ENERGY SAVINGS OPPORTUNITY SURVEY (ESOS) OF SCHOFIELD BARRACKS FAMILY HOUSING AREAS A, D, E, F, I, J, K-1

U.S. ARMY CONTRACT NO. DACA83-89-D-0073

FINAL SUBMITTAL

~~VOLUME I~~

EXECUTIVE SUMMARY

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MEMO FOR RECORD:

SUBJECT: Energy Savings Opportunity Study, Schofield Barracks, HI

This study is an example of a pitfall that should be avoided in the future. The results of the study are acceptable; the only problem encountered with the AE was that they were late with the final submittal. However, the pitfall is that a large effort was expended to investigate very limited potential savings. This study was limited to the family housing area at Schofield Barracks, Hawaii. The only energy source for the quarters is electricity; and they are neither heated nor air conditioned. This really leaves very few possibilities for energy conservation. The ones that readily come to mind are lighting improvements and domestic hot water; and the results of the report confirm this. Although the entire list of standard ECOs was included in the scope of work, the only two that resulted in recommendations were replacing incandescent fixtures with fluorescent fixtures and repairing existing domestic hot water heat pumps. Most of the ECOs on the list were not investigated because they were not applicable. So we spent $68,000 and got a 6-inch thick report for two recommended projects with projected annual savings of $115,000. This represents a savings, but we really spent more than we had to.

Could we have avoided this pitfall? Probably. Solicit input from local people, ie, DEH engineers and shop personnel, occupants, operations personnel, etc; they have intimate knowledge about the facilities and may have ideas for energy conservation opportunities. Cut the fat out of the scope of work; focus on the most likely ECOs. This takes extra effort in preparation of the scope of work, but it pays off by reducing the AE's effort and our cost.

Anthony W. Battaglia

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1. Introduction:

This study provides an energy survey of the family housing units located in Areas A, D, E, F, I, J, and K-1 of Schofield Barracks based on a limited site survey of typical unit types. All potential economic conservation opportunities have been evaluated to determine their feasibility and energy savings potential.

2. Building Data:

The family housing quarters included in this study consists of 22 different unit types with a combined total of 758 housing units. The floor plans for a number of the different units are virtually identical and have been treated as similar units in the study. Thus, for the purposes of analysis there are only 15 different unit types. Electricity is the only energy source used in the family housing. None of the quarters are provided with central air conditioning and all existing built-in space heaters have been disabled.

3. Present Energy Consumption:

Due to the current electrical metering system in place, we are unable to investigate energy consumption by unit type. The present overall average household consumption was estimated to be 1,638 KWH/month.

For all 758 homes included in this study, the current annual energy consumption amounts to 14,762,800 KWH/year (or 50,390 MBTU/year) with an annual total cost of $1,003,870 for electricity, based on a rate of $0.068/KWH. During the same period the overall base average electrical consumption was 10,410,700 KWH/month.

The electrical consumption from the family housing areas under consideration thus accounts for approximately 12% of the total base electrical usage.

4. Historical Energy Consumption:

Records for the years 1988 and 1989 were provided by the Schofield Barracks Directorate of Facility Engineering. Based on the energy usage in Area K-1, it appears that between 1988 and 1989 the average household electrical consumption increased from 1,275 KWH/month to 1,623 KWH/month, which constitutes a 28% increase. During the same time period the total base electrical usage only increased by 4.4% from 9,970,667 KWH/month to 10,410,667 KWH/month. A breakdown showing the average monthly electrical usage over the two year period in question is shown in Figures 1-2.

5. Reevaluated Project Results:

No previous studies of the family housing have been performed.

6. Energy Conservation Analysis:

All applicable energy conservation opportunities were analyzed for feasibility and energy savings potential. A summary of all the ECO's analyzed for the project as a whole is included in Table 1. The feasible ECO's identified in the study are listed in order of descending SIR's in Table 2, and are summarized as follows:

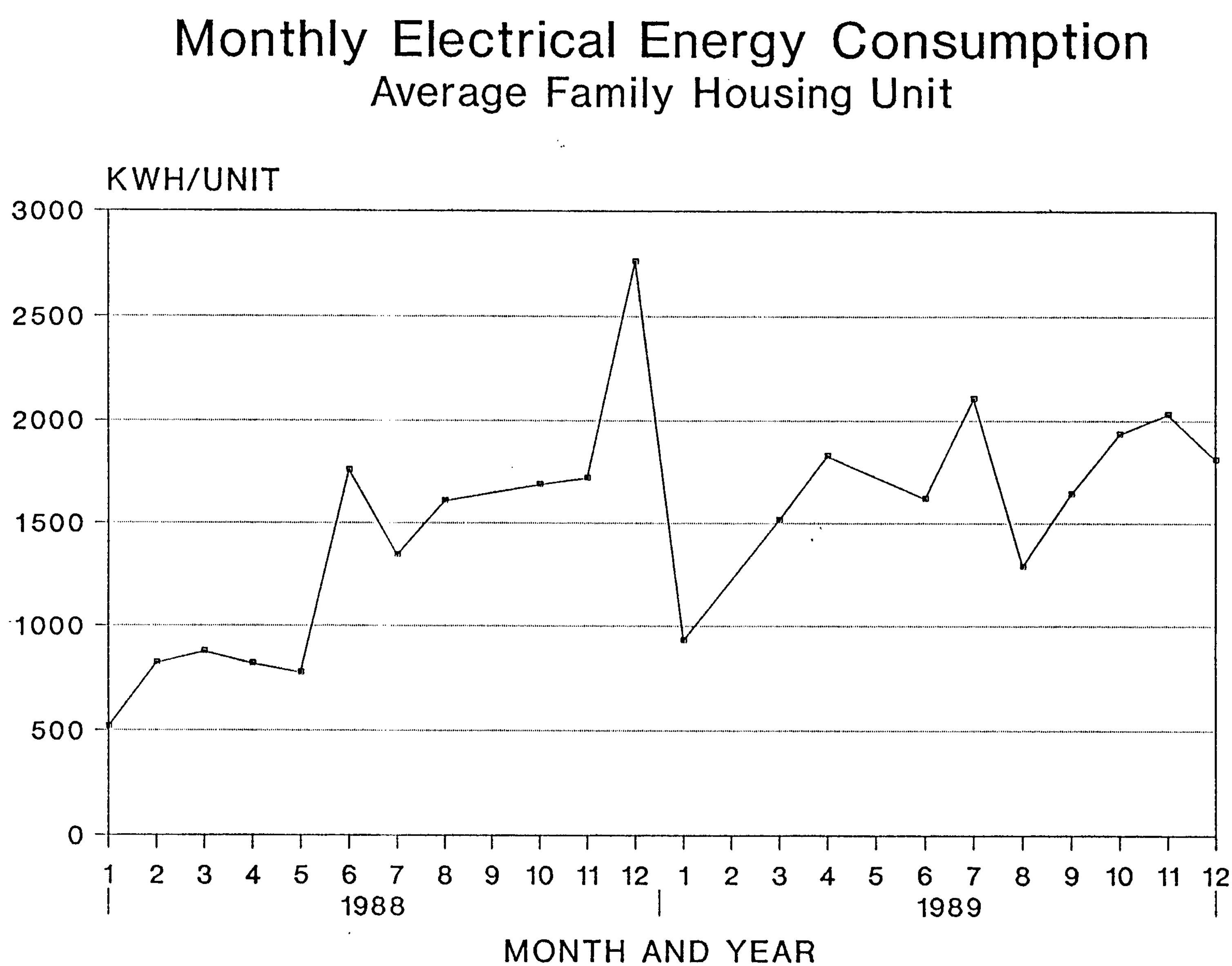

Figure 1: Family Housing Electrical Consumption

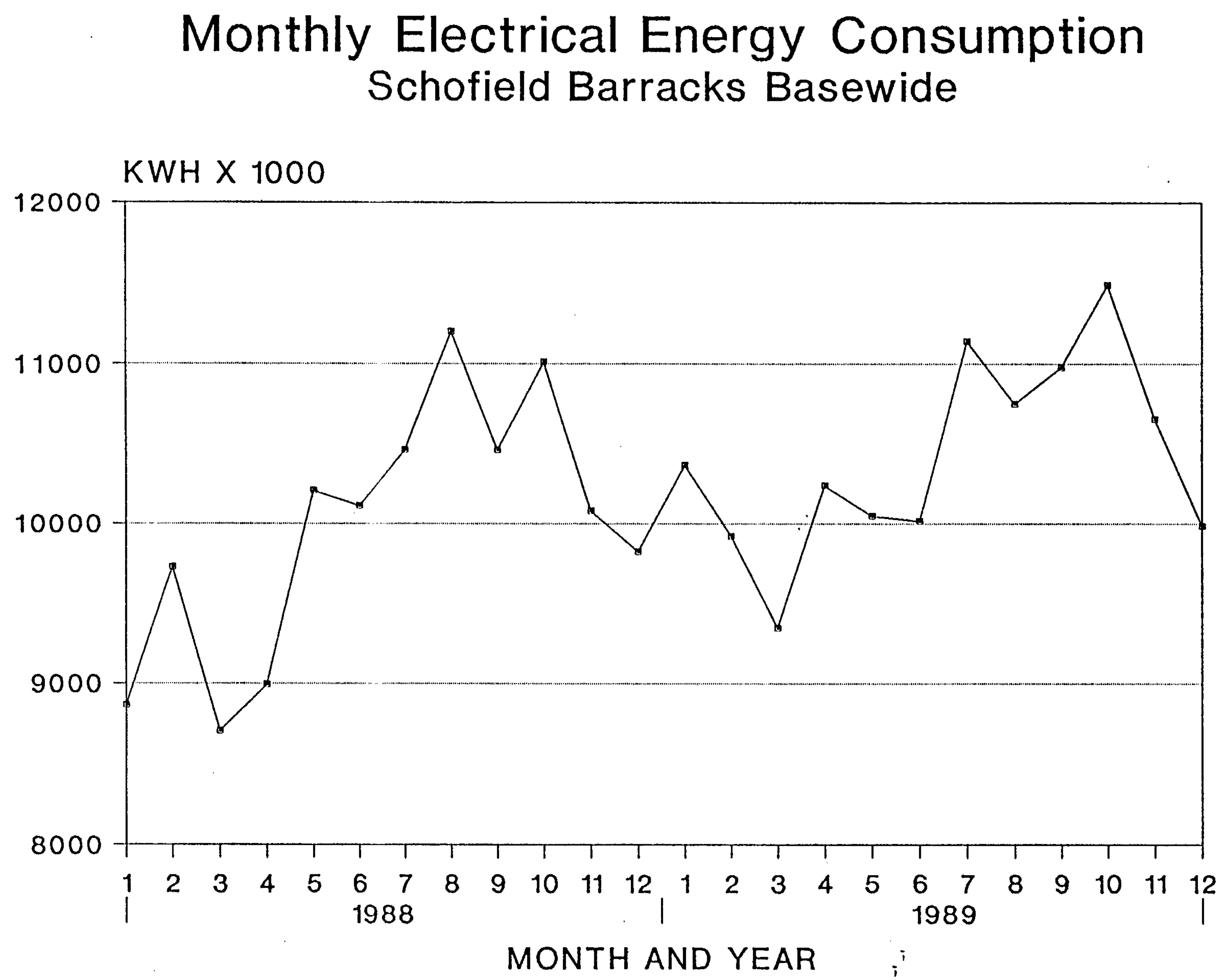

Figure 2: Overall Base Electrical Consumption

TABLE 1: SUMMARY OF ENERGY CONSERVATION OPPORTUNITIES FOR TOTAL PROJECT

		ANNUAL ELECTRICAL ENERGY SAVINGS MBTU	ANNUAL COST SAVINGS	ESTIMATED CONSTRUCTION COST	SIMPLE PAYBACK YEARS	SIR
1.	Insulation					
1.1	Insulation of Roof, Walls, etc.	----	----	----	----	----
1.2	Insulation of Piping	0.0038/LF	$0.26/LF	$3.75/LF	14.4	0.81
2.	Exterior Building Envelope					
2.1	Weather Stripping & Caulking	----	----	----	----	----
2.2	Vestibles	----	----	----	----	----
2.3	Loading Dock Seals	----	----	----	----	----
2.4	Reduction of Glass Area	----	----	----	----	----
2.5	Low Emissivity Windows	----	----	----	----	----
2.6	Water Spray Roof Cooling	----	----	----	----	----
2.7	Solar Film	----	----	----	----	----
3.	Lighting					
3.1	Reduce Lighting Levels	----	----	----	----	----
3.2	Replace Incadescent Lights	1,852	$36,898	$221,542	6.0	1.94
3.3	Energy Conserving Fluorescent Light & Ballast	64.194	$ 1,278	$140,549	110	0.11
3.4	Replace Kitchen Light Fixtures	(Combined w/ 3.3)				
3.5	Use More Energy Efficient Lighting Source	(Combined w/ 3.2)				
3.6	Reflectors for Fluorescent Fixtures	----	----	----	----	----
3.7	Occupancy Sensors to Control Lighting	----	----	----	----	----
3.8	Separate Switches to Control Lighting	----	----	----	----	----
3.9	Reduce Street Lighting	----	----	----	----	----
4.	Hot Water					
4.1	Control Hot Water Circulation Pump	----	----	----	----	----
4.2	Heat Reclaim from Family Housing Condenser...	----	----	----	----	----
4.3	Reclaim Heat from Hot Refrigerant Gas	----	----	----	----	----
4.4	Instantaneous Hot Water Heaters	5.810/unit	$38.56/unit	$1480/unit	36.9	0.11
4.5	Decentralize Domestic Hot Water Heaters	(Combined w/ 4.3)				
4.6	Install Shower Flow Restrictors/ Limited Flow Showerheads	----	----	----	----	----
4.7	Repair Broken Domestic Hot Water Heat Pumps	3,934	$78,382	$40,878	0.52	6.23

4.8 Install Timeclocks	----	----	----	----	----
4.9 Shutdown Energy to Hot Water Heater or Modify Controls	----	----	----	----	----
5. Electrical System					
5.1 Improve Power Factor	----	----	----	----	----
5.2 Transformer Overvoltage	----	----	----	----	----
5.3 Transformer Loading	----	----	----	----	----
6. HVAC System					
6.1 Economizer Cycles (DB)	----	----	----	----	----
6.2 Radiator Controls	----	----	----	----	----
6.3 FM Radio Controls	----	----	----	----	----
6.4 Chiller Replacement	----	----	----	----	----
6.5 Chiller Controls	----	----	----	----	----
6.6 Replace Absorption Chiller	----	----	----	----	----
6.7 Boiler Oxygen Trim Control (Fixed or Portable)	----	----	----	----	----
6.8 Revise Boiler Controls	----	----	----	----	----
6.9 Insulate Steam & Condensate Lines	----	----	----	----	----
6.10 Waste Heat Recovery	----	----	----	----	----
6.11 Thermal Storage	----	----	----	----	----
6.12 Steam Trap Inspection	----	----	----	----	----
6.13 Revise or Repair Building HVAC Controls	----	----	----	----	----
6.14 Night Setback/Setup Thermostats	----	----	----	----	----
6.15 Infrared Heaters	----	----	----	----	----
6.16 Air Curtains	----	----	----	----	----
6.17 Prevent Air Stratification	----	----	----	----	----
6.18 Reduce Airflows	----	----	----	----	----
6.19 High Efficiency Motor Replacement	----	----	----	----	----
7. Motor/Equipment					
7.1 High Efficiency Motor Replacement	----	----	----	----	----

TABLE 2: SUMMARY OF FEASIBLE ECO'S FOR TOTAL PROJECT

		ANNUAL ELECTRICAL ENERGY SAVINGS MBTU	TOTAL ANNUAL COST SAVINGS	ESTIMATED CONSTRUCTION COST	SIMPLE PAYBACK YEARS	SIR
*1.	Repair Broken Domestic Hot Water Heat Pumps	3,934	$78,382	$40,878	0.52	6.23
2.	Replace Incadescent Lights	1,852	$36,898	$221,542	6.0	1.94
3.	Insulation of Piping	0.0038/LF	$0.26/LF	$3.75/LF	14.4	0.81
4.	Instantaneous Hot Water Heaters	5.810/UNIT	$38.56/UNIT	$1,424/UNIT	36.9	0.11
5.	Energy Conserving Fluorescent Light & Ballast	64.19	$1,278	$140,549	110	0.11

* Assuming that 20% of the existing heat pumps are not operable

A. Repair/Replace Broken Domestic Hot Water Pumps: Repair of the broken heat pumps currently in place would produce an annual cost savings of $78,382 with a SIR of 6.23 and a payback period of 0.52 years.

B. Replace Incandescent Light: Replacement of existing incandescent lamps with fluorescent adapters would reduce energy costs by $36,898/year for a resulting payback of 6.0 years and a SIR of 1.94.

C. Insulation of HW Piping: This ECO would produce an annual cost savings of $0.26 for each linear foot of HW piping that is insulated with a payback of 14.4 years and a SIR of 0.81.

D. Instantaneous HW Heaters: Heat loss reduction by decentralization of HW production shows a cost savings of $38.56/unit with a payback period of 36.9 years and a SIR of 0.11.

E. Energy Conserving Fluorescent Lights and Ballasts: Replacement of existing fluorescent lights with energy conserving fluorescent fixtures would present a cost savings of $1,278/year, a payback period of 110 years and a SIR of 0.11.

Based on this analysis, we recommend the following ECO's be implemented:

Description	Annual Electrical Savings MBTUH	$	Construction + SIOH Cost	Payback Period	SIR	Project Type
1. Repair Broken Domestic HW Heat Pumps	3,934	78,382	$ 43,100	0.52	6.23	N/A
2. Replace Incandescent Lights	1,852	36,898	$233,727	6.00	1.94	Low Cost
TOTAL	5,786	115,280				

All other ECO's were found to be non-cost effective with savings to investment ratios below one, or were not applicable to the family housing environment.

In the course of this study, it was found that the OCFHO currently has a project, in the pre-award stage, to repair and maintain family housing HW heat pumps throughout the base. These plans coincide with our recommendation to implement a repair project for the broken heat pumps.

In addition to implementation of the two recommended ECO's, we also recommend that the base metering system be upgraded and reorganized so that the electrical energy consumption in the housing areas can be monitored more effectively. In preparing this study we found it difficult to obtain the information required to accurately determine the historical energy consumption for the family housing areas under investigation due to the layout of the existing metering system. Metering is only done on an area by area basis and the extent of each area is not clearly defined, and may include loads from non-residential occupancies.

In order to effectively monitor the family housing energy consumption and to observe energy reductions resulting from the implemented ECO's, the base metering system must be improved. The DFE should reexamine the existing system and determine the specific loads monitored by each meter. If possible it would be beneficial to separate the housing loads from the industrial and street lighting loads through deductive metering. It would also be helpful to have individual metering of each housing unit in order to keep the residents aware of energy usage. However, this may be costly to implement and it is difficult to quantify the energy savings that could be obtained from such a plan.

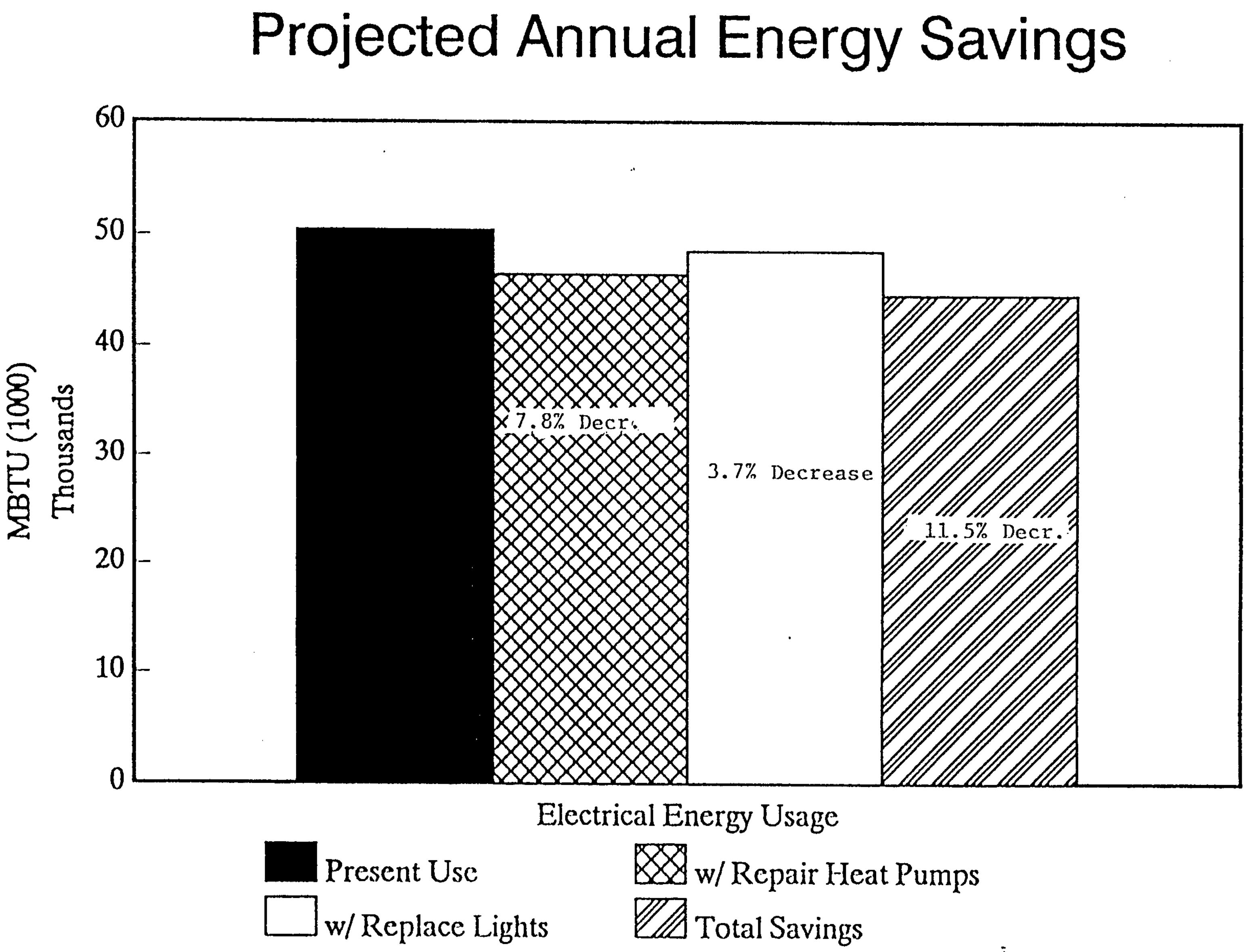

Figure 3: Projected Energy Savings with Recommended ECO's

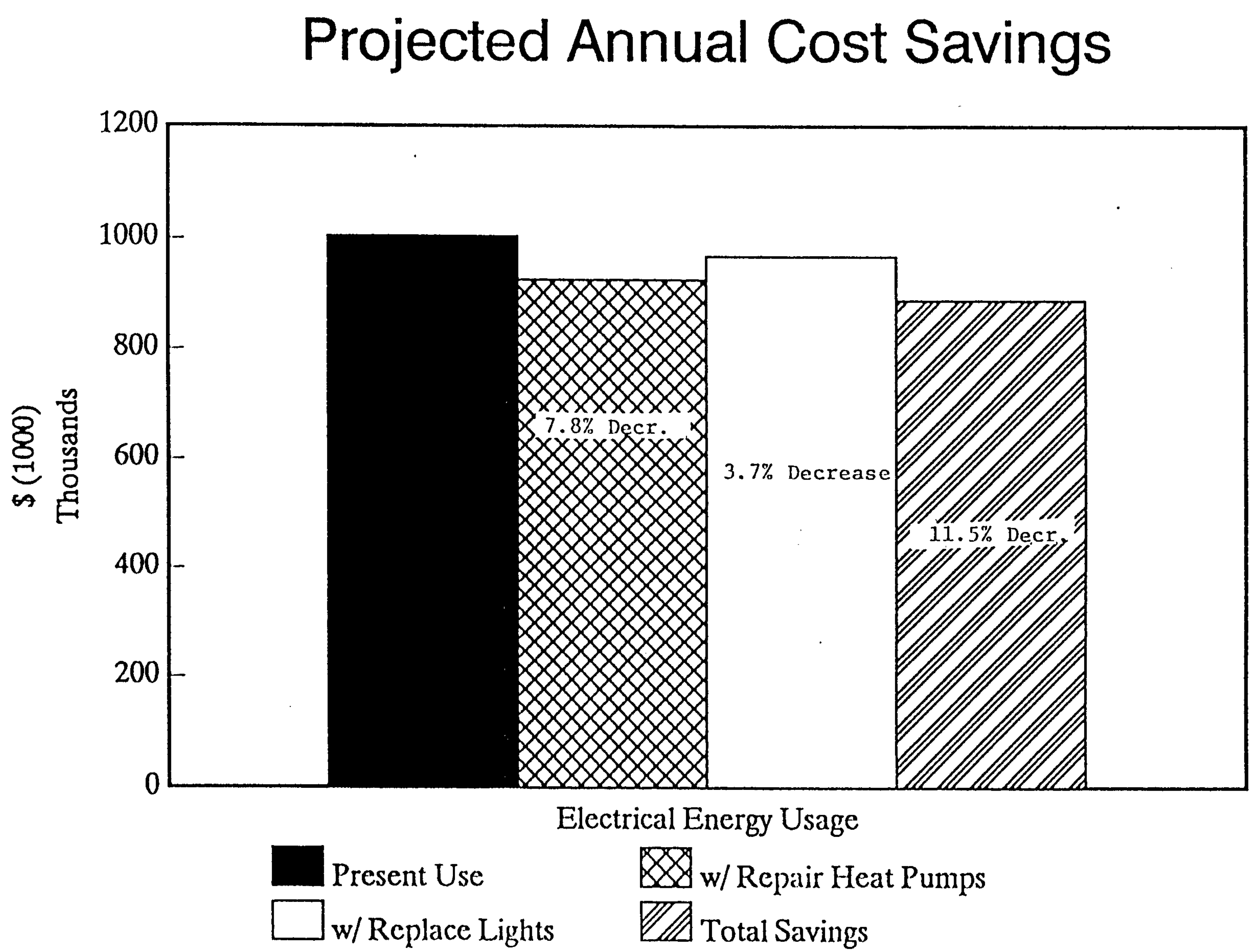

Figure 4: Projected Cost Savings with Recommended ECO's