(See Chrs Entry)

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ORIGINAL

November 14, 1997

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By Hand Delivery

Blanca S. Bayó, Director
Records and Reporting
Florida Public Service Commission
4075 Esplanade Way, Room 110
Tallahassee, Florida 32399-0850

970000

~~980000~~

Re: Commercial/Industrial Hot Water Storage Research Project

Dear Ms. Bayó:

Enclosed for filing on behalf of Florida Power & Light Company are the original and fifteen (15) copies of Commercial/Industrial Hot Water Storage Research Project/Final Report. The Project was originally approved in Docket No. 900091-EU.

If you or your Staff have any questions regarding this filing, please contact me.

Very truly yours,

Charles A. Guyton

Charles A. Guyton

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Florida Power & Light Co.

Commercial / Industrial

Hot Water Storage Research Project

Final Report

November 1997

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I. INTRODUCTION

In June 1990, FPL filed a petition with the Florida Public Service Commission ("Commission") to conduct a Commercial/Industrial Hot Water Storage Research Project. The project was approved by the Commission, and FPL proceeded with the research project. FPL identified and evaluated various design concepts, developed storage water heater prototypes and conducted laboratory testing of those prototypes. This report is a summary of the results of the research as well as FPL's conclusions and recommendations.

II. DESCRIPTION OF COMMERCIAL/INDUSTRIAL HOT WATER STORAGE RESEARCH PROJECT

II.A. Purpose of Research Project

The purpose of this project was to assess the viability and feasibility of heating water during off peak hours and storing it until needed during the day as a potential means of reducing on peak electricity usage, and thus becoming a demand side management program. More specifically, the project aimed at developing compact electric storage water heaters for use in residential and commercial applications. In order for FPL to evaluate this technology and make a program development decision for implementing of such a program, a residential and a commercial water heater prototype had to be developed. This research project evaluated potential demand and energy savings as well as customer savings and paybacks associated with the different options available. The scope of this research project did not include research of market potential.

II.B. Background

In June 1990, FPL petitioned the Commission for approval of its Commercial/Industrial Hot Water Storage Research Project. Subsequently, FPL's Commercial/Industrial Hot Water Storage Research Project was approved in October 1990 as part of the company's DSM Plan for the 90s. A copy of this is shown in Appendix A.

The proposed development of an electric storage water heater was based on certain constraints such as capacity, size, temperature, maximum allowable cost and applicable codes and standards. The constraint imposed on the size required the volume of the new water heater to be no more than 150% of the volume of a conventional water heater of the same thermal storage capacity. The allowable cost constraint, based on avoiding the peak load due to water heating for an average residential customer, fell in the $400 to $500 range. This constraint was based on an original assumption of avoiding 311 watts during peak periods at an avoided generating cost of $1000/kW.

The project was conducted in four phases: (1) thermal energy storage materials were identified and (2) evaluated, (3) various design concepts were developed and evaluated, and (4) laboratory testing of systems based on the concepts was conducted. Based on the work completed in the first two phases of the project, two off peak water heater concepts were selected for further development and testing. In Phase III of the project, prototypes of two water heaters, the HDPE (High Density Polyethylene) storage heater and the high temperature sensible heat storage heater, were built in the laboratory. The prototypes were tested for thermal performance, accelerated lifetime, and intermediate-term performance according to a documented test plan agreed upon by all parties associated with the project.

At the end of Phase III, two patent applications were filed for the water heaters developed. The concepts were disclosed to two manufacturers on a confidential

basis, for the purpose of soliciting their input on the manufacturability of the water heaters. The result of the studies showed that the HDPE storage water heater had better overall thermal performance than the high temperature sensible heat storage water heater. Therefore, the HDPE water heater was selected for further study, and its design was finalized in collaboration with Vaughn Manufacturing Inc. Based on the thermal performance and the manufacturability potential of this design, it was concluded that it was the design best suited for commercialization.

Field testing of the residential and the commercial prototypes manufactured by Vaughn was conducted at the Energy Research and Education Park of the University of Florida under Phase IV. The test results show that the two water heaters worked effectively in providing all of the daily hot water needs of their respective applications with only one off peak charge. Details of the water heater design, experimental test plan and procedures, and results are presented in this report.

II.C. Theory of Operation and Scope of Research

An electric storage water heater is charged once a day during the off peak period and stores the hot water for use throughout the day. Although the required capacity of a water heater depends on the application, a thermal storage capacity of 15 kWh (60 gallons) is sufficient for the daily water requirements of an average residential customer. Considering two or more charging periods between peak periods, and the actual average supply water temperature for Florida (~ 72°F, instead of the national average of 59°F), then the assumed 60 gallons capacity provides an additional cushion of 20% to 80% more hot water for an average residential customer. In the commercial sector the most common size of water heater is the 100 gallon size. Therefore, a water heater with a storage capacity of 30 kWh (110 gallons) was selected as the unit to be developed.

Various storage concepts involving sensible heat storage, latent heat storage, combination of sensible and latent heat storage, and chemical reactions can be used to store hot water. For this project, chemical reaction storage was abandoned from this research project in favor of the sensible and latent heat because of the technical complexity of chemical reactions.

Conventional water heaters are of the sensible heat water storage type, consisting of an insulated tank with one or more immersion heating elements. For residential water heating applications, 30 gallon and 40 gallon storage tank water heaters are most common and sell in the range of $100 to $250 per unit. However, these water heaters do not have sufficient capacity to provide the necessary storage for off peak operation. A larger tank operating at higher temperatures is needed to meet the demand during peak hot water usage.

Larger capacity off peak water heaters are available as non-pressurized and pressurized water storage units. Water is typically heated to 203°F in non-pressurized units, and to 280°F in pressurized units at a pressure of about 50 psig. However, the main disadvantages of large capacity water storage water heaters are the large size of the unit and the large standby losses from the storage tank. Since one of the objectives of this research project was to develop a water heater that reduced the volume of the storage unit by at least half the volume of a conventional water heater, large capacity water storage units dropped from consideration. Therefore, two water heater concepts became the main focus of the research, the sensible heat storage in solids at high temperature and the latent heat storage in Phase Change Materials (PCMs).

Thermal energy storage in solids has historically been used for space heating applications by introducing an air-water heat exchanger in a conventional space heating system or by running stainless steel tubes through the solid and directly passing water through the tubes. These units usually utilize ceramic storage materials that are electrically heated during off peak periods to very high

temperatures. To achieve the lowest volume, it is necessary to use the storage medium with the highest possible energy density. This leads to a choice of either a ceramic material or cast iron. However, since cast iron has high electrical conductivity, which requires special materials for the heating element, and high cost, its use as a storage material is not preferred. Ceramic materials necessitate the addition of an air-water heat exchanger or the running of a stainless steel tube through the solid. Due to the complexity of the blower arrangement in the heat exchanger and the tubing in the other solid heat storage method, the research concentrated on the latent heat storage water heater concept.

The advantage of storing thermal energy in the form of latent heat is that a high volumetric energy density is achieved over a narrow temperature range. Several PCMs that undergo solid-liquid and solid-solid phase transformation meeting this criterion were identified. These PCMs can be classified into various categories such as: salt hydrates, organic paraffin's, non-paraffin organics, solid-state PCMs and eutectics of organic and/or inorganic compounds. For water heating applications, those PCMs that have transition temperatures in the range of 140° to 211°F are most suitable for thermal storage. Although many materials showed the appropriate characteristics, six were selected for further consideration since the others are very expensive or not commercially available. In general, the materials selected for analysis were those with volumetric energy densities higher than 100 kWh/m^3.

Based on extensive testing in Phase III, the HDPE storage water heater design was finalized and two prototypes, a residential and a commercial unit, were fabricated. The residential storage tank is made of 1/8 inches thick steel plate, 18 inches in diameter and 40 inches in height. The tank is filled with HDPE and propylene glycol up to 35 inches from the bottom to leave room at the top for thermal expansion of the oil. A 4 kW electrical resistance element is suspended from the center of the top cover. The heating element is designed to provide more heat at the bottom than at the top so that thermal stratification can be minimized. A 5 inch diameter open mesh cylinder around the electrical element separates the element from the HDPE

pellets. The heat exchanger is a long finned copper tubing wound into three coils of different diameters, which are immersed into the HDPE pellets and propylene glycol solution. The tank is insulated with four layers of 1 inch thick fiberglass insulation. A thermostat automatically turns the heating element off when the storage bed temperature reaches the preset upper limit of 284°F. For safe operation, a pressure relief valve is set at the top of the tank and set to 40 psig. to prevent excessive pressure build-up. The commercial unit uses the same design, but it has more volume, and it incorporates a circulating pump to reduce stratification.

III. R&D PROJECT COSTS

The total energy conservation cost recovery dollars approved by the Commission for this research project was $225,000. These expenditures were based on FPL's best estimate for the four phase research and development process, which is included as Exhibit II within the petition. The primary expenditures associated with this research project included the following:

- Contract to conduct a four phased feasibility study, and
- FPL expenses associated with project management.

FPL's total expenditures to complete the Commercial/Industrial Hot Water Storage Research Project were $ 228,039. FPL has only recovered $225,000 through the ECCR Clause for this project.

IV. R&D EVALUATION

IV.A. Method of Evaluation

Residential Water Heater

A residential water heater prototype was completely instrumented and installed at the University of Florida solar house. Thermocouples were installed to monitor the

temperatures at selected positions of the system. In the charging process, the storage material was heated to an average bed temperature of 284°F during the nighttime (off peak period). The bed temperatures at different heights were recorded every 30 seconds and the total electricity input was measured by a kWh meter.

In the first group of discharge tests, water was continuously drawn through the heater at a constant flow rate. Three different flow rates, 1.5, 2, and 3 gpm were used for testing. These flow rates are typical of various residential applications, such as showers, dish washers, clothes washers, etc. The temperatures of the hot water entering and exiting the mixing valve were recorded.

In the second group of tests, water was drawn from the storage system according to a simulated test plan which closely resembled the daily hot water consumption in a typical household. The test plan followed a plan recommended by ASHRAE in the ASHRAE Applications Handbook 1987. The discharge operation was manually controlled.

Commercial Water Heater

The instrumentation setup and test procedures were the same as the ones used for the residential water heater. Tests, included charging, discharging at various continuous draw rates and discharging according to a simulated field test plan, which was similar to the one used with the residential water heater except that the time required for each event was doubled.

IV.B. Evaluation of Results

Residential Water Heater

The residential storage water heater took approximately two hours to fully charge the storage unit from an average bed temperature of 122° to 284°F. Thermal stratification was low until the HDPE pellets at the top have changed phase

completely. The maximum temperature difference is 77°F to 86°F, which is acceptable.

Based on discharging the water heater at 1.5, 2 and 3 gpm, the temperature of direct discharge at the end of each test was still 185°F, which means additional useful hot water could be drawn. Thus, the prototype water heater has sufficient capacity to meet the typical hot water needs of a residential household with a single charge during the off peak period.

Commercial Water Heater

The temperature profiles for the commercial water heater showed a temperature stratification of 122°F to 140°F between the top and the bottom of the storage bed. The bottom portion of the HDPE pellets is about 104°F lower than the phase change temperature of 259°F. These results prompted the modification of the design for the commercial water heater to include a circulating pump to distribute the oil from the bottom to the top of the tank for a short period of time to reduce stratification. Tests with the modified design showed that after the oil circulating pump is operated for 30 minutes, the temperature difference decreased significantly from 46° to 50°F.

The results of the test showed the water heater was able to meet all of the water heating requirements with a single off peak charge.

IV.C. Petition Comparisons

When FPL filed its Commercial/Industrial Hot Water Storage Research Project Petition, FPL projected an average non-coincident participant demand of approximately 3.38 kW for both summer and winter with no annual energy reduction.

At the time the petition was filed, the project had a benefit to cost ratio, with generation deferral credits, of 1.70 based on the above savings. However, based on the R&D results and additional research results, FPL estimates that typical residential and commercial customers energy and demand savings are as shown in Table 1.

Table 1

	Summer Demand (kW) Saving (Increase)	Winter Demand (kW) Saving (Increase)	Energy (kWh) Saving (Increase)
Residential	0.19	0.42	0
Small commercial (non-demand)	0.20	0.13	0
Medium commercial (demand)	1.28	0.50	(346)

V. COST EFFECTIVENESS TESTS

Based on the savings for a typical customer installing a storage water heater and additional inputs shown in Table 2, cost effectiveness analyses was performed for the scenarios shown in Table 3. These analyses assumed that customers currently on TOU rates were still operating their conventional water heaters during on peak periods. Installation of a storage water heater allows them to move all water heating usage to off peak periods.

A copy of a representative cost effectiveness test is in Appendix B.

Table 2

Customer	Life of Storage Water Heater	Incremental Cost - New Construction	Incremental Cost - Retrofit
Residential	15 years	$225	$550
Small commercial (non-demand)	15 years	$225	$550
Medium commercial (demand)	15 years	$1,711	$2,000

Table 3

Customer	Baseline Rate	Revised Rate	New / Retrofit	RIM Ratio	Participant Test Ratio
Residential	Standard	TOU	New	.65	1.77
	Standard	TOU	Retrofit	.65	.72
	TOU	TOU	New	.63	1.83
	TOU	TOU	Retrofit	.63	.75
Small commercial	Standard	TOU	New	.68	1.18
	Standard	TOU	Retrofit	.68	.48
	TOU	TOU	New	.57	1.42
	TOU	TOU	Retrofit	.57	.58
Medium commercial	Standard	TOU	New	1.00	.66
	Standard	TOU	Retrofit	1.00	.56
	TOU	TOU	New	1.00	.72
	TOU	TOU	Retrofit	1.00	.62

A major contributor to the reduced cost effectiveness of this technology as compared to the original cost effectiveness done as part of the program petition is the cost of generation. In the original analysis a cost of $1,000 per kw was used as compared to a current cost of $285 per kw. Based on this avoided cost, the demand and energy savings and the relatively high incremental cost related to this emerging technology, hot water storage is not cost effective for either FPL or its customers.

VI. CONCLUSION

The Commercial/Industrial Hot Water Storage Research Project has led to the development of two electric storage water heaters, both using cross linked HDPE pellets as the storage material and propylene glycol as the heat transfer oil. The water heaters were built in partnership with Vaughn Manufacturing Corp. Tests under simulated field conditions showed that both water heaters were able to meet the intended hot water needs. Technically, these designs could be used for off peak storage of hot water.

Thermal efficiencies were found to be 88-89% for the residential water heater and 80-83% for the commercial unit. These efficiencies could be improved by increasing the thickness or the quality of the insulation.

Thermal stratification of up to 122°F was found in the commercial water heater design, which is undesirable. One solution is to use a circulating pump to alleviate the stratification. Another solution is to limit the height of the water heater to between 40 and 44 inches.

Both laboratory and field tests have shown that compact HDPE storage water heaters can meet all the daily hot water needs for commercial and residential applications with one full charge during off peak periods, which is one of the two constraints set at the start of the project. However, the water heaters developed have not met the cost constraint. The main stumbling block is the cost of the non -standard electrical resistance element. The element used in the prototypes cost $1,300. Although the cost of the heating element could be brought down to about $150 per unit when ordered in quantities of 10,000 units, the cost is still too high to meet the cost constrainis of residential and commercial water heaters.

Additional efforts need to be focused on commercialization of this technology in order to reduce first costs. FPL will continue to monitor this technology in order to determine when it is a commercially viable technology.

APPENDIX A

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Conservation Plan of Florida Power & Light Company	)))	Docket No. 900091-EG Filed: June 12, 1990

PETITION FOR APPROVAL OF FLORIDA POWER & LIGHT COMPANY'S COMMERCIAL/INDUSTRIAL HOT WATER STORAGE RESEARCH PROJECT

FLORIDA POWER & LIGHT COMPANY ("FPL"), pursuant to Section 366.82(2), Florida Statutes (1989), hereby petitions the Commission to approve the Commercial/Industrial Hot Water Storage ("CIHWS") Research Project, to be conducted in connection with FPL's Demand Side Management Plan for the 90's, and to allow FPL to recover its reasonable and prudent expenditures on the CIHWS Research Project through FPL's Energy Conservation Cost Recovery ("ECCR") Clause. The grounds for this Petition are as follows:

1. FPL is an investor-owned electric utility regulated by the Commission pursuant to Chapter 366, Florida Statutes. FPL is subject to the Florida Energy Efficiency and Conservation Act ("FEECA"), Section 366.81 et seq., Florida Statutes (1989), and its ECCR Clause is subject to the Commission's jurisdiction. FPL is substantially affected thereby.

2. FPL's address is 9250 West Flagler Street, Miami, Florida 33174. Correspondence concerning this Petition should be sent to:

John T. Butler
Steel Hector & Davis
4000 Southeast Financial Center
Miami, Florida 33131-2398

-and-

Steve E. Dickinson
Florida Power & Light Company
8700 West Flagler Street, Suite 200
Miami, Florida 33174

3. The CIHWS Research Project is an approach to reduce the peak demand impact of electric resistance water heating among FPL's commercial/industrial customers. By means of a viable, cost-effective storage system, hot water needed during the peak hours would be heated during off-peak hours. The CIHWS Research Project is intended to evaluate the technical feasibility and customer acceptance. If CIHWS is shown to be economically and technically feasible and is well accepted by FPL's customers, FPL will develop a permanent program for the CIHWS technology and propose the program to the Commission for approval. The CIHWS Research Project is described in more detail in Appendix I, attached hereto.

4. As described in Section 2 of Appendix I, FPL intends to limit participation in this CIHWS Research Project to commercial customers. The Project is scheduled to be completed by 4th Quarter, 1993 and total expenditures for the research project will not exceed $225,000. If the research project approach, which is described in Exhibits I and II, fails to meet any of FPL's criteria for the research and development process, no further ECCR money would be spent for the development of this technology.

5. A program promoting CIHWS would help advance the policy objectives set forth in Rule 25-17.001, Florida Administrative Code and FEECA. As further explained in Appendix I, FPL projects that such a program could provide up to 54.73 MW of peak demand reduction by the year 2008. The CIHWS Research Project is necessary in order to make a business decision for the development of such a program.

6. FPL projects that a program promoting CIHWS would be cost-effective. Appendices II and III, attached hereto, are the results of the cost-effectiveness analysis of such a program using the Commission's methodology prescribed in Rule 25-17.008, Florida Administrative Code and EPRI's Load Management Strategy Testing Model ("LMSTM"). The cost of the research project is included in these analyses. Of course, the demand and energy reduction assumptions are necessarily speculative at this time, and FPL would have to review and revise them, based on the results of the CIHWS Research Project, before submitting a permanent program promoting CIHWS. FPL intends to evaluate and document the results of the CIHWS Research Project and use a monitoring plan which is described in Section 3 of Appendix I.

WHEREFORE, FPL respectfully petitions the Commission to approve the CIHWS Research Project to be conducted in connection with FPL's Demand Side Management Plan for the 90's, and to allow FPL to recover its reasonable and prudent expenditures on the research project through FPL's ECCR Clause.

Respectfully submitted,

STEEL, HECTOR & DAVIS
4000 Southeast Financial Center
Miami, Florida 33131-2398
(305)577-2800

Attorneys for Florida Power & Light Company

By: _____
John T. Butler

Appendix I

FPL's COMMERCIAL/INDUSTRIAL HOT WATER STORAGE RESEARCH PROJECT

TECHNICAL DESCRIPTION

Section 1 - Project Technology:

Among the various approaches to alleviating the peak demand impact is commercial/industrial hot water storage. Hot water required during FPL's system peak would be supplemented by hot water which was heated and stored during off-peak hours. By means of a viable, cost-effective storage system, hot water needed during the peak would be heated during off-peak hours and this reduction in demand from conventional electric resistance water heating is consistent with FEECA goals.

Section 2 - Project Description:

FPL's hypothesis is that a 5 to 15 percent penetration of HWS technology exists in the commercial water heating market for restaurants, hotels, hospitals and other large hot water users. The CIHWS Research Project would not only evaluate the installation of additional storage capacity but investigate the feasibility of alternatives such as high temperature and pressure storage tanks which may reduce the amount of storage required. This type of HWS technology may be the most beneficial since customers are often concerned with the additional spacing required with conventional HWS.

This technology will not only provide individual customer savings, but will also act to lower FPL's system peak demand by as much as 54.73 MW by the year 2008. Based on the projected average participant, the expected peak demand reduction per customer would be approximately 3.38 KW for the summer and 3.38 for the winter and no annual energy reduction

is expected. To confirm these benefits to individual commercial customers, and quantify the peak reduction achievable, FPL proposes CIHWS research project installations in various commercial segments as mentioned above. The design and cost of these experiments are more fully described in Exhibits I and II.

If the research projects confirm FPL's projected peak demand reductions and a permanent program continues to appear cost-effective, then a system-wide commercial CIHWS program would be developed and brought before the Commission for approval. If the results from the research project fail to meet any of FPL's criteria, including cost-effectiveness, the CIHWS concept would be discontinued and no further Energy Conservation Cost Recovery ("ECCR") money would be spent on this project.

Customers who participate in the research project will be approached on an individual basis and incentives may be required for customer participation. FPL may seek a research facility to manage and perform the CIHWS research project on a turnkey basis. Payments and all other identifiable costs associated with the project will be limited to the project cost amount shown in Exhibit II. Any deviation in costs will be reported to the Commission as part of FPL's semi-annual ECCR Factor True-up. Further, FPL may seek funding for this project from sources such as EPRI, U.S. Department of Energy (DOE), Governor's Energy Office (GEO) and/or other entities interested in electric energy conservation research. If successful, such funds would be used to lower ECCR costs and/or expand the scope of the research project if justifiable.

Section 3 - Project Monitoring and Analysis:

FPL would target those customers most likely to benefit from the technology as candidates for the research project. The objective of the research project would be to demonstrate and quantify the demand and energy impact as well as customer savings when compared with a conventional system. FPL anticipates the total monitoring phase of the project would be for a period of 29 to 32 months. That is:

Site Selection/Installation	4-6 months
Monitoring	24 months
Analysis	1-2 months

Project results would be reviewed monthly during the monitoring phase of the project.

Section 4 - Cost-Effectiveness:

A fully implemented CIHWS program is projected to be cost-effective using the Commission's approved cost-effectiveness methodology and EPRI's Load Management Strategy Testing Model ("LMSTM"). Appendices II and III, attached hereto, contain these results. The cost of the research project is included in these analyses. For a hypothetical future CIHWS program, FPL estimates a total utility cost per customer of approximately $1,500 with administrative costs of $500 and incentive costs of $1,000 and 15,000 participants by the year 2008.

EXHIBIT I
FPL'S COMMERCIAL/INDUSTRIAL HOT WATER STORAGE RESEARCH PROJECT

Hypothesis:

Commercial/Industrial Hot Water Storage ("CIHWS") will provide individual customer savings as well as reduce FPL's system peak demand.

Purpose of the Research:

To make a business decision for the development and implementation of a CIHWS program in 1993 estimated to provide 54.73 MW of peak demand reduction by the year 2008.

Objectives of the Study:

- To develop the most viable and feasible method for this technology
- To compare KW reduction and cost differential of a hot water storage system over a conventional hot water system
- To discover and overcome potential barriers that may be associated with this technology
- To test acceptance of the technology with architects and engineering consultants
- To make a qualitative assessment of customer acceptance as a base for a market research study to determine target markets and expected penetrations
- To quantify the data used for EPRI's Load Management Strategy Testing Model (LMSTM)
  - Seasonal Load Shapes
  - Seasonal KW Impact
  - Seasonal KWH Impact

Method:

Conduct Research and Development Process as described in Exhibit II.

EXHIBIT II

DEVELOPMENT PROCESS FOR FPL'S COMMERCIAL/INDUSTRIAL HOT WATER STORAGE RESEARCH PROJECT

Stage I - Establish Research Concept	Projected Costs
1) Literature Search 2) Industry Search 3) Institute Search (EPRI, EEI, etc...)	
Objective: Gather Data and Define Research Objective and Scope	$ 15,000
MILESTONE - Management Review (Pass/Fail/Modify)	
Stage II - Economic Evaluation	
1) Cost Estimates 2) Benefit Estimates 3) Cost-Effectiveness Analysis	
Objective: Determine Benefit/Cost Ratio for Viability	$ 7,500
MILESTONE - Lead Team Review (Pass/Fail/Modify)	
Stage III - Technical Evaluation	
1) Design Experiment 2) Conduct Laboratory Tests 3) Technical Analysis	
Objective: Identify Feasibility and Risk Factors	$ 42,500
MILESTONE - Management Review (Pass/Fail/Modify)	
Stage IV - Site Testing	
1) Establish Site Plan 2) Install Research Project 3) Conduct Site Analysis	
Objective: Confirm Economic and Technical Assumptions	$135,500
MILESTONE - Lead Team Review (Pass/Fail/Modify)	
Stage V - Market Study	
1) Customer Acceptance 2) Architect and Engineer Acceptance 3) Establish Target Markets	
Objective: Confirm Sales Potential	$ 24,500
Total Projected R&D Costs =	**$225,000**

INPUT DATA FOR COST EFFECTIVENESS DETERMINATION
PROGRAM NAME: C/I HOT WATER STORAGE

PSC FORM CE 3.1.A
PAGE 1 OF 2
JUNE 8, 1990

I. CONSERVATION PROGRAM OPERATIONAL AND COST DATA

(1)	GEN REDUCTION PER CUSTOMER ... 4.03 KW L	0 KWH	
(2)	PEAK REDUCTION PER CUSTOMER	3.6 KW	
(3)	KWH REDUCTION PER CUSTOMER	0 KWH	
(4)	KWH REDUCTION THAT IS ON-PEAK PER CUST ...	100 %	
(5)	TOTAL PARTICIPATING CUSTOMERS	2,500	

II. CONSERVATION PROGRAM COST DATA:

(1)	UTILITY NON-RECURRING COST PER CUSTOMER	$1,414.20	
(2)	UTILITY NON-RECURRING COST ESCALATION RATE	5.3 %	
(3)	UTILITY RECURRING COST PER CUSTOMER PER YEAR	$0.00	
(4)	UTILITY RECURRING COST . ESCALATION RATE	0.0 %	
(5)	UTILITY REBATE/FINANCIAL INCENTIVE	1000	
(6)	CUSTOMER EQUIPMENT COST PER CUSTOMER ...	$2,000.00	
(7)	CUSTOMER EQUIPMENT ESCALATION RATE	5.3 %	
(8)	CUSTOMER OEM COST PER CUSTOMER PER YEAR ...	$0.00	
(9)	CUSTOMER OEM ESCALATION RATE	0.0 %	
(10)	SOCIETAL COST PER CUSTOMER PER YEAR	$0.00	
(11)	SOCIETAL BENEFIT PER CUSTOMER PER YEAR	$0.00	
(12)	FEDERAL INCOME TAX CREDIT PER CUSTOMER	$0.00	

III. UTILITY MARGINAL COST DATA:

(1)	IN-SERVICE YEAR FOR AVOIDED GEN, TRN, AND DST FACILITIES	YEAR 7	
(2)	AVOIDED GENERATING UNIT ON-PEAK HOURS	25 %	
(3)	CAPACITY FACTOR (C.F.)	63 %	
(4)	BASE YEAR	1990	
(5)	ESCALATION RATE	5.3 %	
(6)	AVOIDED FACILITY COST:		
	A. GEN COST:	1443 $/KW	
	B. TRN COST:	238 $/KW	
	C. DST COST	0 $/KW PK	
	D. GEN FIXED OEM COST	42.8 $/KW YR	
	E. TRN FIXED OEM COST	8.74 $/KW YR	
	F. DST FIXED OEM COST	0.00 $/KW YR	
(7)	AVOIDED FUEL	1.52 C/KWH	
(8)	AVOIDED GENERATING UNIT VARIABLE OEM	0.10 C/KWH	
(9)	FUEL ESCALATION RATE:	6.3 %	
(10)	ON-PEAK OFF-SYSTEM SALES AVAILABLE AFTER THE YEAR THE UNIT WAS TO HAVE BEEN ON LINE .	0.0 %	

IV. UTILITY EMBEDDED COST DATA:

(1)	FUEL COST	2.28 C/KWH	
(2)	NONFUEL COST	6.25 C/KWH	
(3)	KWH ESCALATION RATE	5.4 %	

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INPUT DATA FOR COST EFFECTIVENESS DETERMINATION
PROGRAM NAME: C/I HOT WATER STORAGE

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PAGE 2 OF 2

JUNE 8, 1990

V. YEARLY INPUT DATA:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		MARGINAL FUEL COST --- UTILITY ---		--- STATE ---		--- UTILITY ---		--- STATE ---	
YEAR	CUMULATIVE PARTICIPATING CUSTOMERS	ON PEAK (C/KWH)	OFF PEAK (C/KWH)	ON PEAK (C/KWH)	OFF PEAK (C/KWH)	ON PEAK (C/KWH)	OFF PEAK (C/KWH)	ON PEAK (C/KWH)	OFF PEAK (C/KWH)
90	0	2.43	2.29	2.43	2.29	2.43	2.29	2.43	2.29
91	0	3.03	2.61	3.03	2.61	3.03	2.61	3.03	2.61
92	0	3.66	2.93	3.66	2.93	3.66	2.93	3.66	2.93
93	0	4.46	3.72	4.46	3.72	4.46	3.72	4.46	3.72
94	500	4.91	4.01	4.91	4.01	4.87	3.97	4.87	3.97
95	1,500	4.94	4.19	4.94	4.19	4.89	4.09	4.89	4.09
96	2,500	5.27	4.20	5.27	4.20	5.62	4.64	5.62	4.64
97	2,500	6.26	4.82	6.26	4.82	6.36	4.85	6.36	4.85
98	2,500	6.71	4.78	6.71	4.78	6.78	4.97	6.78	4.97
99	2,500	7.80	5.26	7.80	5.26	7.88	5.64	7.88	5.64
0	2,500	7.74	5.39	7.74	5.39	7.87	5.49	7.87	5.49
1	2,500	7.74	5.32	7.74	5.32	7.81	5.36	7.81	5.36
2	2,500	9.02	6.13	9.02	6.13	9.09	6.40	9.09	6.40
3	2,500	9.83	7.27	9.83	7.27	9.88	7.30	9.88	7.30
4	2,500	10.41	7.47	10.41	7.47	10.49	7.60	10.49	7.60
5	2,500	10.88	7.51	10.88	7.51	10.91	7.66	10.91	7.66
6	2,500	11.92	8.35	11.92	8.35	11.96	8.44	11.96	8.44
7	2,500	12.47	8.60	12.47	8.60	12.52	8.67	12.52	8.67
8	2,500	13.53	9.43	13.53	9.43	13.59	9.51	13.59	9.51

PSC FORM CE 3.1.8/ •

INPUT DATA FOR COST EFFECTIVENESS DETERMINATION
PROGRAM NAME: C/I HOT WATER STORAGE

JUNE 8, 1990

VI. FINANCIAL DATA:

(1) GENERATION:
(1A) DEBT .....PERCENT 44.0 COST 10.0 %
(1B) PREFERRED .....PERCENT 9.0 COST 10.0 %
(1C) EQUITY .....PERCENT 47.0 COST 14.5 %
(1D) EFFECTIVE TAX RATE ..... 37.6 %
(1E) GENERATOR BOOK LIFE ..... 30.0 YEARS
(1F) INSURANCE & OTHER TAXES ..... 1.46 %

(2) TRANSMISSION & DISTRIBUTION:
(2A) DEBT .....PERCENT 44.0 COST 10.0 %
(2B) PREFERRED .....PERCENT 9.0 COST 10.0 %
(2C) EQUITY .....PERCENT 47.0 COST 14.5 %
(2D) EFFECTIVE TAX RATE ..... 37.6 %
(2E) TRANS. & DIST BOOK LIFE ..... 36.0 YEARS
(2F) INSURANCE & OTHER TAXES ..... 1.46 %

(3) DISCOUNT RATE:
(3A) UTILITY ..... 12.0 %
(3B) CUSTOMER ..... 12.0 %

VII. DERIVATION OF CAPITAL CARRYING CHARGES FOR AVOIDED GENERATION

YEAR	(1) AVOIDED ELECTRIC PLANT IN SERVICE $(000)	(2) DEBT $(000)	(3) PREFERRED $(000)	(4) EQUITY $(000)	(5) TAX $(000)	(6) TOTAL DEBT PREFERRED EQUITY & TAX $(000)	(7) DEPREC. $(000)	(8) INSURANCE & OTHER TAXES $(000)	(9) TOTAL ANNUAL FIXED COST $(000)
90	2,186	0	0	0	0	0	0	0	0
91	7,872	0	0	0	0	0	0	0	0
92	16,097	0	0	0	0	0	0	0	0
93	22,305	0	0	0	0	0	0	0	0
94	25,239	0	0	0	0	0	0	0	0
95	27,984	0	0	0	0	0	0	0	0
96	27,051	1,211	248	1,875	1,281	4,615	933	409	5,956
97	26,118	1,170	239	1,812	1,237	4,458	933	409	5,800
98	25,186	1,129	231	1,748	1,194	4,302	933	409	5,643
99	24,253	1,088	222	1,685	1,151	4,145	933	409	5,487
0	23,320	1,047	214	1,621	1,107	3,989	933	409	5,330
1	22,387	1,006	206	1,557	1,064	3,832	933	409	5,174
2	21,454	965	197	1,494	1,020	3,676	933	409	5,017
3	20,522	923	189	1,430	977	3,520	933	409	4,861
4	19,589	882	180	1,367	934	3,363	933	409	4,705
5	18,656	841	172	1,303	890	3,207	933	409	4,548
6	17,723	800	164	1,240	847	3,050	933	409	4,392
7	16,790	759	155	1,176	803	2,894	933	409	4,235
8	15,858	718	147	1,112	760	2,737	933	409	4,079

PSC FORM CE 3.2.A

JUNE 8, 1990

AVOIDED CAPACITY COST BENEFITS
PROGRAM NAME: C/I HOT WATER STORAGE

YEAR	(1) AVOIDED GEN UNIT INVEST $(000)	(2) AVOIDED GEN UNIT CCR	(3) AVOIDED GEN FIXED COST/YR $(000)	(4) ANNUAL KWH GEN OF AVOIDED UNIT GEN (000)	(5) AVOIDED FUEL COST $(000)	(6) AVOIDED UNIT OEM COST $(000)	(7) MINUS THE COST OF ENERGY NOT DISPLACED $(000)	(8) MINUS LOSS IN OFF-SYS SALES $(000)	(9) AVOIDED NET GEN COST $(000)
90	2,186	.0000	0	0	0	0	0	0	0
91	7,872	.0000	0	0	0	0	0	0	0
92	16,097	.0000	0	0	0	0	0	0	0
93	22,305	.0000	0	0	0	0	0	0	0
94	25,239	.0000	0	0	0	0	0	0	0
95	27,984	.0000	0	0	0	0	0	0	0
96	27,984	.2128	5,956	73,217	1,605	683	3,271	0	4,973
97	27,984	.2072	5,800	73,217	1,706	719	3,793	0	4,432
98	27,984	.2017	5,643	73,217	1,813	758	3,853	0	4,361
99	27,984	.1961	5,487	73,217	1,927	798	4,316	0	3,896
0	27,984	.1905	5,330	73,217	2,049	840	4,377	0	3,842
1	27,984	.1849	5,174	73,217	2,178	884	4,338	0	3,898
2	27,984	.1793	5,017	73,217	2,315	931	5,017	0	3,247
3	27,984	.1737	4,861	73,217	2,461	981	5,791	0	2,511
4	27,984	.1681	4,705	73,217	2,616	1,033	6,007	0	2,346
5	27,984	.1625	4,548	73,217	2,781	1,087	6,115	0	2,301
6	27,984	.1569	4,392	73,217	2,956	1,145	6,767	0	1,726
7	27,984	.1513	4,235	73,217	3,142	1,206	7,005	0	1,578
8	27,984	.1458	4,079	73,217	3,340	1,270	7,655	0	1,034
NOMINAL TOTAL:			$65,226	951,820	$30,889	$12,335	$68,306	$0	$40,144
NPV:			$19,161		$7,873	$3,191	$17,223	$0	$13,003

PSC FORM CE 3.2.8

JUNE 8, 1990

AVOIDED CAPACITY COST BENEFITS
PROGRAM NAME: C/I HOT WATER STORAGE

YEAR	(10) AVOIDED TRANS INVEST $(000)	(11) AVOIDED TRANS CCR P.U.	(12) AVOIDED TRANS FIXED COST/YR $(000)	(13) AVOIDED TRANS OEM $(000)	(14) AVOIDED DIST INVEST $(000)	(15) AVOIDED DIST CCR P.U.	(16) AVOIDED DIST FIXED COST/YR $(000)	(17) AVOIDED DIST OEM $(000)	(18) AVOIDED TRANS & DIST COST $(000)	(19) TOTAL AVOIDED KW COST $(000)
90	0	.0000	0	0	0	.0000	0	0	0	0
91	0	.0000	0	0	0	.0000	0	0	0	0
92	0	.0000	0	0	0	.0000	0	0	0	0
93	0	.0000	0	0	0	.0000	0	0	0	0
94	0	.0000	0	0	0	.0000	0	0	0	0
95	0	.0000	0	0	0	.0000	0	0	0	0
96	3,271	.2101	687	120	0	.0000	0	0	807	5,780
97	3,271	.2054	672	126	0	.0000	0	0	798	5,230
98	3,271	.2008	657	133	0	.0000	0	0	790	5,150
99	3,271	.1961	641	140	0	.0000	0	0	782	4,677
0	3,271	.1914	626	148	0	.0000	0	0	774	4,616
1	3,271	.1868	611	155	0	.0000	0	0	766	4,664
2	3,271	.1821	596	164	0	.0000	0	0	759	4,006
3	3,271	.1775	581	172	0	.0000	0	0	753	3,264
4	3,271	.1728	565	181	0	.0000	0	0	747	3,092
5	3,271	.1682	550	191	0	.0000	0	0	741	3,042
6	3,271	.1635	535	201	0	.0000	0	0	736	2,462
7	3,271	.1588	520	212	0	.0000	0	0	731	2,309
8	3,271	.1542	504	223	0	.0000	0	0	727	1,761
NOMINAL TOTAL:			$7,745	$2,166			$0	$0	$9,911	$50,055
NPV:			$2,256	$560			$0	$0	$2,817	$15,820

PSC FORM CE 3.3

JUNE 8, 1990

KWH AND FUEL COSTS SAVINGS DUE TO CONSERVATION PROGRAM
PROGRAM NAME: C/I HOT WATER STORAGE

YEAR	(1) KWH SAVINGS (000)	(2) AVOIDED MARGINAL FUEL COST $(000)	(3) GAIN IN OFF-SYSTEM SALES $(000)	(4) TOTAL FUEL COST SAVINGS $(000)
90	0	0	0	0
91	0	0	0	0
92	0	0	0	0
93	0	0	0	0
94	0	0	0	0
95	0	0	0	0
96	0	0	0	0
97	0	0	0	0
98	0	0	0	0
99	0	0	0	0
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
NOMINAL TOTAL:	0	$0	$0	$0
NPV:		$0	$0	$0

PSC FORM CE 3.4

JUNE 8, 1990

ALL CUSTOMERS COST - BENEFIT ANALYSIS
PROGRAM NAME: C/I HOT WATER STORAGE

YEAR	(1) TOTAL AVOIDED KW & KWH COSTS $(000)	(2) COMPANYS TOTAL COST $(000)	(3) TOTAL CONSERVATION PROGRAM SAVINGS $(000)	(4) PARTICIPATING CUST SAVINGS IN BILL/TOTAL EMBEDDED COST $(000)	(5) ALL CUSTOMER BENEFIT/ NO GROWTH UTILITY $(000)	(6) PARTICIPATING CUST SAVINGS IN BILL/FUEL COST ONLY $(000)	(7) ALL CUSTOMER BENEFIT /GROWTH UTILITY $(000)
90	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0
93	0	0	0	0	0	0	0
94	0	869	-869	0	-869	0	-869
95	0	1,831	-1,831	0	-1,831	0	-1,831
96	5,780	1,928	3,852	0	3,852	0	3,852
97	5,230	0	5,230	0	5,230	0	5,230
98	5,150	0	5,150	0	5,150	0	5,150
99	4,677	0	4,677	0	4,677	0	4,677
0	4,616	0	4,616	0	4,616	0	4,616
1	4,664	0	4,664	0	4,664	0	4,664
2	4,006	0	4,006	0	4,006	0	4,006
3	3,264	0	3,264	0	3,264	0	3,264
4	3,092	0	3,092	0	3,092	0	3,092
5	3,042	0	3,042	0	3,042	0	3,042
6	2,462	0	2,462	0	2,462	0	2,462
7	2,309	0	2,309	0	2,309	0	2,309
8	1,761	0	1,761	0	1,761	0	1,761
NOMINAL TOTAL:	$50,055	$4,628	$45,427	$0	$45,427	$0	$45,427
NPV:	$15,820	$2,568	$13,252	$0	$13,252	$0	$13,252

PSC FORM CE 3.5

FLORIDA SOCIETAL BENEFIT
PROGRAM NAME: C/I HOT WATER STORAGE

JUNE 6, 1990

	COMPANY EXPENDITURES			INDIVIDUAL CUSTOMER & OTHER COST				TOTALS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
YEAR	NON-RECURRING COST $(000)	RECURRING COST $(000)	TOTAL COMPANY COST $(000)	PARTICIPATING CUSTOMERS EQUIPMENT COST $(000)	PARTICIPATING CUSTOMERS O & M COST $(000)	OTHER COSTS MINUS OTHER BENEFITS $(000)	TOTAL PARTICIPATING CUSTOMERS AND OTHER COSTS $(000)	TOTAL PROGRAM COST $(000)	TOTAL AVOIDED COSTS $(000)	NET SAVINGS TO FLORIDA (COSTS) $(000)
90	0	0	0	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0	0	0
93	0	0	0	0	0	0	0	0	0	0
94	869	0	869	1,229	0	-615	615	1,484	0	-1,484
95	1,831	0	1,831	2,589	0	-1,295	1,295	3,125	0	-3,125
96	1,928	0	1,928	2,726	0	-1,363	1,363	3,291	5,780	2,489
97	0	0	0	0	0	0	0	0	5,230	5,230
98	0	0	0	0	0	0	0	0	5,150	5,150
99	0	0	0	0	0	0	0	0	4,677	4,677
0	0	0	0	0	0	0	0	0	4,616	4,616
1	0	0	0	0	0	0	0	0	4,664	4,664
2	0	0	0	0	0	0	0	0	4,006	4,006
3	0	0	0	0	0	0	0	0	3,264	3,264
4	0	0	0	0	0	0	0	0	3,092	3,092
5	0	0	0	0	0	0	0	0	3,042	3,042
6	0	0	0	0	0	0	0	0	2,462	2,462
7	0	0	0	0	0	0	0	0	2,309	2,309
8	0	0	0	0	0	0	0	0	1,761	1,761
NOMINAL TOTAL:	$4,628	$0	$4,628	$6,545	$0	$-3,273	$3,273	$7,901	$50,055	$42,154
NPV:	$2,568	$0	$2,568	$3,632	$0	$-1,816	$1,816	$4,384	$15,820	$11,436

EMBEDDED COST - BENEFIT ANALYSIS TO PARTICIPATING CUSTOMERS
PROGRAM NAME: C/I HOT WATER STORAGE

PSC FORM CE 3.0

JUNE 8, 1990

YEAR	(1) PARTICIPATING CUSTOMER EMBEDDED SAVINGS IN BILLS $(000)	(2) MINUS PARTICIPATING CUSTOMER EQUIPMENT COSTS $(000)	(3) MINUS PARTICIPATING CUSTOMER DSM COSTS $(000)	(4) PARTICIPATING CUSTOMER TAX CREDITS $(000)	(5) PARTICIPATING CUSTOMERS SAVINGS $(000)	(6) UTILITY REBATE/ INCENTIVE $(000)	(7) PARTICIPATING CUSTOMERS SAVINGS WITH UTILITY REBATE/ INCENTIVE $(000)
90	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0
93	0	0	0	0	0	0	0
94	0	1,229	0	0	-1,229	615	-615
95	0	2,589	0	0	-2,589	1,295	-1,295
96	0	2,726	0	0	-2,726	1,363	-1,363
97	0	0	0	0	0	0	0
98	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
NOMINAL TOTAL:	$0	$6,545	$0	$0	$-6,545	$3,273	$-3,273
NPV:	$0	$3,632	$0	$0	$-3,632	$1,816	$-1,816

SUMMARY OF INDIVIDUAL AND COMBINED DEMAND-SIDE OPTIONS
BENEFIT/COST RATIOS
(NPV – 1990 MILLION $)

DEMAND SIDE OPTIONS:	Present Value of Program Costs (Gen.)	Present Value of Revenue Losses	Present Value of Net Costs (Total)	Present Value of Net Benefits (W/O Gen Def Credits)	LMSTM B/C Ratio (W/O Gen Def Credits)	Gen Def Credit	Value of Net Benefits (W/Gen Def Credits)	LMSTM B/C Ratio (W/Gen Def Credits)
1. Residential Ceiling Insulation	14.07	68.26	82.33	60.41	0.73	39.39	99.80	1.21
2. Conservation Window Treatment	7.22	17.79	25.01	18.25	0.73	10.87	29.12	1.16
3. Residential High Efficiency HVAC	81.70	148.75	230.45	143.40	0.62	130.06	273.46	1.19
4. Water Heating HRU	2.72	2.40	5.12	2.85	0.56	2.40	5.25	1.03
5. C/I Chiller Retrofits	43.02	175.58	218.60	139.35	0.64	92.80	232.15	1.06
6. C/I Thermal Energy Storage	14.66	25.22	39.88	16.81	0.42	63.09	79.90	2.00
7. C/I Efficient Lighting	10.66	58.07	68 73	44.20	0.64	28.38	72.58	1.06
8. C/I Central Chiller System	2.99	7.99	10.98	7.00	0.64	6.12	13.12	1.19
9. C/I Hot Water Storage	8.97	17.92	26.89	14.18	0.53	31.47	45.65	1.70
10. C/I Cold Air Distribution System	1.05	4.05	5.10	3.61	0.71	2.50	6.11	1.20
11. C/I Heat Pipe	4.18	65.74	69.92	46.54	0.67	67.04	113.58	1.62
12. C/I Water Heating Heat Pump	1.10	4.68	5.78	4.52	0.78	1.70	6.22	1.08
13. Residential Thermal Energy Storage	5.84	0.00	5.84	0.73	0.13	5.22	5.95	1.02
14. All Conservation Programs	198.18	596.45	794.63	502.00	0.63	481.00	983.00	1.24
15. On Call (RLC)	476.10	21.42	497.52	902.46	1.81	N/A	902.46	1.81
16. C/I Load Management	2.52	170.84	173.36	226.25	1.31	N/A	226.25	1.31

APPENDIX B

INPUT DATA – PART I CONTINUED
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME: Water Storage - residential

I PROGRAM DEMAND SAVINGS & LINE LOSSES

(1) CUSTOMER kW REDUCTION AT METER	0.22	kW
(2) GENERATOR kW REDUCTION PER CUSTOMER	0.29	kW
(3) kW LINE LOSS PERCENTAGE	8.32	%
(4) GENERATOR kWh REDUCTION PER CUSTOMER	1,780.2	kWh ****
(5) kWh LINE LOSS PERCENTAGE	8.75	%
(6) GROUP LINE LOSS MULTIPLIER	1.0000	
(7) CUSTOMER kWh INCREASE AT METER	1660.0	kWh ****

II ECONOMIC LIFE & K FACTORS

(1) STUDY PERIOD FOR THE CONSERVATION PROGRAM	25	YEARS
(2) GENERATOR ECONOMIC LIFE	30	YEARS
(3) T&D ECONOMIC LIFE	35	YEARS
(4) K FACTOR FOR GENERATION	1.61229	
(5) K FACTOR FOR T & D	1.44767	

III UTILITY & CUSTOMER COSTS

(1) UTILITY NON RECURRING COST PER CUSTOMER	---	$/CUST
(2) UTILITY RECURRING COST PER CUSTOMER	---	$/CUST
(3) UTILITY COST ESCALATION RATE	---	%**
(4) CUSTOMER EQUIPMENT COST	---	$/CUST
(5) CUSTOMER EQUIPMENT ESCALATION RATE	---	%**
(6) CUSTOMER O & M COST	---	$/CUST/YR
(7) CUSTOMER O & M COST ESCALATION RATE	---	%**
* (8) INCREASED SUPPLY COSTS	---	$/CUST/YR
* (9) SUPPLY COSTS ESCALATION RATES	---	%**
* (10) UTILITY DISCOUNT RATE	9.22	%
* (11) UTILITY AFUDC RATE	10.70	%
* (12) UTILITY NON RECURRING REBATE/INCENTIVE	---	$/CUST
* (13) UTILITY RECURRING REBATE/INCENTIVE	---	$/CUST
* (14) UTILITY REBATE/INCENTIVE ESCALATION RATE	---	%

IV AVOIDED GENERATOR AND T&D COSTS

(1) BASE YEAR	1996	
(2) IN-SERVICE YEAR FOR AVOIDED GENERATING UNIT	2001	
(3) IN-SERVICE YEAR FOR AVOIDED T&D	1999-2001	
(4) BASE YEAR AVOIDED GENERATING COST	285	$/kW
(5) BASE YEAR AVOIDED TRANSMISSION COST	70	$/kW
(6) BASE YEAR DISTRIBUTION COST	50	$/kW
(7) GEN, TRAN & DIST COST ESCALATION RATE	2.55	%**
(8) GENERATOR FIXED O & M COST	8	$/kW/YR
(9) GENERATOR FIXED O&M ESCALATION RATE	3.34	%**
(10) TRANSMISSION FIXED O & M COST	2.73	$/kW
(11) DISTRIBUTION FIXED O & M COST	13.01	$/kW
(12) T&D FIXED O&M ESCALATION RATE	3.34	%**
(13) AVOIDED GEN UNIT VARIABLE O & M COSTS	0.030	CENTS/kWh
(14) GENERATOR VARIABLE O&M COST ESCALATION RATE	2.47	%**
(15) GENERATOR CAPACITY FACTOR	30%	** (in-service year)
(16) AVOIDED GENERATING UNIT FUEL COST	1.88	CENTS PER kWh** (in-service year)
(17) AVOIDED GEN UNIT FUEL COST ESCALATION RATE	5.03	%**

V NON-FUEL ENERGY AND DEMAND CHARGES

(1) NON FUEL COST IN CUSTOMER BILL	---	CENTS/kWh
(2) NON-FUEL COST ESCALATION RATE	---	%
(3) DEMAND CHARGE IN CUSTOMER BILL	---	$/kW/MO
(4) DEMAND CHARGE ESCALATION RATE	---	%

* SUPPLEMENTAL INFORMATION NOT SPECIFIED IN WORKBOOK
** VALUE SHOWN IS FOR FIRST YEAR ONLY (VALUE VARIES OVER TIME)
*** PROGRAM COST CALCULATION VALUES ARE SHOWN ON PAGE 2
**** THIS IS A LOAD SHIFTING PROGRAM. VALUE SHOWN IN ITEM (4) IS ANNUAL KWH/CUST SHIFTED AWAY FROM PEAK HRS. VALUE SHOWN IN ITEM (7) IS ANNUAL KWH/CUST THAT IS PAID BACK DURING OFF-PEAK

* INPUT DATA – PART 1 CONTINUED
PROGRAM METHOD SELECTED REV_REQ
PROGRAM NAME: Water Storage - residential

YEAR	(1) UTILITY PROGRAM COSTS WITHOUT INCENTIVES $(000)	(2) UTILITY INCENTIVES $(000)	(3) OTHER UTILITY COSTS $(000)	(4) TOTAL UTILITY PROGRAM COSTS $(000)	(5) ENERGY CHARGE REVENUE LOSSES $(000)	(6) DEMAND CHARGE REVENUE LOSSES $(000)	(7) PARTICIPANT EQUIPMENT COSTS $(000)	(8) PARTICIPANT O&M COSTS $(000)	(9) OTHER PARTICIPANT COSTS $(000)	(10) TOTAL PARTICIPANT COSTS $(000)
1996	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	17	0	225	0	0	225
1998	0	0	0	0	35	0	0	0	0	0
1999	0	0	0	0	35	0	0	0	0	0
2000	0	0	0	0	33	0	0	0	0	0
2001	0	0	0	0	32	0	0	0	0	0
2002	0	0	0	0	32	0	0	0	0	0
2003	0	0	0	0	31	0	0	0	0	0
2004	0	0	0	0	31	0	0	0	0	0
2005	0	0	0	0	31	0	0	0	0	0
2006	0	0	0	0	31	0	0	0	0	0
2007	0	0	0	0	32	0	0	0	0	0
2008	0	0	0	0	33	0	0	0	0	0
2009	0	0	0	0	34	0	0	0	0	0
2010	0	0	0	0	36	0	0	0	0	0
2011	0	0	0	0	38	0	0	0	0	0
2012	0	0	0	0	38	0	335	0	0	335
2013	0	0	0	0	39	0	0	0	0	0
2014	0	0	0	0	40	0	0	0	0	0
2015	0	0	0	0	39	0	0	0	0	0
2016	0	0	0	0	39	0	0	0	0	0
2017	0	0	0	0	39	0	0	0	0	0
2018	0	0	0	0	39	0	0	0	0	0
2019	0	0	0	0	39	0	0	0	0	0
2020	0	0	0	0	39	0	0	0	0	0
NOM	0	0	0	0	831	0	560	0	0	560
NPV	0	0	0	0	310	0	288	0	0	288

* SUPPLEMENTAL INFORMATION NOT SPECIFIED IN WORKBOOK
** NEGATIVE COSTS WILL BE CALCULATED AS POSITIVE BENEFITS FOR TRC AND RIM TESTS

CALCULATION OF GEN K-FACTOR
PROGRAM METHOD SELECTED REV_REQ
PROGRAM NAME: Water Storage - residential

YEAR	(2) MID-YEAR RATE BASE $(000)	(3) DEBT $(000)	(4) PREFERRED STOCK $(000)	(5) COMMON EQUITY $(000)	(6) INCOME TAXES $(000)	(7) OTHER TAXES & INSURANCE $(000)	(8) DEPREC. $(000)	(9) DEFERRED TAXES $(000)	(10) TOTAL FIXED CHARGES $(000)	(11) PRESENT WORTH FIXED CHARGES $(000)	(12) CUMULATIVE PW FIXED CHARGES $(000)
2001	98	4	0	7	4	1	3	0	19	19	19
2002	94	4	0	6	3	1	3	1	19	17	37
2003	89	3	0	6	3	1	3	1	18	15	52
2004	85	3	0	6	3	1	3	1	17	13	65
2005	80	3	0	6	3	1	3	1	17	12	77
2006	76	3	0	5	3	1	3	1	16	10	88
2007	72	3	0	5	3	1	3	1	16	9	97
2008	68	3	0	5	3	1	3	0	15	8	105
2009	65	2	0	4	2	1	3	0	14	7	112
2010	61	2	0	4	2	1	3	0	14	6	118
2011	57	2	0	4	2	1	3	0	13	6	124
2012	53	2	0	4	2	1	3	0	13	5	129
2013	50	2	0	3	2	1	3	0	12	4	133
2014	46	2	0	3	2	1	3	0	12	4	137
2015	42	2	0	3	1	1	3	0	11	3	140
2016	38	1	0	3	1	1	3	0	11	3	143
2017	35	1	0	2	1	1	3	0	10	2	145
2018	31	1	0	2	1	1	3	0	9	2	147
2019	27	1	0	2	1	1	3	0	9	2	149
2020	24	1	0	2	1	1	3	0	8	2	151
2021	20	1	0	1	1	1	3	(0)	8	1	152
2022	18	1	0	1	2	1	3	(1)	7	1	153
2023	16	1	0	1	2	1	3	(1)	7	1	154
2024	14	1	0	1	2	1	3	(1)	7	1	155
2025	11	0	0	1	2	1	3	(1)	6	1	156
2026	9	0	0	1	2	1	3	(1)	6	1	157
2027	7	0	0	1	2	1	3	(1)	6	1	157
2028	5	0	0	0	2	1	3	(1)	6	1	158
2029	3	0	0	0	1	1	3	(1)	5	0	158
2030	1	0	0	0	1	1	3	(1)	5	0	158

IN SERVICE COST ($000)	98
IN SERVICE YEAR	2001
BOOK LIFE (YRS)	30
EFFEC. TAX RATE	38.575
DISCOUNT RATE	9.22%
OTAX & INS RATE	1.40%

CAPITAL STRUCTURE

SOURCE	WEIGHT	COST	
DEBT	45%	8.50	%
P/S	0%	0.00	%
C/S	55%	12.50	%

K-FACTOR = CPWFC / IN-SVC COST = 1.61229

DEFERRED TAX AND MID-YEAR RATE BASE CALCULATION
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME: Water Storage - residential

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
YEAR	TAX DEPRECIATION SCHEDULE	TAX DEPRECIATION $(000)	ACCUMULATED TAX DEPRECIATION $(000)	BOOK DEPRECIATION $(000)	ACCUMULATED BOOK DEPRECIATION $(000)	BOOK DEPRECIATION FOR DEFERRED TAX $(000)	ACCUMULATED BOOK DEPR FOR DEFERRED TAX $(000)	DEFERRED TAX DUE TO DEPRECIATION $(000)	TOTAL EQUITY AFUDC $(000)	BOOK DEPR RATE MINUS 1/LIFE	(10)*(11) TAX RATE $(000)	SALVAGE TAX RATE $(000)	ANNUAL DEFERRED TAX (9)-(12)+(13) $(000)	ACCUMULATED DEFERRED TAX $(000)
2001	3.75%	4	4	3	3	3	3	0	5	0	0	0	0	(1)
2002	7.22%	7	11	3	7	3	6	1	5	0	0	0	1	0
2003	6.68%	6	17	3	10	3	9	1	5	0	0	0	1	2
2004	6.18%	6	23	3	13	3	12	1	5	0	0	0	1	3
2005	5.71%	6	28	3	16	3	15	1	5	0	0	0	1	4
2006	5.29%	5	34	3	20	3	18	1	5	0	0	0	1	4
2007	4.89%	5	38	3	23	3	22	1	5	0	0	0	1	5
2008	4.52%	4	43	3	26	3	25	0	5	0	0	0	0	5
2009	4.46%	4	47	3	29	3	28	0	5	0	0	0	0	5
2010	4.46%	4	51	3	33	3	31	0	5	0	0	0	0	6
2011	4.46%	4	56	3	36	3	34	0	5	0	0	0	0	7
2012	4.46%	4	60	3	39	3	37	0	5	0	0	0	0	7
2013	4.46%	4	64	3	43	3	40	0	5	0	0	0	0	8
2014	4.46%	4	68	3	46	3	43	0	5	0	0	0	0	8
2015	4.46%	4	73	3	49	3	46	0	5	0	0	0	0	9
2016	4.46%	4	77	3	52	3	49	0	5	0	0	0	0	9
2017	4.46%	4	81	3	56	3	53	0	5	0	0	0	0	10
2018	4.46%	4	86	3	59	3	56	0	5	0	0	0	0	10
2019	4.46%	4	90	3	62	3	59	0	5	0	0	0	0	11
2020	4.46%	4	94	3	66	3	62	0	5	0	0	0	0	11
2021	2.23%	2	96	3	69	3	65	(0)	5	0	0	0	(0)	11
2022	0.00%	0	96	3	72	3	68	(1)	5	0	0	0	(1)	10
2023	0.00%	0	96	3	75	3	71	(1)	5	0	0	0	(1)	8
2024	0.00%	0	96	3	79	3	74	(1)	5	0	0	0	(1)	7
2025	0.00%	0	96	3	82	3	77	(1)	5	0	0	0	(1)	6
2026	0.00%	0	96	3	85	3	80	(1)	5	0	0	0	(1)	5
2027	0.00%	0	96	3	88	3	84	(1)	5	0	0	0	(1)	4
2028	0.00%	0	96	3	92	3	87	(1)	5	0	0	0	(1)	2
2029	0.00%	0	96	3	95	3	90	(1)	5	0	0	0	(1)	1
2030	0.00%	0	96	3	98	3	93	(1)	5	0	0	0	(1)	0

SALVAGE / REMOVAL COST	0.00
YEAR SALVAGE / COST OF REMOVAL	2029
DEFERRED TAXES DURING CONSTRUCTION (SEE PAGE 5)	(1
TOTAL EQUITY AFUDC CAPITALIZED (SEE PAGE 5)	5
BOOK DEPR RATE - 1/USEFUL LIFE	3.33%

DEFERRED TAX AND MID-YEAR RATE BASE CALCULATION
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME Water Storage - residential

(1)	(2)	(3)	(4)	(5)	(5a)*	(5b)*	(6)	(7)	(8)
YEAR	TAX DEPRECIATION SCHEDULE	TAX DEPRECIATION $(000)	DEFERRED TAX $(000)	END OF YEAR NET PLANT IN SERVICE $(000)	ACCUMULATED DEPRECIATION $(000)	ACCUMULATED DEF TAXES $(000)	BEGINNING YEAR RATE BASE $(000)	ENDING OF YEAR RATE BASE $(000)	MID-YEAR RATE BASE $(000)
2001	3.75%	4	0	96	3	(1)	100	96	98
2002	7.22%	7	1	92	7	0	96	91	94
2003	6.68%	6	1	86	10	2	91	87	89
2004	6.18%	6	1	85	13	3	87	82	85
2005	5.71%	6	1	82	16	4	82	78	80
2006	5.29%	5	1	79	20	4	78	74	76
2007	4.89%	5	1	75	23	5	74	70	72
2008	4.52%	4	0	72	26	6	70	67	68
2009	4.46%	4	0	69	29	6	67	63	65
2010	4.46%	4	0	66	33	6	63	59	61
2011	4.46%	4	0	62	36	7	59	55	57
2012	4.46%	4	0	59	39	7	55	52	53
2013	4.46%	4	0	56	43	8	52	48	50
2014	4.46%	4	0	52	46	8	48	44	46
2015	4.46%	4	0	49	49	9	44	40	42
2016	4.46%	4	0	46	52	9	40	37	38
2017	4.46%	4	0	43	56	10	37	33	35
2018	4.46%	4	0	39	59	10	33	29	31
2019	4.46%	4	0	36	62	11	29	25	27
2020	4.46%	4	0	33	66	11	25	22	24
2021	2.23%	2	(0)	29	69	11	22	19	20
2022	0.00%	0	(1)	26	72	10	19	17	18
2023	0.00%	0	(1)	23	75	8	17	15	16
2024	0.00%	0	(1)	20	78	7	15	12	14
2025	0.00%	0	(1)	16	82	6	12	10	11
2026	0.00%	0	(1)	13	85	5	10	8	9
2027	0.00%	0	(1)	10	88	4	8	6	7
2028	0.00%	0	(1)	7	92	2	6	4	5
2029	0.00%	0	(1)	3	95	1	4	2	3
2030	0.00%	0	(1)	0	98	0	2	0	1

* Column not specified in workbook

(1) YEAR	(2) NO YEARS BEFORE IN-SERVICE	(3) PLANT ESCALATION RATE	(4) CUMULATIVE ESCALATION FACTOR	(5) YEARLY EXPENDITURE (%)	(6) ANNUAL SPENDING ($/kW)	(7) CUMULATIVE AVERAGE SPENDING ($/kW)
1996	-5	0.00%	1.000	0.00%	0.00	0.00
1997	-4	2.55%	1.026	0.00%	0.00	0.00
1998	-3	2.55%	1.052	0.00%	0.00	0.00
1999	-2	2.67%	1.080	36.77%	113.15	56.57
2000	-1	2.89%	1.111	63.23%	200.20	213.25
				100.00%	313.34	

YEAR	NO YEARS BEFORE IN-SERVICE	(8) CUMULATIVE SPENDING WITH AFUDC ($/kW)	(9a)* DEBT AFUDC ($/kW)	(9b)* CUMULATIVE DEBT AFUDC ($/kW)	(9) YEARLY TOTAL AFUDC ($/kW)	(9a)* CUMULATIVE TOTAL AFUDC ($/kW)	(9b)* CONSTRUCTION PERIOD INTEREST ($/kW)	(9c)* CUMULATIVE CPI ($/kW)	(9d)* DEFERRED TAXES ($/kW)	(9e)* CUMULATIVE DEFERRED TAXES ($/kW)	(10) INCREMENTAL YEAR-END BOOK VALUE ($/kW)	(11) CUMULATIVE YEAR-END BOOK VALUE ($/kW)
1996	-5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1997	-4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1998	-3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1999	-2	56.57	2.16	2.16	6.05	6.05	4.81	4.81	(1.02)	(1.02)	119.20	119.20
2000	-1	219.30	8.43	10.59	23.57	29.63	18.53	23.34	(3.90)	(4.92)	223.77	342.97
			10.59		29.63		23.34		(4.92)		342.97	

IN SERVICE YEAR	2001
PLANT COSTS	265
AFUDC RATE	10.70%

	BOOK BASIS	BOOK BASIS FOR DEF TAX	TAX BASIS
CONSTRUCTION CASH	90	90	90
EQUITY AFUDC	5		
DEBT AFUDC	3	3	
CPI			2
TOTAL	98	93	92

* Column not specified in workbook

INPUT DATA – PART 2
PROGRAM METHOD SELECTED REV_REQ
PROGRAM NAME Water Storage - residential

(1)	(2)	(3)	(4)	(5)	(6)*	(7)	(8)	(9)
YEAR	CUMULATIVE TOTAL PARTICIPATING CUSTOMERS	ADJUSTED CUMULATIVE PARTICIPATING CUSTOMERS	UTILITY AVERAGE SYSTEM FUEL COST (CA/Wh)	AVOIDED MARGINAL FUEL COST (CA/Wh)	INCREASED MARGINAL FUEL COST (CA/Wh)	REPLACEMENT FUEL COST (CA/Wh)	PROGRAM kW EFFECTIVENESS FACTOR	PROGRAM kWh EFFECTIVENESS FACTOR
1996	0	0	0.00	2.28	3.35	0.00	1.00	1.00
1997	1,000	1,000	0.00	2.29	3.24	0.00	1.00	1.00
1998	1,000	1,000	0.00	2.39	3.61	0.00	1.00	1.00
1999	1,000	1,000	0.00	2.39	4.18	0.00	1.00	1.00
2000	1,000	1,000	0.00	2.48	4.63	0.00	1.00	1.00
2001	1,000	1,000	0.00	2.65	5.31	2.26	1.00	1.00
2002	1,000	1,000	0.00	2.63	4.58	2.50	1.00	1.00
2003	1,000	1,000	0.00	2.61	4.54	2.49	1.00	1.00
2004	1,000	1,000	0.00	2.79	5.35	2.96	1.00	1.00
2005	1,000	1,000	0.00	2.89	5.34	3.22	1.00	1.00
2006	1,000	1,000	0.00	3.06	5.78	3.45	1.00	1.00
2007	1,000	1,000	0.00	3.25	6.27	3.76	1.00	1.00
2008	1,000	1,000	0.00	3.37	6.62	3.67	1.00	1.00
2009	1,000	1,000	0.00	3.54	6.94	3.93	1.00	1.00
2010	1,000	1,000	0.00	3.83	7.56	4.39	1.00	1.00
2011	1,000	1,000	0.00	3.95	7.73	4.76	1.00	1.00
2012	1,000	1,000	0.00	4.12	8.19	4.74	1.00	1.00
2013	1,000	1,000	0.00	4.20	8.17	5.02	1.00	1.00
2014	1,000	1,000	0.00	4.34	8.54	5.08	1.00	1.00
2015	1,000	1,000	0.00	4.70	9.31	5.67	1.00	1.00
2016	1,000	1,000	0.00	4.80	9.62	5.80	1.00	1.00
2017	1,000	1,000	0.00	4.92	10.01	5.95	1.00	1.00
2018	1,000	1,000	0.00	5.14	10.69	6.33	1.00	1.00
2019	1,000	1,000	0.00	5.27	11.04	6.44	1.00	1.00
2020	1,000	1,000	0.00	5.42	11.33	6.53	1.00	1.00

* THIS COLUMN IS USED ONLY FOR LOAD SHIFTING PROGRAMS WHICH SHIFT CONSUMPTION TO OFF-PEAK PERIODS
THE VALUES REPRESENT THE OFF PEAK SYSTEM FUEL COSTS.

AVOIDED GENERATING BENEFITS
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME: Water Storage - residential

YEAR	(2) AVOIDED GEN UNIT CAPACITY COST $(000)	(3) AVOIDED GEN UNIT FIXED O&M $(000)	(4) AVOIDED GEN UNIT VARIABLE O&M $(000)	(5) AVOIDED GEN UNIT FUEL COST $(000)	(6) REPLACEMENT FUEL COST $(000)	(7) AVOIDED GEN UNIT BENEFITS $(000)
1996	0	0	0	0	0	0
1997	0	0	0	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	0	0	0	0	0	0
2001	19	3	0	14	17	20
2002	19	3	0	11	14	19
2003	18	3	0	9	10	20
2004	17	3	0	10	13	18
2005	17	3	0	12	14	18
2006	16	3	0	15	16	18
2007	16	4	0	17	18	18
2008	15	4	0	18	17	19
2009	14	4	0	15	16	18
2010	14	4	0	9	10	16
2011	13	4	0	9	11	15
2012	13	4	0	17	20	14
2013	12	5	0	17	20	14
2014	12	5	0	16	19	14
2015	11	5	0	19	22	13
2016	11	5	0	16	19	13
2017	10	5	0	13	15	13
2018	9	6	0	15	18	12
2019	9	6	0	15	18	12
2020	8	6	0	14	17	12

NOM	274	84	3	281	325	318
NPV	97	24	1	85	98	108

AVOIDED T&D AND PROGRAM FUEL SAVINGS
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME: Water Storage - residential

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(8a)*
YEAR	AVOIDED TRANSMISSION CAP COST $(000)	AVOIDED TRANSMISSION O&M COST $(000)	TOTAL AVOIDED TRANSMISSION COST $(000)	AVOIDED DISTRIBUTION CAP COST $(000)	AVOIDED DISTRIBUTION O&M COST $(000)	TOTAL AVOIDED DISTRIBUTION COST $(000)	PROGRAM FUEL SAVINGS $(000)	PROGRAM OFF-PEAK PAYBACK $(000)
1996	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	20	20
1998	4	1	5	2	4	6	43	43
1999	4	1	4	2	4	6	43	43
2000	3	1	4	2	4	6	44	44
2001	3	1	4	2	4	6	47	47
2002	3	1	4	2	4	6	47	47
2003	3	1	4	2	4	6	46	46
2004	3	1	4	2	5	7	50	50
2005	3	1	4	2	5	7	52	52
2006	3	1	4	2	5	7	54	54
2007	3	1	4	2	5	7	58	58
2008	2	1	4	2	5	7	60	60
2009	2	1	4	2	6	7	63	63
2010	2	1	4	1	6	7	65	65
2011	2	1	4	1	6	8	70	70
2012	2	1	4	1	6	8	73	73
2013	2	2	4	1	7	8	75	75
2014	2	2	3	1	7	8	77	77
2015	2	2	3	1	7	9	84	84
2016	2	2	3	1	8	9	86	86
2017	2	2	3	1	8	9	88	88
2018	1	2	3	1	8	9	91	91
2019	1	2	3	1	9	10	94	94
2020	1	2	3	1	9	10	97	97
NOM	55	31	87	38	137	173	1,526	1,526
NPV	24	10	34	16	44	60	503	503

* THESE VALUES REPRESENT THE COST OF THE INCREASED FUEL CONSUMPTION DUE TO GREATER OFF-PEAK ENERGY USAGE. USED FOR LOAD SHIFTING PROGRAMS ONLY.

TOTAL RESOURCE COST TEST
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME: Water Storage - residential

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
YEAR	INCREASED SUPPLY COSTS $(000)	UTILITY PROGRAM COSTS $(000)	PARTICIPANT PROGRAM COSTS $(000)	OTHER COSTS $(000)	TOTAL COSTS $(000)	AVOIDED GEN UNIT BENEFITS $(000)	AVOIDED T&D BENEFITS $(000)	PROGRAM FUEL SAVINGS $(000)	OTHER BENEFITS $(000)	TOTAL BENEFITS $(000)	NET BENEFITS $(000)	CUMULATIVE DISCOUNTED NET BENEFITS $(000)
1996	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	225	0	225	0	0	0	0	0	(225)	(206)
1998	0	0	0	0	0	0	11	0	0	11	11	(197)
1999	0	0	0	0	0	0	11	0	0	11	11	(189)
2000	0	0	0	0	0	0	10	0	0	10	10	(182)
2001	0	0	0	0	0	20	10	0	0	30	30	(162)
2002	0	0	0	0	0	19	10	0	0	29	29	(145)
2003	0	0	0	0	0	20	10	0	0	31	31	(129)
2004	0	0	0	0	0	18	11	0	0	29	29	(114)
2005	0	0	0	0	0	18	11	0	0	29	29	(101)
2006	0	0	0	0	0	18	11	0	0	29	29	(89)
2007	0	0	0	0	0	18	11	0	0	29	29	(78)
2008	0	0	0	0	0	19	11	0	0	30	30	(68)
2009	0	0	0	0	0	18	11	0	0	29	29	(59)
2010	0	0	0	0	0	16	11	0	0	27	27	(51)
2011	0	0	0	0	0	15	11	0	0	27	27	(44)
2012	0	0	335	0	335	14	11	0	0	26	(310)	(113)
2013	0	0	0	0	0	14	12	0	0	26	26	(114)
2014	0	0	0	0	0	14	12	0	0	26	26	(108)
2015	0	0	0	0	0	13	12	0	0	25	25	(104)
2016	0	0	0	0	0	13	12	0	0	25	25	(99)
2017	0	0	0	0	0	13	12	0	0	25	25	(95)
2018	0	0	0	0	0	12	13	0	0	25	25	(92)
2019	0	0	0	0	0	12	13	0	0	25	25	(88)
2020	0	0	0	0	0	12	13	0	0	25	25	(85)
NOM	0	0	560	0	560	318	260	0	0	578	18	
NPV	0	0	288	0	288	108	94	0	0	202	(85)	

Discount Rate: 9.22 %
Benefit/Cost Ratio (Col(11) / Col(6)): 0.70

PARTICIPANT COSTS AND BENEFITS
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME: Water Storage - residential

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
YEAR	SAVINGS IN PARTICIPANTS BILLS $(000)	TAX CREDITS $(000)	UTILITY REBATES $(000)	OTHER BENEFITS $(000)	TOTAL BENEFITS $(000)	CUSTOMER EQUIPMENT COSTS $(000)	CUSTOMER O&M COSTS $(000)	OTHER COSTS $(000)	TOTAL COSTS $(000)	NET BENEFITS $(000)	CUMULATIVE DISCOUNTED NET BENEFITS $(000)
1996	0	0	0	0	0	0	0	0	0	0	0
1997	28	0	0	0	28	225	0	0	225	(197)	(180)
1998	57	0	0	0	57	0	0	0	0	57	(132)
1999	57	0	0	0	57	0	0	0	0	57	(89)
2000	54	0	0	0	54	0	0	0	0	54	(50)
2001	53	0	0	0	53	0	0	0	0	53	(16)
2002	52	0	0	0	52	0	0	0	0	52	15
2003	51	0	0	0	51	0	0	0	0	51	42
2004	51	0	0	0	51	0	0	0	0	51	68
2005	50	0	0	0	50	0	0	0	0	50	91
2006	51	0	0	0	51	0	0	0	0	51	112
2007	53	0	0	0	53	0	0	0	0	53	132
2008	53	0	0	0	53	0	0	0	0	53	150
2009	55	0	0	0	55	0	0	0	0	55	168
2010	59	0	0	0	59	0	0	0	0	59	185
2011	62	0	0	0	62	0	0	0	0	62	201
2012	62	0	0	0	62	335	0	0	335	(273)	135
2013	64	0	0	0	64	0	0	0	0	64	149
2014	65	0	0	0	65	0	0	0	0	65	162
2015	64	0	0	0	64	0	0	0	0	64	174
2016	63	0	0	0	63	0	0	0	0	63	185
2017	64	0	0	0	64	0	0	0	0	64	195
2018	64	0	0	0	64	0	0	0	0	64	204
2019	64	0	0	0	64	0	0	0	0	64	213
2020	64	0	0	0	64	0	0	0	0	64	220
NOM	1,363	0	0	0	1,363	560	0	0	560	802	
NPV	508	0	0	0	508	288	0	0	288	220	

In Service of Gen Unit: 2001
Discount Rate: 9.22 %
Benefit/Cost Ratio (Col(6) / Col(10)): 1.77

RATE IMPACT TEST
PROGRAM METHOD SELECTED: REV_REQ
PROGRAM NAME: Water Storage - residential

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
YEAR	INCREASED SUPPLY COSTS $(000)	UTILITY PROGRAM COSTS $(000)	INCENTIVES $(000)	REVENUE LOSSES $(000)	OTHER COSTS $(000)	TOTAL COSTS $(000)	AVOIDED GEN UNIT & FUEL BENEFITS $(000)	AVOIDED T&D BENEFITS $(000)	REVENUE GAINS $(000)	OTHER BENEFITS $(000)	TOTAL BENEFITS $(000)	NET BENEFITS $(000)	CUMULATIVE DISCOUNTED NET BENEFITS $(000)
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	17	0	17	0	0	0	0	0	(17)	(16)
1998	0	0	0	35	0	35	0	11	0	0	11	(24)	(36)
1999	0	0	0	35	0	35	0	11	0	0	11	(24)	(55)
2000	0	0	0	33	0	33	0	10	0	0	10	(23)	(71)
2001	0	0	0	32	0	32	20	10	0	0	30	(2)	(72)
2002	0	0	0	32	0	32	19	10	0	0	29	(3)	(74)
2003	0	0	0	31	0	31	20	10	0	0	31	(1)	(74)
2004	0	0	0	31	0	31	18	11	0	0	29	(3)	(75)
2005	0	0	0	31	0	31	18	11	0	0	29	(2)	(76)
2006	0	0	0	31	0	31	18	11	0	0	29	(2)	(77)
2007	0	0	0	32	0	32	18	11	0	0	29	(3)	(78)
2008	0	0	0	33	0	33	19	11	0	0	30	(3)	(79)
2009	0	0	0	34	0	34	18	11	0	0	29	(5)	(81)
2010	0	0	0	36	0	36	16	11	0	0	27	(9)	(83)
2011	0	0	0	38	0	38	15	11	0	0	27	(11)	(86)
2012	0	0	0	38	0	38	14	11	0	0	26	(12)	(89)
2013	0	0	0	39	0	39	14	12	0	0	26	(13)	(92)
2014	0	0	0	40	0	40	14	12	0	0	26	(14)	(95)
2015	0	0	0	39	0	39	13	12	0	0	25	(13)	(98)
2016	0	0	0	39	0	39	13	12	0	0	25	(13)	(100)
2017	0	0	0	39	0	39	13	12	0	0	25	(13)	(102)
2018	0	0	0	39	0	39	12	13	0	0	25	(14)	(104)
2019	0	0	0	39	0	39	12	13	0	0	25	(14)	(106)
2020	0	0	0	39	0	39	12	13	0	0	25	(14)	(108)
NOM.	0	0	0	831	0	831	318	260	0	0	578	(253)	
NPV	0	0	0	310	0	310	108	94	0	0	202	(108)	

Discount Rate: 9.22 %
Benefit/Cost Ratio (Col(12) / Col(7)): 0.65