Housing selection was done using a statistical classification of residential electric customers developed by the CPS Load Research Program. As part of the CPS Load Research Program, CPS developed a statistical classification of electric residential customers. The classification system identifies five different levels of energy consumption. These residential strata are defined by the highest one month consumption in the months of July, August, or September. The residential (RE) class strata are as follows:

Stratum 1	0 - 600 KWH/mo.
Stratum 2	600 - 1200 KWH/mo.
Stratum 3	1200 - 2000 KWH/mo.
Stratum 4	2000 - 3000 KWH/mo.
Stratum 5	Over 3000 KWH/mo.

Strata 2,3,4 and 5, were selected for in-depth study. The four residential structures selected were: (1) a Stratum 2, 820 square foot existing residential unit; (2) a Stratum 3, 1775 square foot average residential unit developed by Southwest Research Institute (SRI); (3) a Stratum 4, 2146 square foot residential unit designed by Ray Ellison Builders of San Antonio, Texas; and (4) a Stratum 5, 3450 square foot residential unit similar to the Stratum 3 home developed by SRI. The analysis did not include a Stratum 1 home because of findings presented in other energy conservation studies. Analysis showed that this stratum's energy usage proved too low for energy measures to be cost effective. Therefore, this study did not decide whether to implement conservation measures in this stratum based strictly on a cost/benefit analysis. Social issues such as the equity of the utility's overall conservation strategy for low income customers should play the most important role in policy decision concerning energy conservation measures for this stratum.

TABLE 1
SELECTED RESIDENTIAL ENERGY CONSERVATION MEASURES

Building Envelope
- Increase Wall Insulation to R19.
- Increase Wall Insulation to R25.
- Add Reflective Film to Single Pane Windows.
- Add Double Pane Windows.
- Add Reflective Film to Double Pane Windows.
- Add Caulking and Weatherstripping.
- Reduce Infiltration.
- Reduce Infiltration and increase Wall Insulation.
- Add Caulking, Weatherstripping, and R-25 Wall Insulation.
- Increase Outside Shading.
- Increase Indoor Shading.
- Change Wall and Roof color.

Heating, Cooling, and Ventilation Design
- Increase Central Air Conditioning to EER 9.
- Increase Central Air Conditioning to EER 10.
- Add Water Heater Jacket.
- Replace Gas Heat with Electric Heat.
- Replace Heating/Cooling system with Heat Pump.

Combined
- Combine R19 Wall Insulation and EER 9 Air Conditioning.
- Combine R25 Wall Insulation and EER 9 Air Conditioning.
- Combine R25 Wall Insulation, EER 9 A/C, Reflective Film, Water Heater Jacket, Caulking and Weatherstripping.
- Combine R25 Wall Insulation, EER 9 A/C, Reflective Film, Water Heater Jacket, reduce Infiltration by 50 percent.

As explained above, the four houses used in this study come from three sources. Therefore, their original design characteristics differ regarding amount of glass area, number and design of outside walls and roof, and other building envelope factors. (For this analysis' purposes, placement of inside walls had no effect on results.) However, to keep the analysis as consistent as possible, the original design criteria for building envelope, orientation, and shading were blended to form one set of assumptions used for all four houses. Changing the glass area and/or the surfaces' placement would, however, have distorted the analysis rather than improving it because house size definitely dictates the number of windows and walls. Therefore, the study left these housing characteristics unchanged.

Table 2 describes the results of the PREP runs on the Stratum 3 house. Similar tables were developed for the Stratum 2, 4, and 5 houses. Some of the data in these tables were put

TABLE 2
STRATUM 3 HOME

CASE DESCRIPTION	KWH'S USED	KWH'S SAVED	KWH DOLLARS SAVED	PEAK KW'S USED	PEAK KW'S SAVED	MCF'S USED	MCF'S SAVED	GAS DOLLARS SAVED	TOTAL DOLLARS SAVED	COST OF MEASURE	PAYBACK PERIOD IN YRS
BASE CASE	8633	--		6.6	--	38.4	--				
CHG EER 7 A/C TO EER 8	7977	656	$50.51	5.9	0.7	38.4	0	$0.00	$50.51	$1,190	
CHG EER 7 A/C TO EER 9	7450	1183	$91.09	5.3	1.3	38.4	0	$0.00	$91.09	$165	1.8
CHG EER 7 A/C TO EER 10	7043	1590	$122.43	4.9	1.7	38.4	0	$0.00	$122.43	$1,175	9.6
ZERO WALL INSULATION	9539	-906	($69.76)	8.0	-1.4	69.5	-30.1	($165.25)	($235.01)	$946	4.0
INCR CEILING INSULATION TO R19	7455	1178	$90.71	6.0	0.6	28.8	9.6	$52.70	$143.41		
INCR CEILING INSULATION TO R25	7372	1261	$97.10	5.9	0.7	28.1	10.3	$56.55	$153.65	$385	2.5
COMBINE R19 INSULATION AND EER 9 A/C	6535	2098	$161.55	4.9	1.7	28.8	9.6	$52.70	$214.25		
COMBINE R25 INSULATION AND EER 9 A/C	6470	2163	$166.55	4.8	1.8	28.1	10.3	$56.55	$223.10	$550	2.5
ADD REFLECTIVE FILM TO SINGLE PANE WINDOWS	8004	629	$48.43	6.4	0.2	39.6	-1.2	($6.59)	$41.84	$50	1.2
ADD DOUBLE PANE WINDOWS	8559	74	$5.70	6.3	0.3	33.9	4.5	$24.71	$30.41	$810	26.6
ADD REFLECTIVE FILM AND DOUBLE PANE WINDOWS	8021	612	$47.12	6.2	0.4	35.3	3.1	$17.02	$64.14	$860	13.4
ADD WATER HEATER JACKET	8412	221	$17.02	6.5	0.1	38.7	-0.3	($1.65)	$15.37	$8	0.5
ADD CAULKING AND WEATHERSTRIPPING	8444	189	$14.55	6.4	0.2	37.1	1.3	$7.14	$21.69	$68	3.1
CUT INFILTRATION RATE IN HALF	7813	820	$63.14	5.9	0.7	33.0	5.4	$29.65	$92.79	$68	0.7
CUT INFIL RATE IN HALF AND ADD R25 INSULATION	6558	2075	$159.78	5.2	1.4	22.7	15.7	$86.19	$245.97	$453	1.8
ADD CAULKING, WEATHER-STRIPPING, AND R25 INSUL	7175	1458	$112.27	5.7	0.9	26.7	11.7	$64.23	$176.50	$453	2.6
COMBINE R25 INSL, EER9 A/C, REFLECTIVE FILM, WATER HEATER JACKET, CAULKING AND WEATHERSTRIPPING	5718	2915	$224.46	4.2	2.4	28.6	9.8	$53.80	$278.26	$676	2.4
COMBINE R25 INSL, EER9 A/C, REFLECTIVE FILM, WATER HEATER JACKET, AND INFILTR RATE CUT IN HALF	5260	3373	$259.72	3.8	2.8	24.6	13.8	$75.76	$335.48	$676	2.0
REPLACE GAS HEAT WITH ELECTRIC HEAT	17077	-8444	($650.19)	9.7 (winter)	-3.1	0.0	38.4	$210.82	($439.37)		
EER 7 AIR CONDITIONER VS HEAT PUMP ($ VS EER 9)	11089	-2456	($189.11)	5.6	1.0	0.0	38.4	$210.82	$21.71	$1,950	89.8
EER 7 AIR CONDITIONER VS HEAT PUMP ($ VS EER 10)	11089	-2456	($189.11)	5.6	1.0	0.0	38.4	$210.82	$21.71	$1,300	59.9
VERY LIGHT OUTSIDE WALLS	7037	1596	$122.89	6.3	0.3	42.8	-4.4	($24.16)	$98.73	$45	0.5
VERY DARK OUTSIDE WALLS	11264	-2631	($202.59)	6.5	0.1	33.0	5.4	$29.65	($172.94)	$45	-0.3

into the cost/benefit model used to determine energy conservation measures cost-effectiveness.

DEMAND SIDE MANAGEMENT

The third major step in calculating energy conservation benefits and costs was to determine the cost-effectiveness of specific conservation and load management program investment alternatives. The objective of this analysis was to determine which measures/programs evaluated with the PREP analysis actually have a positive economic impact on the participant, the non-participant, to the utility, the city or all parties; or, if it is economically unfeasible for any entity involved. The analysis was completed utilizing a micro-computer based LOTUS 1-2-3 spreadsheet model called Demand Side Planner (DSP). The objective was achieved through DSP results which produced a cost/benefit ratio for several perspectives for each program by stratum level.

The perspectives considered in this analysis included the utility, the municipality, the participant, and the non-participants. The measurement of these impacts become increasingly important as municipalities and regulatory agencies require the utilities to pursue conservation options as a means to meet customers requirements. The cost/benefit analysis was developed to provide quantitative measures of cost-effectiveness of various conservation and load management programs. The net present values and cost/benefit ratios derived provide objective economic indicators for all the perspectives. Both the cost and benefits of demand-side programs were calculated over the life of a proposed program.

Typically, this comparison is expressed as a cost/benefit ratio: that is the value of the benefits divided by the value of the cost. If the cost/benefit ratio is greater than one (positive), rates (or bills) will be lower than they otherwise would have been over the life of the program(s) assuming no other changes. If the cost/benefit ratio is less than one (negative), then rates (or bills) are expected to be higher than they otherwise would have been over the life of the project. Therefore, a program is characterized as cost-effective (from a given perspective) if the cost/benefit ratio exceeds one. These ratios provided the basis for the selection of cost-effective programs.

THE RESULTS

The fourth step in determining the cost-effectiveness of energy conservation measures is the selection process. The selection of the "best set" of energy conservation measures for San Antonio followed a three step process of evaluation and elimination. First, the cost/benefit ratios, actual dollar impact on rate level, payback years to the participant, cost of the measures, financing options, and non-economic considerations were listed for each measure. Next, a best set of programs was determined using only the economic issues as calcuated by the DSP computer model as criteria. Finally, this initial best set received further analysis, from the perspective of the combined dollar impact and combined KW and KWH savings which resulted. Savings for each measure were calculated based on three different participation levels of 1, 5 and 10 percent. This means, for example, that 5 percent of the customers enter a program each year of the 10 years the program is in place, resulting in a total of 50% participation at the end of 10 years. The study used results of the 5 percent participation level as a standard because the city hopes to expand participation in conservation programs and therefore wanted to evaluate the dollar impact at a higher participation level than currently occurs.

A few general comments pertain to the majority of the measures. First, the proposed programs, (those not already offered by CPS) assumed the same operating and maintenance costs as CPS's similar, already functioning, programs. Second, loan programs, present and proposed, experience high operating and maintenance costs due to bank processing fees and the number of customers processed but never approved. These two factors make the unit cost of loans very high compared to rebates. Finally, CPS loans money through its programs with a seven year payback schedule. This study assumed a five year payback, necessitated by the limitations of the DSP computer program. The difference in cost between five and seven year loans was not significant to the study when tested.

ECONOMIC BEST SET

As stated, the "best set" of energy conservation measures for San Antonio was chosen based solely on economic criteria. If a measure proved cost-effective under a certain financing strategy, it was included in this economic best set. For example, rebates on high efficiency air conditioning units have positive cost/benefit ratios; loans do not. Therefore, rebates on high efficiency air conditioners became part of the best set; loans did not. The following list briefly describes each program in the best set of measures.

- A 15% rebate on retrofit attic insulation over a certain R value, paid by CPS. The program would function like CPS's present air conditioner rebate program.
- A 15% rebate on retrofit wall insulation, paid by CPS. This program would also function like present CPS rebate programs.
- A 20% rebate on retrofit weatherization materials, paid by CPS. Caulking, weatherstripping, water heater insulation wraps, and outlet insulators would qualify for rebates. The participant would have to spend a minimum dollar amount to receive the rebate.
- A 5% rebate on retrofit or new home high efficiency window or central air-conditioner units of EER 9 and above, paid by CPS. This replaces CPS's $150 rebate program. Dealers would continue to receive a $25 incentive payment.
- A mail-in audit, performed by CPS. The participant answers a questionnaire; CPS inputs their answers into a computer program which calculates cost/benefit ratios and payback time. CPS mails the analysis back to the participant.
- A Residential Conservation Service (RCS) audit, offered by CPS. CPS currently does RCS audits on request and hands out free weatherization materials. The only change recommended is for CPS to discontinue giving away material.

In addition to the above programs sponsored by CPS, two programs proved cost-effective for a third party to finance and are therefore recommended.

- A weatherization kit given away free. The kit would contain caulking, weather-stripping, outlet insulators, and a water heater wrap. The entity donating the kit would have to absorb the total cost of the materials. The program would, therefore, necessarily be regarded as a community service or as an aid to low income consumers if structured in this manner.

- Loans at below market interest rates for energy conservation measures. Loans would be issued for high efficiency air conditioners, weatherization, and attic insulation.

ALTERNATIVE PROGRAM COSTS AND SAVINGS

While a "best-set" residential energy conservation program was determined, it is unrealistic to believe that all participants would implement all of the measures. Therefore, the "best-set" was divided into four subsets which reflect different groupings of programs and different levels of participation in the tested energy conservation programs. Each subset has its own annual utility costs and MW savings. The first three subsets represent realistic possibilities of combinations of measures implemented by a household. The last subset shows what would happen if all programs had good participation, an ideal maximum. Table 3 lists the four principal residential energy conservation subsets that include a minimum, mid-range, household maximum, and, lastly, a total maximum level of energy conservation participation if all programs were implemented throughout the service area. This last category assumes all programs gain a certain participation level, regardless of how many measures an individual household implements. Each of the subsets except the maximum level were evaluated from participation levels of 1, 5, and 10 percent. The maximum level was only evaluated with participation levels of 1 and 5 percent. A 10 percent participation level in every measure was believed to be too unlikely a possibility.

As discussed previously, some of these energy conservation programs carry a negative cost/benefit ratio for the Impact on Rate Level perspective. (In all cases, the other four perspectives have positive ratios.) The net dollar costs to the ratepayer that resulted from this negative impact were calculated for each measure. However, to properly assess the economic viability of these "best sets" of energy conservation programs, the study added together each program's annual cost to the individual ratepayer. Table 4 gives these total annual costs. Remember that the dollar costs are based on a participation level of 5% percent of the customers entering the program each year for 10 years through 1995.

TABLE 3
RESIDENTIAL ENERGY CONSERVATION PROGRAMS

A. Minimum Level

- 20% Rebate on Weatherization
- 15% Rebate on Attic Insulation

B. Mid-Range Level

- 20% Rebate on RCS Audit
- Weatherization
- 15% Rebate on Attic Insulation
- EER 9 Air Conditioning

C. Household Maximum Level

- RCS Audit
- 15% Rebate on Attic Insulation
- 15% Rebate on Wall Insulation
- 20% Rebate on Weatherization
- 5% Rebate on EER 10 Air Conditioning
- Increase Exterior Shading
- Decrease Solar Absorbability of Exterior House Color

D. Maximum Total Participation

- 15% Rebate on Attic Insulation
- 15% Rebate on Wall Insulation
- 20% Rebate on Weatherization
- 5% Rebate on EER 9 Air Conditioning
- 5% Rebate on EER 10 Air Conditioning
- Mail-In Audit
- RCS Audit
- Increased Exterior Shading
- Decreased Exterior Solar Absorbability of Exterior House Color

TABLE 4
ENERGY CONSERVATION "BEST-SET" ANNUAL COSTS PER RATEPAYERS

Description	Annual Cost/Bill in 1985	Present Value Annual Cost/Bill in 1995
Minimum Level	$ .69	$ .50
Mid Range Level	$2.23	$1.61
Household Maximum Level	$2.16	$1.56
Maximum Total Participation	$2.93	$2.11

As shown, the present value cost per ratepayer increases only minimally if additional measures are included. However, the customer's return on investment increases significantly. In addition, the cost per ratepayer would decrease as the customer base increased (numbers in Table 4 are based on 1986 total customers. CPS expects customer base to double by 2010).

Tables 5 details pertinent information for one of the three levels of participation in the four "best-set" subsets (identical tables were developed for the other two participation levels). Specifically, the table shows the total number of participants, the cumulative total annual cost to the utility to run the program (calculated by adding the total annual operating and maintenance expense and the total rebates paid), the present value of the net dollar savings to the utility and to the participants over the 30 year life of the program, the annual MW savings - total and peak, and the annual MWH savings.

Figures 2, 3, 4, and 5 at the end of the chapter summarize most of these same results for all stratum levels. The graphs depict the total present value dollar savings to the participant, the total peak MW saved in 1995, the total present value dollar savings to the utility, and the dollar cost to the utility in 1986. Each graph contains the values for all the programs and for all participation levels in all four subsets.

The results demonstrate the definite economic benefits to the utility and the customer due to energy conservation. For example, if the utility implements a weatherization and attic insulation program and has 1 percent of its customers participate, there is a potential to save 56 MW

TABLE 5
ALL STRATUM AT 5 PERCENT PARTICIPATION LEVEL

Program	Total Number of Participants	Annual Cost to Utility for Implementation	Present Value Net Dollar Savings to Utility Over 30 Years	Present Value Net Dollar Savings to Part. Over 30 Years	Annual MW Savings** Peak	Annual MW Savings** Total	Annual MWH Savings
Total - Minimum Level of Energy Conservation Measures (ECM)*							
1986	12,411	$ 1,300,800			13	22	28,237
1990	72,395	1,885,696			78	140	171,638
1995	157,683	2,874,090			173	282	373,580
2000	157,683	0			132	208	305,245
2005	157,683	0			89	123	224,717
2010	85,288	0			48	67	121,408
2015	0	0	$ 351,746,500	$ 200,159,096	0	0	0
Total - Mid-Range Level of ECM's***							
1986	12,411	$ 3,787,123			25	39	46,648
1990	72,395	5,509,157			140	231	257,890
1995	157,683	8,397,006			308	482	561,443
2000	157,683	0			267	408	493,108
2005	157,683	0			162	231	326,329
2010	85,288	0			48	67	121,408
2015	0	0	$ 514,226,673	$ 302,602,631	0	0	0
Total - Household Maximum Level of ECM's							
1986	12,411	6,150,415			42	56	63,145
1990	72,395	8,371,749			186	325	356,318
1995	157,683	10,825,307			508	686	784,652
2000	157,683	0			463	612	713,409
2005	157,683	0			344	413	519,071
2010	85,288	0			138	151	205,626
2015	333	0	$ 759,565,287	$ 345,072,042	0	0	3,165
Total - Maximum Level of ECM's							
1986	94,231	$ 7,709,905			79	111	157,584
1990	510,222	10,656,334			431	618	829,320
1995	961,049	14,305,224			928	1,327	1,869,467
2000	994,928	0			833	1,169	1,663,427
2005	592,766	0			516	660	931,969
2010	187,761	0			138	151	205,626
2015	1,558	0	$ 1,638,744,179	$ 916,882,284	0	0	2,231

*See Table 3 for a listing of energy conservation measures under Minimum, Mid-Range, Household Maximum and Maximum Levels

**Savings decrease even through the number of households participating stays constant because weather-stripping wears out faster than insulation.

***Costs include audit and rebates on weatherization an insulation. MW, MWH savings, and net dollar savings counted only for weatherization, insulation, and EER 9 - nothing for audit.)

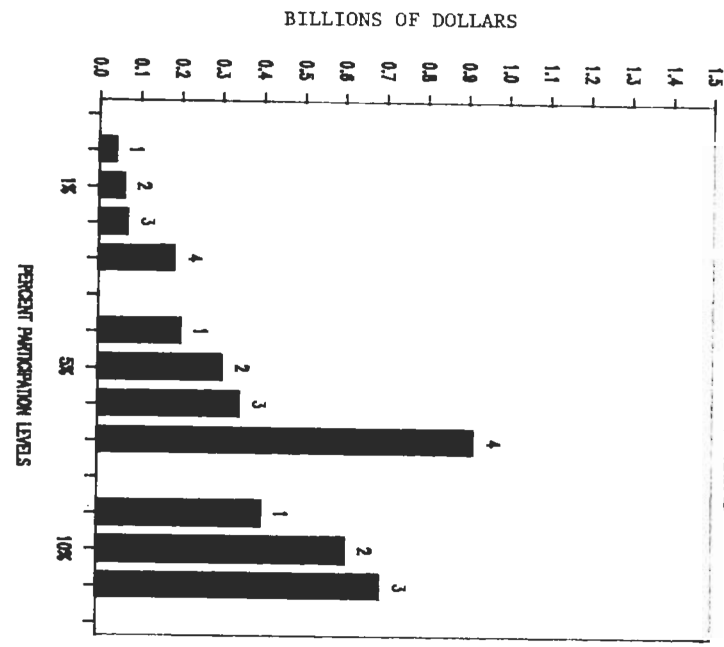

FIGURE 2
TOTAL PV $ SAVINGS TO PARTICIPANT
IF DIFFERENT PROGRAMS ARE IMPLEMENTED

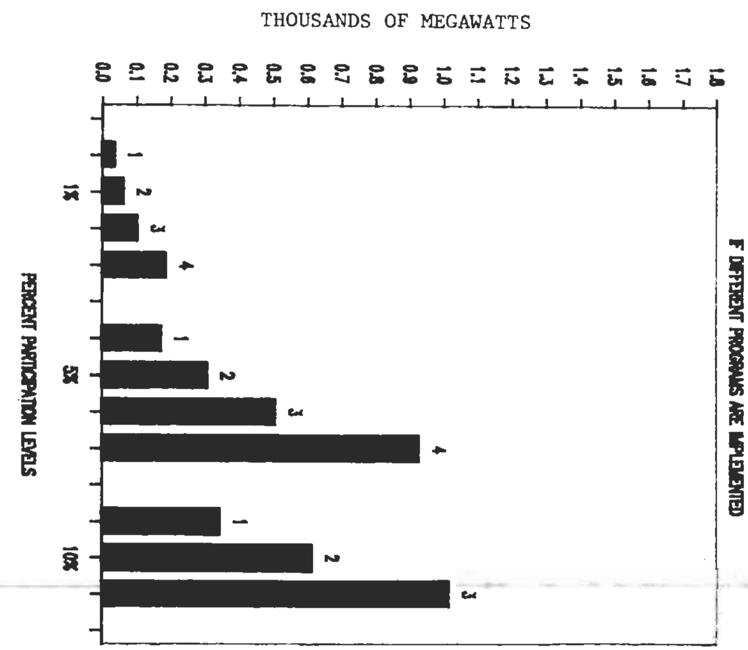

FIGURE 3
PEAK MW SAVED IN 1995
IF DIFFERENT PROGRAMS ARE IMPLEMENTED

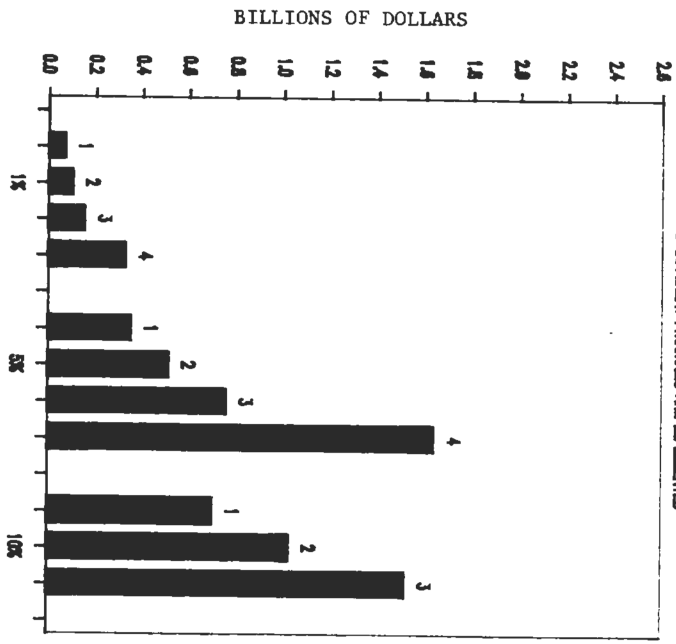

FIGURE 4
TOTAL PV $ SAVINGS TO UTILITY
IF DIFFERENT PROGRAMS ARE IMPLEMENTED

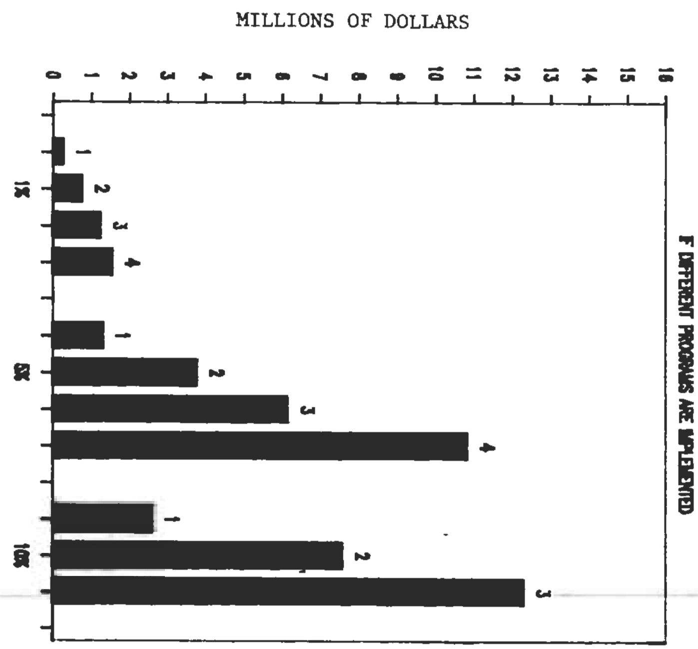

FIGURE 5
TOTAL DOLLAR COST TO UTILITY IN 1986
IF DIFFERENT PROGRAMS ARE IMPLEMENTED

1 = Minimum 2 = Mid-Range 3 = Household Maximum 4 = Maximum Total

in 1995. By increasing air conditioning and appliance energy efficiency at the same time, the savings could increase to 96 MW. A 5 percent participation level for the weatherization and attic insulation programs has the potential to save 282 MW in 1995, 482 MW when efficient air conditioning and appliances are added. For both participation levels, the present value net dollar savings to the utility and the participant over 30 years is significant. For a cost to the utility of approximately $3.5 million to implement the weatherization, insulation, and air conditioning measures, the 1 percent participation level generates $102.8 million in savings to the utility and about $60.5 million to the participants.

Program Evaluation

The final step of the methodology selected the best energy conservation measures to implement and determined the dollar impact and demand and energy savings of the programs for the six perspectives evaluated. The cost/benefit analysis offered a consistent evaluation but did not select which perspective should take precedence. Although the analysis did not deal with policy and regulatory issues, the quantitative analysis did provide decision-makers with the factual evidence to support decisions regarding which programs to implement and which conservation strategies to support. In summary, the analysis:

- Provided empirical data that represented program development costs and savings.
- Provided decision-makers with a "total awareness" of how programs interacted with the utility, the municipality and the ratepayers.
- Provided the ability to compare program efficiency versus cost-effectiveness.
- Provided the integration of conservation planning with supply-side management of load forecasting and generation planning.

CONCLUSIONS AND RECOMMENDATIONS

The level and detail of the cost-benefit methodology allowed this study to assess demand reduction and energy savings associated with a range of "best-set" of energy conservation options and participation levels. The cost/benefit analysis provided the city, CPS, and its ratepayers with the costs and savings resulting from energy conservation alternatives. The results of the analysis have, without doubt, provided the city with quantifiable data to promote energy conservation/efficiency strategies throughtout CPS's service area.

The results of this study include:

- The development of a methodology to analyze quantifiable factors relating to conservation strategies, applicable for future studies.
- The dollar costs and savings associated with various KWH, KW and MCF savings resulting from conservation strategies.
- An evaluation of financial and participant incentive options.
- An economic "best-set" stated in four alternative subsets of measures for San Antonio's residential energy conservation program.
- Quantifiable data to support policy decisions.

The goal of the study was to establish empirical data regarding energy conservation activities, both current and potential, in San Antonio. The evaluation methodology has identified a range of "best-set" scenarios, each with their respective costs, MW and MWH savings, and participation levels. The minimum range with 1 percent and 10 percent participation resulted in a MW savings in 1995 of 35 and 346 respectively and present dollar savings to the utility of $70 million and $703 million respectively. The total maximum range with 1 percent participation and the household maximum with 10 percent participation resulted in a MW savings in 1995 of 186 and 1,016 respectively, and present dollar savings to the utility of $328 million and $1.5 billion, respectively. (1995 is the year in which the maximum annual MW savings is realized.)

After fully assessing these strategies, the city should request that this analysis be integrated into the load forecast and generation planning process of CPS. Emphasis is placed on the policy decisions required to set goals for energy efficiency and how these goals will impact future generation and plant construction.

The "best-set" strategies and programs identified should be implemented by CPS but they must be continually monitored. Accurate load forecasting will be dependent on continual usage of computerized planning and forecasting models and should also include demand metering to determine the demand savings from conservation programs. Even though CPS currently has excess capacity above the 20 percent required by state law, energy conservation is cost-effective to the utility. It is important to stress that the analysis conducted has been conservative and does not include all possible residential measures nor any commercial and industrial measures. The city and CPS should develop an Energy Efficiency Plan and include residential, commercial and industrial structures.