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Cape Canaveral Air Force Station Integrated Resource Assessment

Volume 3: Resource Assessment

March 1994

**Prepared for the U.S. Department of Energy
Federal Energy Management Program
under Contract DE-AC06-768LO 1830**

**Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
by Battelle Memorial Institute**

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CAPE CANAVERAL AIR FORCE STATION
INTEGRATED RESOURCE ASSESSMENT

VOLUME 3: RESOURCE ASSESSMENT

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ABSTRACT

The U.S. Air Force (USAF) has tasked the Pacific Northwest Laboratory (PNL)^(a) in support of the U.S. Department of Energy (DOE) Federal Energy Management Program (FEMP), to identify, evaluate, and assist in acquiring all cost-effective energy projects at Cape Canaveral Air Force Station (AFS). Projects considered can be either in the form of energy management or energy conservation. The overall efforts of this task are based on a model program PNL is designing to support energy-use decisions in the federal sector.

This report provides the results of the fossil fuel and electric energy resource opportunity (ERO) assessments performed by PNL at Cape Canaveral AFS, which is located approximately 10 miles north of Cocoa Beach, Florida. It is a companion report to Volume 1: Executive Summary and Volume 2: Baseline Detail.

The results of the analyses of EROs are presented in 11 common energy end-use categories (e.g., boilers and furnaces, service hot water, and building lighting). A narrative description of each ERO is provided, including information on the installed cost, energy and dollar savings, impacts on operations and maintenance (O&M), and, when applicable, a discussion of energy supply and demand, energy security, and environmental issues. Descriptions of the evaluation methodologies and technical and cost assumptions are also provided for each ERO. Summary tables present the cost-effectiveness of energy end-use equipment before and after the implementation of each ERO and present the results of the life-cycle cost (LCC) analysis, indicating the net present value (NPV) and savings-to-investment ratio (SIR) of each ERO.

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SUMMARY

The U.S. Air Force (USAF) has tasked the Pacific Northwest Laboratory (PNL) in support of the U.S. Department of Energy (DOE) Federal Energy Management Program (FEMP) to identify, evaluate, and assist in acquiring all cost-effective energy projects at Cape Canaveral Air Force Station (AFS). This task is part of a model program PNL is designing to support energy-use decisions in the federal sector.

This report describes the methodology used to identify and evaluate the energy resource opportunities (EROs) at Cape Canaveral AFS, provides a life-cycle cost (LCC) analysis for each ERO, and prioritizes the EROs based first upon whether or not they have a positive net present value (NPV) and second upon their savings-to-investment ratio (SIR). The SIR (the ratio of total savings present value to installed cost present value) is used to prioritize EROs and is only applied to projects deemed cost-effective by nature of their positive NPV. EROs with negative NPVs, therefore, will not have an associated SIR measurement. Analysis results are presented in 11 common energy end-use categories (e.g., boilers and furnaces, service hot water, and building lighting).

As illustrated in Table S.1, the present value of the installed cost of all EROs constituting the minimum LCC efficiency resource (i.e., cost-effective) at Cape Canaveral AFS is approximately \$16.6 million in 1993 dollars (1993\$). The present value of the savings associated with this investment is approximately \$48.9 million, for an overall NPV of \$32.3 million.

TABLE S.1. Total Savings, Cost, and NPV (1993\$)

Total Present Value of Installed Cost	Total Present Value of Energy Savings	Total Present Value of Demand Savings	Total Present Value of O&M Savings	Total Present Value of Replacement Savings	Total Present Value of All Savings	Total Net Present Value
16,589,658	25,557,604	17,924,377	649,066	4,815,864	48,946,911	32,357,253

Table S.2 provides a breakdown and summary of the cost-effective electric resource at Cape Canaveral AFS. Cost-sharing and rebate incentives from the utility would normally be factored into the analysis. Although a potential demand-side management relationship with the electric utility, Florida Power and Light (FPL), now exists, Cape Canaveral AFS project managers decided that this document would present an economic analysis from the government-funding-only perspective. Thus, if no cost-sharing with the utility can be arranged, the document will still be useful to the USAF when planning for implementation of various EROs. Once details of a cost-sharing agreement with the utility have been reached, the economic analysis can be redone at any time.

The operations and maintenance (O&M) savings are a reflection of the incremental cost difference between the cost of maintaining the existing equipment and that of maintaining new or retrofitted equipment. Because maintenance costs of new or retrofitted equipment are often the same as the costs to maintain the existing equipment, this incremental maintenance cost is often zero.

Table S.3 accompanies Table S.2, which presents a breakdown and summary of both the energy and demand savings for the first year and full implementation of the cost-effective resource at Cape Canaveral AFS.

TABLE S.2. Summary of Cost-Effective Electric Resource at Cape Canaveral AFS (1993\$)

ERO Category	Present Value of Installed Cost	Present Value of Energy Savings	Present Value of Demand Savings	Present Value of O&M Savings	Present Value of Replac. Savings	Present Value of Total Savings	Net Present Value
Air Conditioning	5,631,801	-663,962	7,050,801	965,176	4,255,171	11,607,187	5,975,385
Boilers	924,950	1,931,863	2,032,477	-4,544	336,174	4,295,970	3,371,020
Envelope	158,018	365,095	47,326	0	0	412,421	254,403
Generators	373,236	-1,373,697	3,823,200	-798,261	0	1,651,242	1,278,006
Heatpipes	2,631,580	11,439,374	0	0	0	11,439,374	8,807,794
Lighting	6,179,025	12,999,180	4,742,382	486,694	0	18,228,257	12,049,232
Motors	691,048	859,750	228,191	0	224,519	1,312,459	621,411
Totals	16,589,658	25,557,604	17,924,377	649,066	4,815,864	48,946,911	32,357,253

TABLE S.3. Summary of Electric Energy and Demand Savings at Cape Canaveral AFS

ERO Category	First-Year Energy Savings (MBtu)	Full Implement. Energy Savings (MBtu)	First-Year Demand Savings (kW-mo)	Full Implement. Demand Savings (kW-mo)
Air Conditioning	3,540	-10,615	1,142	71,565
Boilers	-1,520	-1,520	20,415	20,415
Envelope	2,279	2,279	475	475
Generators	-17,048	-17,048	38,400	38,400
Heatpipes	68,913	68,913	0	0
Lighting	82,082	82,082	47,634	47,634
Motors	4,883	5,740	2,292	2,292
Totals	143,130	129,831	110,359	180,782

Table S.4 presents a breakdown and summary of the total fuel balance at Cape Canaveral AFS. Total existing fuel use is based on information developed for the Volume 2: Baseline Detail companion report to this document (Wahlstrom et al. 1993). Total fuel use after ERO implementation was determined, where possible, by subtracting the total fuel savings from the total existing fuel use.

TABLE S.4. Fuel Balance at Cape Canaveral AFS

Fuel Type	1991 Existing Energy Use (MBtu)	Existing Demand (kW-mo)	Energy Use Reduction (MBtu)	Demand Reduction (kW-mo)	Increased Energy Use (MBtu)	Increased Demand (kW-mo)	Resulting Energy Use (MBtu)	Resulting Demand (kW-mo)
Diesel	218,162	na	0	na	24,887	na	243,049	na
Electricity	655,549	362,135	167,775	242,025	16,529	0	504,303	120,110
Fuel Oil	128,265	na	63,618	na	60,147	na	124,794	na
Totals	1,001,976	362,135	231,393	242,025	101,562	0	872,145	120,110

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ABBREVIATIONS AND ACRONYMS

A/C	air conditioning
ADMIN	administration (building type)
AEC	annual energy and demand cost
AFS	Air Force Station
BLST	ballast
BRK/ADM	barracks/administration (building type)
Btu	British thermal unit
CFC	chlorofluorocarbon
CNG	compressed natural gas
COMCATN	communication (building type)
COP	coefficient of performance
CRIT	critical
CVR	conservation voltage reduction
d	discount rate
DET-RR	detached restroom (building type)
DGR	dry good retail
DOE	U.S. Department of Energy
ECIP	Energy Conservation Investment Program
EEM	energy-efficient motors
ELC	electronic ballast
EMCS	energy management and control system
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ERO	energy resource opportunity
FEDS	Facility Energy Decision Screening software
FEMP	Federal Energy Management Program
FPL	Florida Power & Light
FSEC	Florida Solar Energy Center
HFC	hydrofluorocarbon
HCFC	hydrochlorofluorocarbon
HOSPITL	hospital (building type)
hp	horsepower
HPS	high-pressure sodium
HSG-FAM	family housing (building type)
HUT	small buildings (building type)
HVAC	heating, ventilating, and air conditioning
HW-E	hot water-electric
IC	installed cost
ID	identification
INC	incandescent
INT	integral unit
kVA	kilovoltampere
kW	kilowatt

kWh	kilowatt-hour
kW-mo	kilowatt-month
LCC	life-cycle cost
LDC	local distribution company
LPS	low-pressure sodium
MBtu	million British thermal units
MILCON	military construction
MTRPOOL	motorpool (building type)
MW	megawatt
MWh	megawatt-hour
MWR	morale, welfare, & recreation (building type)
N/C	noncritical
NIST	National Institute of Standards and Technology
NO _x	oxides of nitrogen
NPV	net present value
O&M	operations and maintenance
ODP	open drip-proof
OM	annual O&M cost
PLT-BLD	plant building (building type)
PM	preventive maintenance
PNL	Pacific Northwest Laboratory
PV(IC)	present value of installed cost
PV(EC)	present value of annual energy cost
PV(OM)	present value of annual O&M cost
PV(OMS)	present value of O&M savings
PV(REP)	present value of future replacement cost
PV(REPS)	present value of replacement savings
R&D	research and development (building type)
REC	recreation (building type)
REF	reflector
REP	replacement cost
RESTRNT	restaurant (building type)
RI	replace immediately
ROF	replace on failure
rpm	revolutions per minute
RTU	roof top unit
SCADA	Supervisory Control and Decision Analysis
SEER	seasonal energy efficiency ratio
SERC	Southeastern Electric Reliability Council
SHGF	solar heat gain factor
SHOP-AIR	aircraft shop (building type)
SHOP-ELEC	electrical shop (building type)
SHOP-WPN	weapons shop (building type)
SIR	savings-to-investment ratio
SHGF	solar heat gain factor
SPW	single present worth factor

ST	steam
ST-E	steam-electric
STD	standard
STOR-UH	unheated storage (building type)
T&D	transmission and distribution
TEFC	total enclosed fan-cooled
TERMINL	passenger terminal (building type)
TES	thermal energy storage
TRAINING	training (building type)
TSM	Lighting Technology Screening Matrix
UPW	uniform present worth factor
USAF	U.S. Air Force
USFW	U.S. Fish and Wildlife Service
VSD	variable-speed drive
W	watt
WHS	warehouse (building type)
WHS-CLD	cold-storage warehouse (building type)

1.0 SELECTION OF ENERGY RESOURCE OPPORTUNITIES

The number of conceivable energy conservation measures, fuel-switching opportunities, and renewable energy projects at a federal site is very large. A three-step process has been developed by Pacific Northwest Laboratory (PNL) to make energy resource opportunity (ERO) selection, evaluation, and prioritization manageable. The steps are:

- Preliminary Screening. Select promising EROs from the master list, considering the site's mission, building stock, end-use equipment characteristics, utility characteristics, climate, energy cost, and other local conditions that affect ERO viability.
- Cost and Performance Analysis. Establish, with a reasonable degree of accuracy, the technical and economic feasibility of each ERO that passed the preliminary screening. An analysis is performed comparing the operating and economic performance of the existing equipment and the ERO. Where applicable, impacts on energy security and the environment are included in the analysis.
- Life-Cycle Cost Analysis and Prioritization of EROs. Perform a life-cycle cost (LCC) analysis and rank EROs by net present value (NPV) so that a package with the optimal return on site and utility investment can be defined. Utility- and technology-specific incentives are accounted for in this evaluation step.

The remainder of Section 1.0 describes the process used for preliminary selection of ERO and presents the ERO master list of screened and selected EROs. Section 2.0 covers the technical characteristics of each conservation and fuel-switching measure considered and analyzes its cost and performance; Section 3.0 provides the results of the LCC analysis and ERO prioritization process. Section 4.0 lists references cited in this document.

1.1 ERO PRELIMINARY SELECTION CRITERIA

The ERO selection process tests the applicability of a long list of EROs (see Table 1.1) using a set of rational criteria that can be applied with relatively little "hard data." This step filters out EROs that are unlikely to be economically feasible; are unlikely to have significant, persistent energy impact at the site; or that will be unduly expensive or difficult to analyze. The ten basic criteria used to characterize and select possible EROs are listed below.

- **Low Incidence.** EROs that apply to end-use equipment representing a very small fraction of site energy use may be eliminated. However, such EROs may be retained in cases where the end-use is concentrated, rather than diffuse, or where it has been previously identified in a detailed audit and the ERO passes the other criteria without difficulty.
- **Economic Feasibility.** A preliminary assessment of economic feasibility can often be made if the utility will commit to an incentive or cost-sharing level in advance. EROs whose costs and performance are well established and fairly uniform across applications can then be screened with respect to the utility's marginal cost of energy supply.
- **Technical Feasibility.** In some cases, conditions at the site will preclude implementation of a certain ERO. Conditions that make retrofit difficult or use patterns that complicate operation or maintenance of the end-use equipment in question may result in elimination of an ERO prior to formal analysis.
- **Primarily Operations and Maintenance (O&M).** A measure that is little more than a no- or low-cost change in operation or maintenance activity will generally be rejected as inappropriate to the integrated resource acquisition program. The measures of interest to the program are capital-intensive measures that are difficult, programmatically, for the site personnel to implement on their own. Cases where there is a significant cost to develop new O&M procedures or procure special instruments and tools may be considered.
- **Mission Critical.** End-use equipment that serves mission-critical functions may not be accessible for retrofit or replacement, or its operation may be so important to critical mission objectives that any reduction or change in the service provided is not tolerable.
- **Site Preference.** The site may have particular objections to certain EROs based on O&M or other infrastructure support requirements, or on unfavorable past experiences with similar measures. In cases where the ERO appears to be very attractive in other respects, it may be analyzed in the belief that the savings might incite a reevaluation of the measure.
- **Insufficient Data.** In some cases the performance or operational characteristics of existing end-use equipment is unknown, and the cost for an outside consultant to determine these characteristics cannot be justified. Insufficient data is not a technical or implementation cost-grounded rejection and should not deter the site-resident energy and O&M staff or local energy service company personnel from further analysis and, if appropriate, implementation of the ERO concerned.
- **Complexity.** In some cases, the complexity of the analysis precludes the analysis of an ERO as part of a high-level, comprehensive site assessment program.

- **Immature Technology.** Some retrofits require equipment that has not achieved sufficient market acceptance or penetration in the federal sector to be considered reliable and effective in the field. The persistence of savings and the sensitivity of savings to O&M, and the propensity for equipment to degrade in energy performance while continuing to provide service, are factors that can disqualify a technology. Such measures will usually not be considered.
- **Other ERO dependent.** A measure may be rejected because it depends on one or more other EROs that have been rejected or whose feasibility is too uncertain. A measure may also be rejected because it has already been implemented in all, or a majority of, the existing end-use opportunities.

One criterion that will generally not be applied is the willingness of the utility to support a particular ERO with incentives. The rationale for this approach is that if the utility's rate structure reasonably reflects its overall cost of supply, a uniform incentive structure should exist that will properly account for its marginal cost of supply. The rates and incentives, together with an unbiased ERO analysis, should result in a near-optimal mix of efficiency, fuel-switching and renewable energy measures. The application of utility preference based on other criteria, such as applicability to the majority of customers, will only serve to move the mix of recommended measures away from the optimal solution.

1.1.1 Master List of Screened and Selected EROs

A master list of generic conservation measures, aggregated from a variety of sources, was used as an origination point in the identification of EROs at Cape Canaveral Air Force Station (AFS). This master list is presented in Table 1.1. For each ERO listed there is an indication of whether or not it passed the preliminary selection process. If the ERO did not pass, a brief explanation is provided.

TABLE 1.1. Master List of EROs at Cape Canaveral AFS

ERO Name	ERO Description	Passed initial screening (Y,N)	Comments
PUMPS & MOTORS			
Efficient motor	Replace motor with high efficiency model	Y	Selected units only
Two-speed motor	Replace existing motor with two-speed motor and controller	N	Limited motor information
Variable-speed drive	Install variable frequency motor drive and control to modulate fluid flow; also reduce motor size if appropriate	N	Limited motor information
AIR CONDITIONING			
Efficient Chiller	Replace existing chiller with more efficient model.	Y	Include the impact of changing refrigerant
Efficient air-conditioner (window units)	Replace window air conditioner with high efficiency model	Y	
Thermal Energy Storage	Install thermal energy storage system (either centralized serving multiple facilities or decentralized systems on larger facilities) to produce either chilled water or ice during off-peak hours for cooling during peak demand periods.	Y	Evaluated on a building-by-building basis. Some potential for centralization
Gas chiller/cogeneration	Chillers can be CNG engine-driven and the waste heat utilized to cut peak demand and overall energy cost.	Y	Based on future availability of gas at the site
Reduce A/C hours	Install clock, activate EMCS or other control means to reduce operating hours and peak coincident load of chillers.	N	Included in EMCS ERO analysis
COMMERCIAL LIGHTING			
Upgrade florescent to T8	Upgrade florescent fixture to high efficiency T8 or similar system	Y	
Replace florescent with new fixture	Replace florescent fixture with new high efficiency T8 or compatible fixture	Y	
De-lamp	Replace, modify or move/remove fixtures to reduce lighting density to level that provides correct illumination.	Y	External lighting only
Upgrade incandescent to PCF fixture	Upgrade incandescent fixture with new compact florescent fixture	Y	
Replace incandescent with PCF fixture	Replace mercury vapor lamps and ballasts with high pressure sodium lamp and ballast (or replace entire fixture)	Y	
Replace incandescent exit signs	Replace incandescent exit signs with LED florescent	Y	
Occupancy Sensors	Install occupancy sensors to control lights	N	Few applications
OCCUPANCY BASED CONTROLS			

TABLE 1.1. (contd)

ERO Name	ERO Description	Passed initial screening (Y,N)	Comments
Occupancy sensors, restrooms	Install occupancy sensor to control lights and exhaust fan in restrooms	N	Few applications
Occupancy sensors, other	Install occupancy sensor to control lights in hallway, lunchroom, office, conference room, or other intermittently occupied area	N	Insufficient data
Switch from photocells to direct switch applications	Remove existing photocells for external lights and some internal lighting	Y	Based expected reduced lighting need
CO ₂ sensor control	Install CO ₂ sensor to control air-handler and ventilation fans	N	Research ERO
Countdown timer	Install countdown timer to control air-handler and ventilation fans during normally unoccupied hours.	N	Not applicable
Occupied mode via EMCS	Implement unoccupied schedules for fans and air-conditioning via EMCS; override during normally unoccupied hours.	N	Not applicable
TRANSMISSION AND DISTRIBUTION			
Efficient Transformers	Replace existing transformers with high-efficiency models	Y	
Reduce Transformer Size	Reduce transformer size to match load	N	Insufficient Data
Conservation Voltage Reduction	Reduce set point on auto-tap-charging transformer to maintain minimum acceptable voltage at end of feeder	Y	
Passive power factor correction	Install capacitor banks to provide passive power factor correction	N	Insufficient Data
DOMESTIC WATER HEATING			
Solar heater	Install solar panels and system to assist in water heating	N	Small overall load
Fuel switch to gas	Replace electric water heaters with gas units	N	Small overall load
Efficient heater	Replace water heater with high efficiency (well insulated) model	N	Small overall load
Insulate service hot water pipes	Insulate service hot water pipes to reduce losses (ASHRAE standard 90A).	N	Small overall load
BOILERS			
New efficient boiler	When the refurbishment cost of an existing boiler is uneconomical, boiler replacement may be considered.	Y	
Pulse or condensing boiler	Pulse or condensing boiler have high efficiency. Seasonal efficiency is typically 8% higher than conventional units.	N	Current systems can't be converted to these types of boilers
Convert to gas-fired	Replace existing hot water boiler with CNG fired boiler.	Y	

TABLE 1.1. (contd)

ERO Name	ERO Description	Passed initial screening (Y,N)	Comments
ENVELOPE			
Insulate ceilings	Batt type fiberglass insulation and blown-in fiberglass or cellulose are most frequently used as ceiling insulation.	Y	Where applicable
Install multi-glazed windows	Multi-glazed windows reduce solar gains	Y	
Tinted/reflective window trim	Window tinting can be applied to an existing window to reduce solar heat gain.	Y	
Weatherstripping	Install weatherstripping to door and some window perimeters to provide a tight seal limiting infiltration.	Y	
Caulking	A bead of caulk should be applied to seams in building structures where air can infiltrate	Y	
SPACE HEATING			
Install new energy efficient replacement furnace	Replacement is cost effective if existing furnaces are old and inefficient.	N	Small heating load at the site
VEHICLES			
Conversion to Compressed Natural Gas	Converting the engines to CNG can cut emissions, maintenance and fuel costs.	Y	
ENERGY MANAGEMENT AND CONTROL SYSTEM			
Implement control capabilities on existing monitoring system.	Expanding the control capabilities of the monitoring system can cut energy consumption by units such as air handlers, chillers, and boilers. Maintenance can also be simplified.	Y	Will be limited to non-critical facilities.
PROCESS ENERGY IMPROVEMENTS			
Desiccant dehumidifier	Install desiccant dehumidifier systems.	N	Insufficient data
Recirculation air path	Provide recirculation path for payload A/C conditioned air.	Y	
Axial flow fans	Retrofit the existing centrifugal fans in clean enclosure A/C systems with axial flow fans.	N	Insufficient data
Dehumidifier bypass	Provide dehumidifier bypass in Payload A/C System.	Y	
Solar detoxification	Installation a solar detoxification system for fuel vapor mitigation	N	Immature technology
Install heat pipes for humidity control	Heat pipes provide a simple means to reduce humidity levels in clean rooms.	Y	
COGENERATION/ GENERATING PLANT			

TABLE 1.1. (contd)

ERO Name	ERO Description	Passed initial screening (Y,N)	Comments
Examine opportunities for installation of generating plant.	Using natural gas boilers or turbines with a generator in conjunction with evaporative coolers can help meet electricity, steam, and cooling needs, while enabling the site to purchase electricity under a reduced rate structure, or reduce purchase from utility.	Y	Based on planning assumptions

2.0 ENERGY RESOURCE OPPORTUNITY EVALUATIONS

The results of the analyses of EROs are presented within 13 common energy end-use categories. A narrative description of each ERO is provided, including information on the initial cost, energy and dollar savings, impacts on O&M and, when applicable, a discussion of energy supply and demand, energy security, and environmental issues. Also provided is a brief description of the evaluation methodologies and technical and cost assumptions used in the analysis.

At the end of each section, a summary table presents the operational performance of energy end-use equipment before and after the implementation of each ERO. The summary tables also provide the results of the LCC analysis, including the NPV and SIR of each ERO.

Individual EROs were evaluated as mutually exclusive measures. This approach allows individual EROs to be ranked or rated based on parameters such as initial cost, NPV, energy savings, and change in O&M requirements. In addition, this evaluation approach permits direct economic comparison of competing EROs.

2.1 FAN AND PUMP MOTOR ERO

2.1.1 Replace Motors With High-Efficiency Models

Description

Energy-efficient three-phase motors are manufactured with predominately open drip-proof (ODP) and total enclosed fan-cooled (TEFC) enclosures. Motors up to 200 hp can be obtained in either 1200, 1800, or 3600 rpm. These motors are particularly attractive in duty-cycling applications because they suffer less thermal stress than standard-efficient motors because of lower losses overall. There are some applications however in which energy-efficient motors (EEMs) are not a good alternative, for example, in situations where high-starting torque is needed because EEMs are optimized for low-slip operation, which generally results in lower starting torque than standard efficiency motors. For most HVAC fan and pump applications, the starting torque is not

an issue. However, the starting characteristics should be kept in mind when preparing retrofit specifications for compressor motors, for example.

Assumptions

The technical assumptions used in the evaluation of this ERO are as follows:

- For the fan motors, the hours of operation are estimated at 7,500 h/yr.
- For the chilled-water pump motors, the annual operating hours are 7,057 (number of hours above 65°F, bin data, engineered weather data, U.S. Air Force [USAF]).
- Average efficiency improvement of high efficiency versus standard efficiency is 4.76% (averaged efficiency improvement of motors sized 2 hp to 50 hp) (WSEO 1992). See Table 2.1 for details.

TABLE 2.1. Motor Efficiency Reference Table

Motor Size, hp	Premium Eff.	Std. Eff.	Savings	Premium Cost	Std. Cost	Cost Diff.	Cost Diff/hp	Prem. Cost/hp	Labor Cost	Labor Cost/hp
50	95.0%	92.4%	2.96%	\$3,200	\$2,487	\$713	\$14.26	\$64.00	\$363	\$7.26
40	94.5%	91.7%	3.23%	\$2,574	\$1,932	\$642	\$16.05	\$64.35	\$363	\$9.08
30	94.1%	91.0%	3.62%	\$1,969	\$1,494	\$475	\$15.83	\$65.63	\$221	\$7.37
25	94.1%	91.0%	3.62%	\$1,558	\$1,346	\$312	\$12.48	\$66.32	\$221	\$8.84
20	93.4%	90.2%	3.80%	\$1,268	\$1,121	\$147	\$7.35	\$63.40	\$221	\$11.05
15	93.0%	88.5%	5.47%	\$1,042	\$887	\$155	\$10.33	\$69.47	\$221	\$14.73
10	91.7%	87.5%	5.23%	\$780	\$516	\$264	\$26.40	\$78.00	\$132	\$13.20
7	91.7%	87.5%	5.23%	\$647	\$540	\$107	\$14.27	\$86.27	\$132	\$17.60
5	90.2%	85.5%	6.09%	\$478	\$376	\$102	\$20.40	\$95.60	\$132	\$26.40
3	89.5%	84.0%	7.32%	\$415	\$280	\$135	\$45.00	\$138.33	\$132	\$44.00
2	86.6%	82.5%	5.74%	\$442	\$250	\$192	\$96.00	\$221.00	\$132	\$66.00
Averages:			4.76%				\$25.31	\$92.03	\$206.36	\$20.50

- Motor life expectancy is 15 years.
- Maintenance costs for standard- and high-efficiency motors are the same.
- An allocation of 1 hp of fan motors for every 820 ft² of floorspace in the facilities.
- Chilled-water pump motors were studied for the various areas shown in Table 2.1. An allocation of 1 hp of motor per 10 tons of cooling were used (based on data obtained from similar on-site inspections at Patrick AFB).

The various cost assumptions are as follows:

- The differential cost (delta) per horsepower of high efficiency versus standard efficiency was \$25.31/hp (averaged price differential of premium efficiency/standard efficiency for the 2 to 50 hp motor size range (WSEO 1992).
- Labor costs of \$20.50/hp, averaged labor per motor divided by motor size were included in the replace immediately (RI) analysis (Nadel et al. 1991).
- The cost differentials for various size motors are shown in Table 2.1, as well as the efficiency improvements by going to the premium efficient units.

Results

The quantitative results of this ERO appear in Tables 2.2 and 2.3. The RI option is the most cost-effective for fan motors, while the replace on failure (ROF) option is the most cost-effective for chilled-water pump motors.

Budget Implications. The total initial cost for motor EROs is as follows:

	<u>Replace Immediately</u>	<u>Replace on Failure</u>
Fan Motors	\$605,385	\$460,042
Chilled-Water Pump Motors	\$112,727	\$85,663

These calculations are made with the assumption that labor will be contracted out. If site personnel can perform the labor, significant savings will result.

Energy and Cost Savings. This ERO will save a total estimated 1,430,762 kWh/yr for the premium-efficient fan motors. At an average electricity cost of \$0.053/kWh, the savings will be \$75,830/yr. The chilled-water pump premium-efficient motors would result in approximately 251,017 kWh of savings for an annual total \$13,304.

Energy Security. This recommendation will have relatively little impact on energy security. If anything, it should help energy security because less kilowatt-hours are used when the motors are retrofitted.

Operations and Maintenance. The maintenance costs for premium-efficient motors were assumed to be the same as for standard motors; thus, they were not factored into this analysis.

Environmental Issues. This ERO has no adverse impact on the environment. Because some energy is saved, the net effect on the environment is positive (i.e., less electrical consumption, thus less generation).

TABLE 2.2. Fan Motor EROs

Existing Fan Motor Operating Parameters

Existing Motor Characteristics			Operating Schedule		Energy Consumption		Energy Demand	
Facility Type	Area (sq ft)	Total hp	Hours On-Peak	Hours Off-Peak	On-Peak (kWh)	Off-Peak (kWh)	No. Months On-Peak	Demand (kW-mo)
ADMIN	316,888	386	2,190	5,310	631,357	1,527,941	12	3,459
BRK/ADM	1,854	2	2,190	5,310	3,694	8,939	12	20
COMCATN	219,783	268	2,190	5,310	437,888	1,059,729	12	2,399
DET-RR	1,585	2	2,190	5,310	3,158	7,642	12	17
FUELDSP	2,399	3	2,190	5,310	4,780	11,567	12	26
HANGAR	40,519	49	2,190	5,310	80,729	195,371	12	442
LAB-MED	12,064	15	2,190	5,310	24,036	58,169	12	132
MTRPOOL	68,337	83	2,190	5,310	136,152	329,501	12	746
MWR	13,585	17	2,190	5,310	27,066	65,503	12	148
NASLEAS	732,416	893	2,190	5,310	1,459,241	3,531,496	12	7,996
NASOWN	745,470	909	2,190	5,310	1,485,249	3,594,438	12	8,138
OTHER	9,580	12	2,190	5,310	19,087	46,192	12	105
PLT-BLD	34,950	43	2,190	5,310	69,633	168,519	12	382
PLT-EQU	68,571	84	2,190	5,310	136,619	330,629	12	749
R&D	1,236,903	1,508	2,190	5,310	2,464,363	5,963,984	12	13,503
RESTRNT	16,443	20	2,190	5,310	32,760	79,283	12	180
SECURITY	37,542	46	2,190	5,310	74,797	181,017	12	410
SHOP	219,099	267	2,190	5,310	436,525	1,056,431	12	2,392
SHOP-ELEC	77,132	94	2,190	5,310	153,675	371,908	12	842
SHOP-WPN	5,150	6	2,190	5,310	10,261	24,832	12	56
STOR-UH	155,553	190	2,190	5,310	309,918	750,031	12	1,698
TRAING	5,548	7	2,190	5,310	11,054	26,751	12	61
WHS	389,801	475	2,190	5,310	776,626	1,879,506	12	4,255

Energy-Efficient Fan Motor Operating Parameters

Energy Efficient Motor Characteristics			Operating Schedule		Energy Consumption		Energy Demand	
Facility Type	Area (sq ft)	Total hp	Hours On-Peak	Hours Off-Peak	On-Peak (kWh)	Off-Peak (kWh)	No. Months On-Peak	Demand (kW-mo)
ADMIN	316,888	386	2,190	5,310	601,304	1,455,211	12	3,295
BRK/ADM	1,854	2	2,190	5,310	3,518	8,514	12	19
COMCATN	219,783	268	2,190	5,310	417,045	1,009,286	12	2,285
DET-RR	1,585	2	2,190	5,310	3,008	7,279	12	16
FUELDSP	2,399	3	2,190	5,310	4,552	11,017	12	25
HANGAR	40,519	49	2,190	5,310	76,886	186,071	12	421
LAB-MED	12,064	15	2,190	5,310	22,892	55,400	12	125
MTRPOOL	68,337	83	2,190	5,310	129,671	313,817	12	711
MWR	13,585	17	2,190	5,310	25,778	62,385	12	141
NASLEAS	732,416	893	2,190	5,310	1,389,781	3,363,396	12	7,615
NASOWN	745,470	909	2,190	5,310	1,414,551	3,423,343	12	7,751
OTHER	9,580	12	2,190	5,310	18,178	43,993	12	100
PLT-BLD	34,950	43	2,190	5,310	66,319	160,497	12	363
PLT-EQU	68,571	84	2,190	5,310	130,115	314,891	12	713
R&D	1,236,903	1,508	2,190	5,310	2,347,060	5,680,099	12	12,861
RESTRNT	16,443	20	2,190	5,310	31,201	75,509	12	171
SECURITY	37,542	46	2,190	5,310	71,237	172,400	12	390
SHOP	219,099	267	2,190	5,310	415,747	1,006,145	12	2,278
SHOP-ELEC	77,132	94	2,190	5,310	146,360	354,205	12	802
SHOP-WPN	5,150	6	2,190	5,310	9,772	23,650	12	54
STOR-UH	155,553	190	2,190	5,310	295,166	714,330	12	1,617
TRAING	5,548	7	2,190	5,310	10,527	25,477	12	58
WHS	389,801	475	2,190	5,310	739,659	1,790,042	12	4,053

TABLE 2.2. (contd)

Energy-Efficient Fan Motor ERO Economics

Facility Type	Economic Parameters				Energy and		Life Cycle Cost			
	First Cost RI (\$)	First Cost ROF (\$)	Life (years)	Time to Failure (years)	Demand Savings		RI		ROF	
					Energy (kWh)	Demand (kW-mo)	NPV (\$)	SIR	NPV (\$)	SIR
ADMIN	43,489	33,048	15	7	102,783	165	40,104	1.92	36,581	2.11
BRK/ADM	254	193	15	7	601	1	211	1.83	199	2.03
COMCATN	30,163	22,921	15	7	71,287	114	27,815	1.92	25,372	2.11
DET-RR	218	165	15	7	514	1	201	1.92	183	2.11
FUELDSP	329	250	15	7	778	1	304	1.92	277	2.11
HANGAR	5,561	4,226	15	7	13,142	21	5,128	1.92	4,677	2.11
LAB-MED	1,656	1,258	15	7	3,913	6	1,527	1.92	1,393	2.11
MTRPOOL	9,378	7,127	15	7	22,165	36	8,648	1.92	7,889	2.11
MWR	1,864	1,417	15	7	4,406	7	1,719	1.92	1,568	2.11
NASLEAS	100,516	76,384	15	7	237,559	381	92,690	1.92	84,550	2.11
NASOWN	102,307	77,745	15	7	241,793	387	94,343	1.92	86,057	2.11
OTHER	1,315	999	15	7	3,107	5	1,212	1.92	1,106	2.11
PLT-BLD	4,797	3,645	15	7	11,336	18	4,423	1.92	4,035	2.11
PLT-EQU	9,411	7,151	15	7	22,241	36	8,678	1.92	7,916	2.11
R&D	169,751	128,997	15	7	401,189	643	156,536	1.92	142,787	2.11
RESTRNT	2,257	1,715	15	7	5,333	9	2,081	1.92	1,898	2.11
SECURITY	5,152	3,915	15	7	12,177	20	4,751	1.92	4,334	2.11
SHOP	30,069	22,850	15	7	71,065	114	27,728	1.92	25,293	2.11
SHOP-ELEC	10,586	8,044	15	7	25,018	40	9,761	1.92	8,904	2.11
SHOP-WPN	707	537	15	7	1,670	3	652	1.92	595	2.11
STOR-UH	21,348	16,223	15	7	50,454	81	19,686	1.92	17,957	2.11
TRAINING	761	579	15	7	1,799	3	702	1.92	640	2.11
V/HS	53,496	40,652	15	7	126,432	203	49,331	1.92	44,998	2.11

TABLE 2.3. Chilled-Water Pump Motor EROs

Existing Chilled Water Pump Motor Operating Parameters

Existing Motors		Operating Schedule		Energy Consumption		Energy Demand	
Area Number	Total hp	Hours On-Peak	Hours Off-Peak	On-Peak (kWh)	Off-Peak (kWh)	No. Months On-Peak	Demand (kW-mo)
2	12	2,190	4,867	19,605	43,569	12	107
3	21	2,190	4,867	34,309	76,246	12	188
4	3	2,190	4,867	4,084	9,077	12	22
5	88	2,190	4,867	143,769	319,509	12	788
6	63	2,190	4,867	102,109	226,924	12	560
7	49	2,190	4,867	80,053	177,908	12	439
8	134	2,190	4,867	218,921	486,525	12	1,200
1W	137	2,190	4,867	223,006	495,602	12	1,222
3A	404	2,190	4,867	659,704	1,466,110	12	3,615
IN	92	2,190	4,867	150,958	335,484	12	827

Energy-Efficient Chilled Water Pump Motor Operating Parameters

Energy Efficient Motors		Operating Schedule		Energy Consumption		Energy Demand	
Area Number	Total hp	Hours On-Peak	Hours Off-Peak	On-Peak (kWh)	Off-Peak (kWh)	No. Months On-Peak	Demand (kW-mo)
2	12	2,190	4,867	18,672	41,495	12	107
3	21	2,190	4,867	32,675	72,617	12	188
4	3	2,190	4,867	3,890	8,645	12	22
5	88	2,190	4,867	136,926	304,300	12	788
6	63	2,190	4,867	97,248	216,122	12	560
7	49	2,190	4,867	76,243	169,440	12	439
8	134	2,190	4,867	208,501	463,366	12	1,200
1W	137	2,190	4,867	212,390	472,011	12	1,222
3A	404	2,190	4,867	628,302	1,396,323	12	3,615
IN	92	2,190	4,867	143,772	319,515	12	827

Energy-Efficient Chilled Water Pump Motor ERO Economics

Area Number	Economic Parameters				Energy and Demand Savings		Life Cycle Cost			
	First Cost		Life (years)	Time to Failure (years)	Energy (kWh)	Demand (kW-mo)	RI		ROF	
	RI (1993 \$)	ROF (1993 \$)					NPV (\$)	SIR	NPV (\$)	SIR
2	1,350	1,026	15	7	10.26	0.00	639	1.47	757	1.74
3	2,363	1,796	15	7	17.96	0.00	1,118	1.47	1,325	1.74
4	281	214	15	7	2.14	0.00	133	1.47	158	1.74
5	9,903	7,526	15	7	75.26	0.00	4,687	1.47	5,551	1.74
6	7,033	5,345	15	7	53.45	0.00	3,329	1.47	3,942	1.74
7	5,514	4,190	15	7	41.91	0.00	2,610	1.47	3,091	1.74
8	15,080	11,459	15	7	114.61	0.00	7,136	1.47	8,452	1.74
1W	15,361	11,673	15	7	116.74	0.00	7,270	1.47	8,610	1.74
3A	45,442	34,532	15	7	345.36	0.00	21,505	1.47	25,470	1.74
IN	10,398	7,902	15	7	79.03	0.00	4,921	1.47	5,828	1.74

2.2 AIR-CONDITIONING EROs

The air-conditioning (A/C) EROs at Cape Canaveral AFS are based on information gathered from the master heating, ventilating, and air-conditioning (HVAC) list. The master HVAC list contains information regarding all of the equipment dedicated to A/C and refrigeration at the site. The A/C equipment is grouped by size, type, and make with the corresponding equipment capacity. Also, information on each piece of equipment includes its facility number, identification (ID) number, the critical/noncritical state, and area of the base in which it is located. Equipment is listed individually, when multiple, identical items are found where the total capacity is entered. This aggregation of capacity by equipment type reduces the amount of data storage required but results in some loss of detail. For example, a building may have a 100 tons of total A/C equipment, which is equivalent to four pieces of equipment at 25 tons each. The master list does not indicate this repetition, therefore, the quantity and individual unit sizes cannot be determined. Another source of information exists on A/C equipment at Cape Canaveral AFS (PRAD Group 1992). However, there was inconsistency between the two data sources, so a decision was made to use the master HVAC list for this ERO. The data in the master HVAC list provided sufficient information for reasonable estimates of the installed A/C equipment baseline and the associated energy consumption.

The data was compiled corresponding to each unit's capacity, the equipment type, and the area of location. For example, in Area 3A, there are four, 30-ton chilled-water units. Breaking down the equipment in this manner allowed for the appropriate coefficient of performance (COP) and life expectancy to be applied to each unit (see assumption listed below).

The equipment's COP was based on the year of installation. The following figure shows COP as a function of the equipment's age. The COPs for the existing equipment at Cape Canaveral AFS were interpolated from this data. Figure 2.1 shows the COP for each equipment type corresponding to the age of the equipment.

Energy and demand savings are based on the difference in COP between new, high-efficiency replacement equipment and the existing equipment.

FIGURE 2.1. Coefficient of Performance as a Function of Equipment Age

2.2.1 Replace Air-Conditioning Equipment

Description

Almost every building at Cape Canaveral AFS has some type of A/C equipment. Energy and demand savings can be realized by replacing the existing A/C equipment with new high-efficiency equipment. In addition, USAF regulations require the elimination of CFC refrigerants in the future. New equipment is available with non-CFC refrigerants to meet these regulations with efficiencies comparable to the best CFC-based models (see the Environmental Issues portion of this section for further discussion).

Assumptions

Technical assumptions are as follows:

- Life expectancy of each unit type is broken into the following assumptions:

Equipment Type	Life Expectancy
Centrifugal (>200 ton)	20 years
Reciprocating (>20 ton)	15 years
Reciprocating (<20 ton)	10 years
Package Units (all sizes)	10 years
Heat Pumps (all sizes)	12 years

- The age of the A/C equipment is assumed to be half its life (i.e., a 200-ton centrifugal chiller was installed in 1983, is 10 years old, and will fail in 2003).
- Existing units have efficiencies based on equipment type and age as described above.
- New unit efficiencies are as follows (from research conducted as part of the Facility Energy Decision Screening [FEDS] Level 1 software development):

Equipment Type	COP
Small Centrifugal (200-500 ton)	5.86
Large Centrifugal (500-1200 ton)	5.17
Small Reciprocating (20-75 ton)	2.85
Large Reciprocating (75-200 ton)	3.63
Small Package (1-20 ton)	2.45

- The load profile of the existing chiller/refrigeration system is proportional to the distribution of the dry-bulb temperatures from the weather data. It is assumed the existing equipment has no night setback.
- The facilities have a balance temperature of 65°F. The balance temperature is the temperature above which cooling becomes necessary. Equipment operating hours are based on the number of hours (from local bin weather data) the outdoor temperature was above 65°F.
- The equipment operating hours for the new efficient chillers were calculated using both night setback and no night setback.

The cost assumptions are as follows:

- O&M costs are assumed to be \$57/ton (1993 dollars) from EPRI TAG -1986. Replacement equipment will have the same O&M requirements as the existing equipment.
- The first cost of replacing equipment for both the baseline and ERO case, including material and installation, were found in MEANS Mechanical 1992 (Means 1991b). For equipment capacities not listed in Means, an iteration between the closest tonnage determined the cost of the unit.

Results

Qualitative results of the ERO analysis appear in Table 2.4. The table contains specific energy, cost, and economic data for A/C equipment (summarized by type and tonnage range) considered for replacement.

Budget Implications. The estimated initial cost of replacing all the listed A/C equipment is \$11,181,053.

Energy and Cost Savings. It is estimated that implementation of this ERO will result in an annual energy savings of 17,694 MWh at a value of \$752,542. Annual demand savings will be 12,096 kW at a value of \$75,543. These estimates are based on 100% implementation of the ERO for a typical operating year.

Operations and Maintenance Impacts. The new equipment is assumed to require the same O&M as the existing equipment. Therefore, there is no change in the O&M budget because of this ERO.

Energy Security. The security of energy supply and distribution to Cape Canaveral AFS will not be affected by implementation of this ERO.

Environmental Issues. Chlorofluorocarbons (CFCs) are a dominant refrigerant in A/C and refrigeration systems. Chlorofluorocarbons have been associated with depletion of the ozone layer when released into the atmosphere. Simply, chlorine atoms destroy ozone molecules in a ratio of 10 chlorine atoms to deplete one million ozone molecules. As a result of the destructive property of CFC refrigerant, international production of CFCs is being phased out by 1996 under the Montreal Protocol. The USAF, recognizing this change in the industry, is therefore reducing their use of CFCs at Cape Canaveral AFS by converting to alternative refrigerants.

Cape Canaveral AFS is adhering to USAF regulations by phasing out A/C units that use CFCs. The site is planning to replace approximately 54 A/C units with high-efficiency models, converting to alternative refrigerants, mainly hydrochlorfluorocarbons (HCFCs) and hydrofluorocarbons (HFCs). Air-conditioning units using the refrigerants CFC-11 and CFC-113 will be replaced with HCFC-123. Also, models operating with high-pressure CFC-12 will be replaced with high-pressure HFC-134a. Cape Canaveral AFS is planning to convert 28.4% of total A/C tonnage. HCFC's have significantly less destructive effects on the ozone layer compared to CFCs because the molecule is less stable, thus breaking down in the lower atmosphere. (EPRI, CFCs and electric chillers) HFCs contain no chlorine; therefore, they have no effect on the depletion of ozone.

The following table shows the number of units and percentage of total A/C equipment planned for replacement from corresponding areas. The areas are defined in Basic Information Guide - Cape Canaveral (Johnson Controls 1991)

Area	No. of Units	Phaseout
1W	5	36%
3A	26	27.7%
4	1	5.3%
5	5	5.4%
6	1	5.1%
8	9	79%

It should be noted that these units are included in the ERO analysis contained in this report, where the base case considers all of the existing equipment and does not take into account the phaseout project.

Another environmental issue to consider when phasing out CFCs is loss of chiller efficiency with alternative refrigerants. If the replacement chillers at Cape Canaveral AFS are operated with CFC refrigerant, the efficiency increases from 0.9 kW/ton to 0.7 kW/ton. The corresponding annual energy

savings is 2,240 MWh and annual demand savings is 7,900 kW at a value of \$126,100/yr. However, there is approximately a 5% efficiency drop when converting from CFCs (0.70 kW/ton) to HCFCs (0.74 kW/ton). Therefore, the energy savings and demand decreases to 1,850 MWh/yr and 6,500 kW/yr, respectively, at a value of \$104,000/yr. The energy penalty associated with this conversion is a decrease of 17.5% a year in energy consumption and dollar savings as a result of switching to alternative refrigerants.

TABLE 2.4. Efficient Chiller EROs at Cape Canaveral AFS

Existing A/C characteristics and operating parameters with no set back

A/C Description	Equipment Characteristics			# of Units	Operating Schedule			Energy Consumption		Coincident Demand (kW-mo)
	Efficiency COP	Rating Ton Range	Total Tons		Total FLE Hours	Hours on-peak	Hours off-peak	on-peak (kWh)	off-peak (kWh)	
CW- Small Package	2.3	1 to 19	38	6	2,233	888	1,345	51,568	78,158	456
CW- Small Reciprocating	2.7	20 to 74	1,045	25	2,233	888	1,345	1,208,024	1,830,935	10,681
CW- Large Reciprocating	3.1	75 to 199	2,435	22	2,233	888	1,345	2,451,660	3,715,846	21,676
CW- Small Centrifugal	5.4	200 to 499	4,199	15	2,233	888	1,345	2,427,030	3,678,515	21,458
CW- Large Centrifugal	4.6	500 and up	2,300	3	2,233	888	1,345	1,560,605	2,365,323	13,798
DE- Small Package	2.3	1 to 19	3307	524	2,233	888	1,345	4487757	6801845	39678
DE- Small Reciprocating	2.7	20 to 74	2,820	97	2,233	888	1,345	3,121,210	4,730,645	27,596
DE- Large Reciprocating	3.1	75 to 126	766	8	2,233	888	1,345	771,241	1,168,927	6,819
Heat Pump	2.4	1 to 100	222	43	2,233	888	1,345	288,712	437,585	2,553

Proposed A/C characteristics and operating parameters with no set back

A/C Description	Equipment Characteristics			# of Units	Operating Schedule			Energy Consumption		Coincident Demand (kW-mo)
	Efficiency COP	Rating Ton Range	Total Tons		Total FLE Hours	Hours on-peak	Hours off-peak	on-peak (kWh)	off-peak (kWh)	
CW- Small Package	2.45	1 to 19	38	6	2,233	888	1,345	48,371	73,313	428
CW- Small Reciprocating	2.85	20 to 74	1,045	25	2,233	888	1,345	1,143,240	1,732,746	10,108
CW- Large Reciprocating	3.63	75 to 199	2,435	22	2,233	888	1,345	2,094,281	3,174,186	18,516
CW- Small Centrifugal	5.86	200 to 499	4,199	15	2,233	888	1,345	2,236,512	3,389,758	19,774
CW- Large Centrifugal	5.17	500 and up	2,300	3	2,233	888	1,345	1,388,546	2,104,542	12,277
DE- Small Package	2.45	1 to 19	3,307	524	2,233	888	1,345	4,209,560	6,380,197	37,218
DE- Small Reciprocating	2.85	20 to 74	2,820	97	2,233	888	1,345	3,085,108	4,675,927	27,277
DE- Large Reciprocating	3.63	75 to 126	766	8	2,233	888	1,345	658,817	998,532	5,825
Heat Pump	2.54	1 to 100	222	43	2,233	888	1,345	272,799	413,466	2,412

Proposed A/C characteristics and operating parameters with set back

A/C Description	Equipment Characteristics			# of Units	Operating Schedule			Energy Consumption		Coincident Demand (kW-mo)
	Efficiency COP	Rating Ton Range	Total Tons		Total FLE Hours	Hours on-peak	Hours off-peak	on-peak (kWh)	off-peak (kWh)	
CW- Small Package	2.45	1 to 19	38	6	1,397	568	829	30,965	45,184	428
CW- Small Reciprocating	2.85	20 to 74	1,045	25	1,397	568	829	731,854	1,067,920	10,108
CW- Large Reciprocating	3.63	75 to 199	2,435	22	1,397	568	829	1,340,670	1,956,303	18,516
CW- Small Centrifugal	5.86	200 to 499	4,199	15	1,397	568	829	1,431,720	2,089,164	19,774
CW- Large Centrifugal	5.17	500 and up	2,300	3	1,397	568	829	888,888	1,297,064	12,277
DE- Small Package	2.45	1 to 19	3307	524	1,397	568	829	2,694,781	3,932,221	37,218
DE- Small Reciprocating	2.85	20 to 74	2,820	97	1,397	568	829	1,974,955	2,881,851	27,277
DE- Large Reciprocating	3.63	75 to 126	766	8	1,397	568	829	421,747	615,412	5,825
Heat Pump	2.54	1 to 100	222	43	1,397	568	829	174,634	254,826	2,412

High Efficiency A/C ERO economics with set back

A/C Description	First Cost	Life (yr)	First Year Energy & Demand Savings					Life Cycle Cost	
	RI (1993 \$)		Energy (kWh)	Demand (kW-mo)	Energy (1993\$)	Demand (1993\$)	Total (1993\$)	NPV (1993\$)	SIR
CW- Small Package	55,900	10	53,577	28	1,901	58	1,959	-22,756	0.58
CW- Small Reciprocating	578,100	10	1,073,170	573	51,002	3,580	54,582	-78,655	0.86
CW- Large Reciprocating	1,336,633	15	3,038,548	3,160	129,628	19,748	149,376	26,633	1.02
CW- Small Centrifugal	1,877,150	20	2,584,661	1,684	109,447	10,528	119,975	-317,981	0.83
CW- Large Centrifugal	873,300	20	1,739,975	1,521	78,105	9,508	85,613	38,555	1.08
DE- Small Package	3,433,715	10	4,662,600	2,480	193,809	15,369	209,178	-1,107,535	0.66
DE- Small Reciprocating	2,300,255	10	3,344,021	319	134,704	9,455	144,159	-499,675	0.79
DE- Large Reciprocating	497,000	15	903,009	994	43,707	6,418	50,125	-48,347	0.90
Heat Pump	231,000	12	296,637	141	12,239	879	13,118	-71,343	0.67

2.2.2 Replace Window Air-Conditioning Units

Description

There are a total of 292 window A/C units in use at Cape Canaveral AFS. The window units have been categorized corresponding to the area of Cape Canaveral AFS in which they are located. Energy and demand savings can be realized by replacing the existing A/C equipment with new high-efficiency units.

Assumptions

- The life expectancy of each window unit is assumed to be 5 years.
- The age of the A/C equipment is assumed to be half its life; i.e., all units were installed in 1990 and will fail in 1995.
- Existing units have efficiencies based on equipment type and age as described above with a COP of 2.3.
- New-unit efficiencies are assumed to be a COP of 2.4 taken from FEDS Level 1 software development document (FEMP 1993a).
- The load profile of the existing window A/C units is proportional to the distribution of the dry-bulb temperatures from the weather data. It is assumed the existing equipment has no night setback.
- The facilities have a balance temperature of 65°F. Cooling becomes necessary above this temperature. Equipment operating hours are based on the number of hours (from local bin weather data) the outdoor temperature was above 65°F.
- The equipment operating hours for the new efficient units assumes that there is night setback; i.e., the units will be shut off during nonoccupied hours.

The cost assumptions are as follows:

- There is no change in O&M costs between the existing and proposed equipment.
- The first replacement cost for equipment, including material and installation, were found in MEANS Mechanical Cost Data (Means 1991b). For equipment capacity not listed in Means, an iteration between the closest tonnage determined the cost of the unit.

Results

Qualitative results of the ERO analysis appear in Table 2.5. The table contains specific energy, cost, and economic data for window A/C equipment considered for replacement.

Budget Implications. The estimated initial cost to replace all listed window A/C equipment is \$270,945.

Energy and Cost Savings. It is estimated that this ERO will result in an annual energy savings of 695,548 kWh at a value of \$25,435. Demand savings will be 254 kW at a value of \$1,590. These estimates are based on 100% implementation of the ERO for a typical operating year.

Operations and Maintenance Impacts. The new equipment is assumed to require the same O&M as the existing equipment. Therefore, there is no change in the O&M budget because of this ERO.

Energy Security. The security of energy supply and distribution to Cape Canaveral AFS will not be affected by implementation of this ERO.

Environmental Issues. As a result of the destructive property of the refrigerant, CFCs, international production of CFCs is being phased out by 1996 under the terms of the Montreal Protocol. The USAF is recognizing this change in the industry, therefore, reducing their use of CFCs on the base by converting to alternative refrigerants.

TABLE 2.5. Efficient Window Air Conditioner EROs at Cape Canaveral AFS

Existing Window Unit A/C characteristics and operating parameters

A/C Description	Equipment Characteristics			# of Units	Operating Schedule			Equiv months on-peak	Energy Consumption		Coincident Demand (kW-mo)
	Efficiency COP	Rating Ton Range	Total Tons		Total FLE Hours	Hours on-peak	Hours off-peak		on-peak (kWh)	off-peak (kWh)	
WU	2.3	1 to 3	509	292	2,233	888	1,345	9.7	690,737	1,046,912	6,107

Proposed WU A/C characteristics and operating parameters

A/C Description	Equipment Characteristics			# of Units	Operating Schedule			Equiv months on-peak	Energy Consumption		Coincident Demand (kW-mo)
	Efficiency COP	Rating Ton Range	Total Ton		Total FLE Hours	Hours on-peak	Hours off-peak		on-peak (kWh)	off-peak (kWh)	
WU	2.4	1 to 3	509	292	2,233	888	1,345	9.7	423,756	618,345	5,853

High Efficiency WU A/C ERO economics

A/C Description	First Cost RI (1993 \$)	Equip. Life (yr)	First Year Energy & Demand Savings					Life Cycle Cost	
			Energy (kWh)	Demand (kW-mo)	Energy (1993\$)	Demand (1993\$)	Total (1993\$)	NPV (\$)	SIR
WU	270,945	5	695,548	254	23,845	1,590	25,435	360,814	2.39

2.2.3 Install Thermal Energy Storage Systems

Cape Canaveral AFS purchases electrical services on a time-of-day rate basis. During the on-peak time, there is a charge per kilowatt-hour and a peak demand charge. During the off-peak time, there is a lower charge per kilowatt-hour and no peak demand charge. For this reason, it is less expensive to consume electrical energy during the off-peak period. Thermal energy storage (TES) systems allow cooling system energy to be stored for use during other time periods. In this type of system, the refrigeration equipment can produce ice or cold water for storage during the off-peak billing period. During the on-peak period, the refrigeration equipment can remain off while the ice or cold water supplies the cooling requirements of the facilities.

Description

This ERO examines the potential savings involved in ice storage only. Chilled-water storage systems require a storage tank that may create additional environmental issues concerning tank location. This does not mean that chilled-water systems are not appropriate for consideration. Each proposed system will need to be studied individually to determine the extent of any possible environmental concerns.

In general, TES systems are less efficient than standard chiller systems because they must produce colder water (typically 30°F to 32°F) than standard chiller systems (42°F to 44°F). However, ice-producing refrigeration equipment has several advantages compared to the existing chiller systems, which help overcome the efficiency losses. First, the cooling load on the TES refrigeration equipment can be optimized, running at full load until the storage system is at full capacity. Running the equipment at full load allows the equipment to operate at its best efficiency. Standard chillers operate at partial load a vast majority of the time (typically a 70% swing) because they are sized to serve the maximum potential cooling load for the building. Therefore, standard chillers operate at a reduced efficiency compared to that obtained for TES refrigeration equipment over a typical diurnal cycle. Second, operating the TES system at night when outside air temperatures are cooler results in lower condensing temperatures, which aids in operating the system at its maximum efficiency. Third, TES equipment operates when the cost of

energy is less expensive, which is its major advantage. Although overall energy consumption increases with TES, energy costs are almost always reduced compared to that for a standard chiller system.

Assumptions

There are numerous refrigeration systems at Cape Canaveral AFS having greater than 25-tons peak capacity that should be considered for TES systems. A list of the individual units was not provided; instead, information regarding different types, the number for each type, and total tonnage by types are listed in Table 2.6.

The technical assumptions are as follows:

- Present energy consumption is estimated with the same assumptions as Table 2.4 in Section 2.2.1 (efficient-chiller ERO). Present and proposed energy consumption is only for the compressor.
- Proposed energy consumption for the TES system assumes that the compressor only operates during the off-peak utility time period. Changes in energy consumption are because of the change in refrigeration equipment efficiency. The efficiency of the proposed refrigeration equipment is for high-efficiency ice TES.
- The net increase in equipment efficiency is 37.5% in kilowatts per ton, compared to a conventional high-efficiency chiller.
- The storage systems are superinsulated so heat gains are assumed to be negligible.
- Equipment capacity (tonnage) for the proposed refrigeration equipment is assumed to be 65% of the present equipment capacity. This equipment capacity has been estimated using a simplified BLAST analysis for ice TES systems, local weather data, and the off-peak utility time period.

The cost assumptions are as follows:

- Equipment and installation costs (in 1986 dollars) are estimated based on data published by the Electric Power Research Institute (EPRI 1988). These costs are \$500/ton for refrigeration equipment, \$35/ton-h for the storage systems (10-hour storage), and \$150/ton for accessory equipment.
- O&M costs are assumed to be \$78/ton for TES and \$58/ton for the existing equipment (1993 dollars) from EPRI TAG -1986. Replacement equipment will have the same O&M requirements as the existing equipment.

Results

The results of the analysis are identified in Table 2.6, which

summarizes the results by type of current chiller system at Cape Canaveral AFS. Proposed refrigeration equipment efficiencies are estimated based on best available information. Actual replacements should be based on the highest available efficiency using actual design and installation conditions. Specific equipment capacities should also be verified before completing an detailed engineering analysis.

Budget Implications. The estimated initial cost of replacing all evaluated A/C equipment with TES equipment is \$13,841,750.

Energy and Cost Savings. Thermal Energy Storage systems do not save energy, but actually increase energy consumption by 6,653 MW/yr. However, there is a reduction in energy cost by \$281,363/yr because TES eliminates demand charges.

Energy Security. This ERO should have minimal impact on energy security. However, equipment downtime because of failure or other events will not necessarily result in loss of cooling for the facility because of the storage system.

Operations and Maintenance. Thermal Energy Storage systems do have more O&M requirements than standard chiller systems where O&M costs are \$78/ton compared to \$58/ton for A/C equipment (EPRI TAG -1986). However, because of the reduction in tonnage associated with TES, the total O&M decreases by \$80,700. There are also some advantages with TES. Failure of the system does not mean loss of cooling, which provides a time buffer for the maintenance staff to respond to problems. Future increases in building heat load can usually be compensated for by increasing modular storage capacity rather than replacing the refrigeration equipment with a larger size. In addition, dehumidification can be more effective because of the lower temperatures involved.

Environmental Issues. The new refrigeration equipment should be specified with alternative refrigerants rather than with CFCs because of international phaseout of CFCs in 1996. HFCs are the long-term preference, although HCFCs are still allowable. HCFCs will be removed from service around the years 2020 to 2030.

TABLE 2.6. Thermal Energy Storage EROs at Cape Canaveral AFS

Existing A/C characteristics and operating parameters

A/C Description	Equipment Characteristics			# of Units	Operating Schedule			Equip months on-peak	Energy Consumption		Coincident Demand (kW-mo)
	Efficiency COP	Rating Ton Range	Total Tons		Total FLE Hours	Hours on-peak	Hours off-peak		on-peak (kWh)	off-peak (kWh)	
CW- Small Reciprocating	2.7	25 to 74	1,005	23	2,233	888	1,345	7.85	1,161,784	1,760,851	10,272
CW- Large Reciprocating	3.1	75 to 199	2,435	22	2,233	888	1,345	7.85	2,451,660	3,715,846	21,676
CW- Small Centrifugal	5.4	200 to 499	4,199	15	2,233	888	1,345	7.85	2,427,030	3,678,515	21,458
CW- Large Centrifugal	4.6	500 and up	2,300	3	2,233	888	1,345	7.85	1,560,805	2,365,323	13,798
DE- Small Reciprocating	2.7	20 to 74	2,700	91	2,233	888	1,345	7.85	2,312,007	3,504,182	27,596
DE- Large Reciprocating	3.1	75 to 126	766	8	2,233	888	1,345	7.85	771,241	1,168,927	6,819
Heat Pump	2.4	100	100	1	2,233	888	1,345	7.85	130,050	197,110	1,150

Proposed TES characteristics and operating parameters

A/C Description	Equipment Characteristics			# of Units	Operating Schedule			Equip months on-peak	Energy Consumption		Coincident Demand (kW-mo)
	Efficiency COP	Rating Ton Range	Total Ton		Total FLE Hours	Hours on-peak	Hours off-peak		on-peak (kWh)	off-peak (kWh)	
CW- Small Reciprocating	2.07	25 to 74	663	23	3,428	NA	3,428	NA	NA	3,803,113	NA
CW- Large Reciprocating	2.64	75 to 199	1,583	22	3,436	NA	3,436	NA	NA	7,244,142	NA
CW- Small Centrifugal	4.26	200 to 499	2,729	15	3,433	NA	3,433	NA	NA	7,736,120	NA
CW- Large Centrifugal	3.76	500 and up	1,495	3	3,435	NA	3,435	NA	NA	4,802,996	NA
DE- Small Reciprocating	2.07	20 to 74	1,755	91	2,538	NA	2,538	NA	NA	7,568,385	NA
DE- Large Reciprocating	2.64	75 to 126	498	8	3,436	NA	3,436	NA	NA	2,278,855	NA
Heat Pump	1.85	100	65	1	3,440	NA	3,440	NA	NA	425,051	NA

Thermal Energy Storage ERO economics

A/C Description	First Cost RI (1993 \$)	Life (yr)	Non-Energy O&M		First Year Energy & Demand Savings					Life Cycle Cost	
			Before (\$/yr)	After (\$/yr)	Energy (kWh)	Demand (kW-mo)	Energy (1993\$)	Demand (1993\$)	Total (1993\$)	NPV (\$)	SIR
CW- Small Reciprocating	1,355,250	15	57,285	50,934	-880,478	10,271	-40,089	64,194	24,105	-140,798	2.27
CW- Large Reciprocating	2,252,250	15	138,796	123,456	-1,076,636	21,676	-55,748	135,475	79,727	-665,263	1.82
CW- Small Centrifugal	3,801,850	20	239,343	212,889	-1,630,578	21,458	-76,039	134,113	58,074	-1,681,026	2.07
CW- Large Centrifugal	1,466,000	20	131,100	116,610	-877,068	13,798	-42,565	86,238	43,672	-1,287,355	2.25
DE- Small Reciprocating	4,270,500	15	163,900	136,890	-1,782,196	20,441	-79,778	127,756	47,978	-991,850	1.78
DE- Large Reciprocating	601,900	15	43,662	38,836	-338,667	6,819	-17,537	42,619	25,062	-530,288	2.45
Heat Pump	65,000	12	5,700	5,070	-97,890	1,150	-4,463	7,188	2,725	-121,527	3.46

2.2.4 Install Gas-Driven Chillers

In the future, natural gas may be available at Cape Canaveral AFS. If so, the possibility exists of converting some facilities at Cape Canaveral AFS to natural gas. The local distribution company (LDC) has stated it may consider bearing the cost of a branch natural-gas line to Cape Canaveral AFS if the facilities were converted to natural gas. The LDC is also open to negotiations considering the cost of natural gas. With this opportunity in mind, this section identifies the break-even cost for natural gas in conjunction with one alternative natural-gas technology that would become available at Cape Canaveral AFS.

The break-even cost for natural gas in this discussion is defined as the cost of natural gas required to achieve a 10-year simple payback. If natural gas can be delivered to the site at a cost less than, or equal to, the break even cost, then the ERO should be considered a worthwhile investment and a more detailed analysis, including life-cycle costing, should be performed. This section investigates the potential of using natural-gas-driven chillers. The use of natural-gas-driven engines for boilers and compressed natural-gas alternative fueled vehicles are considered in other sections.

Description

This ERO examines the possibility of utilizing gas engine-driven chillers in place of existing A/C equipment. Because A/C equipment can be distributed or centralized, equipment types vary significantly and conversion can be accomplished in several fashions. This ERO is more difficult to analyze than a natural-gas boiler ERO.

In a centralized A/C system, natural gas needs to be delivered to only one location within the facility. If the facility is serviced through several distributed A/C systems, gas will need to be piped to each location. This can significantly affect the implementation cost. The cost of converting an A/C system to a gas-driven engine can also vary significantly. In a simple refrigeration system driven by an external A/C motor, the motor can simply be replaced with a natural-gas-driven internal combustion engine. This option can be installed at a cost of approximately \$200/ton. Another, more difficult option may require replacing the entire A/C refrigeration system (prime mover

Breakeven Gas Cost Analysis Natural Gas Engine Driven Chillers

FIGURE 2.2. Break-Even Analysis for Natural-Gas Engine-Driven Chiller

and compressor) at a cost of about \$800 to \$1,300/ton. The worst case may involve replacing an entire roof top unit (RTU), or unitary system, at a cost of approximately \$2,600/ton (Armstrong and Conover 1993). In addition, these costs can vary significantly depending on the size of the system. Small systems are generally much more expensive (per horsepower) than larger systems. Compounding the analysis are the system efficiencies. Larger systems have higher efficiencies than smaller systems. A 10- to 15-ton natural-gas engine-driven chiller or refrigeration system is estimated to have a COP of 0.80 (Armstrong and Conover 1993). Systems in the 50- to 150-ton range are reported to have a COP around 1.20, and larger systems in the 200- to 1,000-ton range are reported to have a COP around 1.70.

Results

To account for all the potential variables, Figure 2.2 was developed illustrating the required break-even natural-gas cost given a specified equipment-installed cost and the noted 10-year payback. The calculations behind Figure 2.2 are the same assumptions made in the analysis of the

existing equipment from the previous chiller ERO section. There are two break-even lines identified in Figure 2.2. One line assumes a gas engine-driven system with a COP equal to 0.80 for smaller systems, and the other line assumes a COP equal to 1.70 for larger systems.

Energy and Cost Savings. As illustrated in Figure 2.2, the conversion to gas engine-driven chillers may be cost-effective on larger systems if the installed cost can be kept below \$600/ton. Although this is marginal, it does indicate that this opportunity merits further review. In a more detailed analysis, this opportunity would directly compete with the high efficiency electric chiller and thermal energy storage EROs.

Operations and Maintenance Impacts. In this analysis, the new equipment is assumed to require the same amount of O&M activities as the existing equipment, although gas engine-driven systems can be expected to have higher O&M costs.

Energy Security. The security of energy supply and distribution to Cape Canaveral AFS will not be affected by implementation of this ERO. This assumes, however, gas will be made available to the end-use source.

Environmental Issues. Implementation of this ERO will result in an increase in local emissions.

2.3 COMMERCIAL LIGHTING EROs

2.3.1 Replace Existing Lighting With Energy-Efficient Options

Description

Few if any of the existing lamps, ballasts, and light fixtures installed at Cape Canaveral AFS are as efficient as currently available. A number of fixture retrofits EROs are evaluated in this section. In many cases, energy can also be saved by installing occupancy sensors or making other control and wiring modifications that result in reduced hours of operation. In a few cases, the lighting levels can be reduced slightly.

Assumptions

The lighting analysis was based on grouping the various lighting configurations within the building classifications into four general

schedules. These lighting schedules were felt to capture the most common occurrences. The schedules are shown below.

- Schedule 1: 7 a.m. to 4 p.m., 251 d/yr (365 days - 104 weekend days - 10 holidays). This schedule represented such building categories as ADMIN, CLINIC, COMCATN, DGR, OTHER, R&D, TERMINL, and TRAING.
- Schedule 2: 6 a.m. to 10 p.m., 365 d/yr. This schedule represents such building categories as BRK/ADM, CLUB, DINING, REC, GROCERY, MTRPOOL, HANGAR, MWR, PLT-BLD, RESTRNT, SHOP, SHOP-AIR, SHOP-ELEC, and SHOP-WPN.
- Schedule 3: 10 a.m. to 2 p.m., 365 d/yr. This schedule represents such building categories as WHS, DET-RR, HUT, STOR-UH, and WHS-CLD.
- Schedule 4: 24 h/d, 365 d/yr. This schedule represents such building categories as HOSPITL, and SECURTY.
- Within each lighting schedule, utilization factors were used to map the estimated lighting counts with the energy-use intensity information provided by FPL.
- The Lighting Technology Screening Matrix (LTSM) computer program was used to determine first costs of fixture upgrades and retrofits that are feasible for a given type of existing fixture (FEMP 1993b).
- Operating hours for the various schedules are shown in Table 2.7.

TABLE 2.7. Operating Schedules

Operating Parameters	Sched. 1 (h/yr)	Sched. 2 (h/yr)	Sched. 3 (h/yr)	Sched. 4 (h/yr)
On-Peak Occ.	900	2,154	293	2,154
On-Peak Unocc.	1,255	0	1,862	0
Off-Peak Occ.	1,359	3,686	1,167	6,606
Off-Peak Unocc.	5,246	2,920	5,438	0

Results

Results of the ERO analysis are provided in Table 2.8 for Schedule 1 and 2 buildings, and Table 2.9 for Schedule 3 and 4 buildings. For each table, information is provided on existing lighting operating parameters, efficient lighting parameters, and the resulting economics from implementing the ERO.

Budget Implications. The total first cost of implementing the ERO for the Schedule 1, 2, 3, and 4 buildings was estimated to be \$241,501, \$3,219,488, \$1,512,340, and \$1,458,430, respectively. These totals include the installation and/or replacement of all necessary equipment and materials and associated labor.

Energy and Cost Savings. The amount of energy savings will be directly proportional to the number of operating hours during both peak and off-peak times. The estimated range of energy and demand savings ranges from 14,567,154 kWh (Schedule 2 buildings) to 445,347 kWh (Schedule 1 buildings). The demand savings ranges from 33,354 to 1,463 kW-mo for Schedule 2 and 1 buildings, respectively. The amount of energy savings ranges from \$494,592 to \$15,053, and the demand savings range from \$207,556 to \$9,141 for the same two building schedules.

Energy Security. This recommendation will have relatively little impact to energy security. If anything, it should help energy security because less kilowatt-hours will be used when the lights are retrofitted.

Operations and Maintenance. The O&M cost for this ERO is estimated to be \$15,651, \$145,662, \$65,474, and \$4,806 for the Schedule 1, 2, 3, and 4 buildings, respectively.

Environmental Issues. This ERO has no adverse impact on the environment. Because some energy would be saved, the net effect on the environment would be positive (because of less electrical consumption, thus less generation).

2.3.2 De-Lamp and Reduce Exterior Lights

Description

This analysis results from environmental restrictions that are unique to Cape Canaveral AFS. A series of draft lighting management plans have been developed for the various areas within the Cape Canaveral AFS. These plans provides site specific guidelines for the operation and reduction of lights that are known to adversely affect threatened and endangered sea turtle nesting activity on the Cape Canaveral AFS coastal beach. This action is

required by the U.S. Fish and Wildlife Service^(a) to reduce, to the maximum extent practicable, the incidental take of sea turtle hatchlings resulting from disorientation caused by direct and indirect lighting generated from various facilities on Cape Canaveral AFS.

Specific portions of these plans result in reduced energy consumption through a combination of activities, including switching to lower wattage lamps and eliminations of lights (delamping). This section attempts to quantify the electric energy savings due to exterior lighting modifications required by the environmental regulations.

Assumptions

The technical assumptions are as follows:

- All information on replacements and eliminations was obtained from the draft lighting management plans prepared for specific portions of Cape Canaveral AFS.
- Specific information on replacement lamps (i.e., lumen output and wattage) was not available in the plans, so the lumen output of the replacement lamps was matched with that of the existing lamps to choose the appropriate replacement wattage. All existing and replacement watt draw and lumen output were obtained from the Lighting Technology Screening Matrix (FEMP 1993b).
- Operating hours were not specifically given in the plans, therefore they were inferred from the written description of the areas operation characteristics.

Results

Qualitative results of the analysis appear in Table 2.10 and 2.11. The table contains specific energy savings data.

Energy and Cost Savings. It is estimated that an annual energy savings of 624,538 kWh at a total savings of \$20,640 will be achieved with replacement of lighting (see Table 2.10). It is estimated an annual energy savings of 152,037 kWh at a total savings of \$5,022 will be possible from lighting eliminations (see Table 2.11).

Environmental Issues. The draft lighting management plans for Cape Canaveral AFS were developed to assist in the effort to mitigate adverse

(a) U.S. Fish & Wildlife Service, letter dated December 19, 1989.

effects from area lighting on the endangered sea turtle population. Therefore, the environmental issues are the driver for reduced energy consumption.

TABLE 2.8. Commercial Lighting EROs for Schedule 1 and 2 Buildings

Schedule 1

Existing Lighting operating parameters

Fixture Code	Existing Fixtures			% Fixtures Used at Once	Energy Consumption		Sum of 12 Monthly Coincident Demand (kW-mo)	
	Fixture Type	Watts Each	No. of Units		on-peak (kWh)	off-peak (kWh)	Coincident Demand (kW-mo)	
							On-Peak	Off- Peak
1	FL 2X4 3-60 STD	232	661	1.0	130,565	429,140	1,640	#NA
2	FL 2X4 4-34 STD	158	3	1.0	448	1,455	6	#NA
3	HPS 150 PEND	188	174	1.0	27,858	91,541	393	#NA
4	INC 60 CEIL	60	2,332	1.0	119,329	392,058	398	#NA

Efficient Lighting operating parameters

Fixture Code	Replacement Fixtures			% Fixtures Used at Once	Energy Consumption		Sum of 12 Monthly Coincident Demand (kW-mo)	
	Fixture Type	Watts Each	No. of Units		on-peak (kWh)	off-peak (kWh)	On-Peak	Off- Peak
1	MH 175 PEND	210	661	1.0	118,211	388,446	1,666	#NA
2	FL 2X4 3F40T12 ELC3	105	3	1.0	298	987	4	#NA
3	LPS 90 PEND	135	174	1.0	20,004	65,734	282	#NA
4	CFL 13 + BLST UNIT	18	2,332	1.0	35,799	117,617	504	#NA

Efficient Lighting ERO economics

Fixture Code	Economic Parameters			First Year Energy and Demand Savings					Life Cycle Cost	
	First Cost (\$)	Existing O&M (\$/yr)	Retrofit O&M (\$/yr)	Energy (kWh)	Demand (kW-mo)	Energy (1992\$)	Demand (1992\$)	Total (1992\$)	NPV (\$)	SIR
1	108,582	7,668	3,569	53,078	175	1,796	1,091	2,887	1,390	1.01
2	233	10	5	638	2	22	12	34	373	2.60
3	45,096	637	1,070	33,660	111	1,139	692	1,831	-22,724	0.50
4	87,590	2,472	11,007	357,971	-105	12,113	7,346	19,459	176,163	3.15

Schedule 2

Existing Lighting operating parameters

Fixture Code	Existing Fixtures			% Fixtures Used at Once	Energy Consumption		Sum of 12 Monthly Coincident Demand (kW-mo)	
	Fixture Type	Watts Each	No. of Units		on-peak (kWh)	off-peak (kWh)	On-Peak	Off- Peak
1	FL 2X4 2-34 STD	79	5,336	1.0	643,908	1,678,588	5,059	#NA
2	FL 2X4 3-60 STD	233	257	1.0	83,593	206,144	715	#NA
3	FL 2X4 4-34 STD	158	17,786	1.0	4,124,908	10,489,361	33,722	#NA
4	INC 60 CEIL	60	40,896	1.0	3,642,151	9,327,633	29,447	#NA

Efficient Lighting operating parameters

Fixture Code	Replacement Fixtures			% Fixtures Used at Once	Energy Consumption		Sum of 12 Monthly Coincident Demand (kW-mo)	
	Fixture Type	Watts Each	No. of Units		on-peak (kWh)	off-peak (kWh)	On-Peak	Off-Peak
1	FL 2X4 2F40T12ES ELC2	60	5,336	1.0	489,044	1,274,877	3,842	#NA
2	MH 175 PEND	210	257	1.0	75,666	186,596	648	#NA
3	FL 2X4 3F40T12 ELC3	105	17,786	1.0	2,741,236	6,970,778	18,039	#NA
4	CFL 13 + BLST UNIT	18	40,898	1.0	1,092,645	2,798,290	8,834	#NA

Efficient Lighting ERO economics

Fixture Code	Economic Parameters			First Year Energy and Demand Savings					Life Cycle Cost	
	First Cost (\$)	Existing O&M (\$/yr)	Retrofit O&M (\$/yr)	Energy (kWh)	Demand (kW-mo)	Energy (1992\$)	Demand (1992\$)	Total (1992\$)	NPV (\$)	SIR
1	259,703	12,860	9,658	558,575	1,217	18,958	7,604	26,562	213,423	1.82
2	42,217	2,981	1,388	27,475	68	933	424	1,358	14,256	1.34
3	1,381,439	59,761	32,371	4,902,255	15,683	160,461	70,699	237,160	2,813,002	3.15

TABLE 2.9. Commercial Lighting EROs for Schedule 3 and 4 Buildings

Schedule 3

Existing Lighting operating parameters

Fixture Code	Existing Fixtures			% Fixtures Used at Once	Energy Consumption		Sum of 12 Monthly Coincident Demand (kW-mo)	
	Fixture Type	Watts Each	No. of Units		on-peak (kWh)	off-peak (kWh)	On-Peak	Off-Peak
1	FL 2X4 2-34 STD	79	31	0.9	2,110	3,611	12	#NA
2	FL 2X4 3-80 STD	232	4,316	0.9	1,908,261	5,068,119	10,631	#NA
3	FL 2X4 4-34 STD	158	38	0.9	12,933	28,514	72	#NA
4	FL 2X4 4-40 STD	186	542	0.9	228,824	620,843	1,275	#NA
5	HPS 150 PEND	188	790	0.9	319,912	971,132	1,782	#NA
6	INC 60 CEIL	60	13,705	0.9	1,621,303	4,480,808	9,032	#NA

Efficient Lighting operating parameters

Fixture Code	Replacement Fixtures			% Fixtures Used at Once	Energy Consumption		Sum of 12 Monthly Coincident Demand (kW-mo)	
	Fixture Type	Watts Each	No. of Units		on-peak (kWh)	off-peak (kWh)	On-Peak	Off-Peak
1	FL 2X4 2F40T12ES ELC2	60	31	0.9	1,603	2,742	9	#NA
2	MH 175 PEND	210	4,316	0.9	1,727,306	4,585,711	9,623	#NA
3	FL 2X4 3F40T12 ELC3	105	38	0.9	8,594	17,620	48	#NA
4	FL 2X4 3F32T8 ELC3 REF	88	542	0.9	102,737	278,746	572	#NA
5	LPS 90 PEND	135	790	0.9	229,724	697,355	1,280	#NA
6	CFL 13 + BLST UNIT	18	13,705	0.9	486,628	1,344,648	2,711	#NA

Efficient Lighting ERO economics

Fixture Code	Economic Parameters			First Year Energy and Demand Savings				Life Cycle Cost		
	First Cost (\$)	Existing O&M (\$/yr)	Retrofit O&M (\$/yr)	Energy (kWh)	Demand (kW-mo)	Energy (1992\$)	Demand (1992\$)	Total (1992\$)	NPV (\$)	SIR
1	1,509	75	56	1,376	3	47	18	65	(177)	0.88
2	708,989	50,066	23,306	661,364	1,008	22,439	6,301	28,740	621,172	2.37
3	2,951	128	69	13,232	24	451	151	602	7,492	3.54
4	79,387	4,195	2,921	468,183	702	15,876	4,390	20,266	244,778	4.36
5	204,744	2,891	4,859	363,995	502	12,319	3,140	15,459	(84,363)	0.69
6	514,760	14,527	34,263	4,270,635	6,321	144,793	39,508	184,302	1,750,605	4.00

Schedule 4

Existing Lighting operating parameters

Fixture Code	Existing Fixtures			% Fixtures Used at Once	Energy Consumption		Sum of 12 Monthly Coincident Demand (kW-mo)	
	Fixture Type	Watts Each	No. of Units		on-peak (kWh)	off-peak (kWh)	On-Peak	Off-Peak
1	FL 2X4 4-34 STD	158	652	1.0	221,696	680,524	1,236	#NA
2	INC 60 CEIL	60	1,219	1.0	157,544	483,163	878	#NA
3	INC 2-20 W (exit)	40	9,180	1.0	804,168	2,412,504	4,406	#NA

Efficient Lighting operating parameters

Fixture Code	Replacement Fixtures			% Fixtures Used at Once	Energy Consumption		Sum of 12 Monthly Coincident Demand (kW-mo)	
	Fixture Type	Watts Each	No. of Units		on-peak (kWh)	off-peak (kWh)	On-Peak	Off-Peak
1	FL 2X4 3F32T8 ELC3 REF	88	652	1.0	123,588	379,026	689	#NA
2	CFL 13 + BLST UNIT	18	1,219	1.0	47,283	144,949	263	#NA
3	EXIT - LED	5	9,180	1.0	100,521	301,563	551	#NA

Efficient Lighting ERO economics

Fixture Code	Economic Parameters			First Year Energy and Demand Savings				Life Cycle Cost		
	First Cost (\$)	Existing O&M (\$/yr)	Retrofit O&M (\$/yr)	Energy (kWh)	Demand (kW-mo)	Energy (1992\$)	Demand (1992\$)	Total (1992\$)	NPV (\$)	SIR
1	95,498	3,795	3,514	399,806	548	13,529	3,423	16,952	176,982	2.85
2	45,786	2,499	1,292	448,494	814	15,177	3,840	19,017	184,770	5.04
3	1,317,146	73,899	0	2,814,588	3,856	95,281	24,098	119,378	1,738,921	2.32

TABLE 2.10. Exterior Lighting Replacement Savings

Exterior Lighting Replacement Energy Savings

Existing Characteristics		Replacement Characteristics		Quantity	First Year Savings	
Fixture	Watts Draw	Fixture	Watts Draw		Energy (kWh/yr)	Cost (\$/yr)
High Pressure Sodium	54	Low Pressure Sodium	30	3	263	9
High Pressure Sodium	130	Low Pressure Sodium	65	20	4,745	157
High Pressure Sodium	188	Low Pressure Sodium	135	4	774	26
High Pressure Sodium	200	Low Pressure Sodium	173	48	11,738	388
High Pressure Sodium	305	Low Pressure Sodium	173	77	26,280	869
High Pressure Sodium	365	Low Pressure Sodium	173	17	11,914	394
High Pressure Sodium	465	Low Pressure Sodium	225	182	156,980	5,188
Incandescent	75	Incandescent-Bug	75	50	0	0
Incandescent	100	Incandescent-Bug	75	110	8,726	288
Incandescent	100	Low Pressure Sodium	30	7	123	4
Incandescent	150	Incandescent-Bug	75	177	34,009	1,124
Incandescent	150	High Pressure Sodium	54	56	7,056	233
Incandescent	150	Low Pressure Sodium	30	33	12,822	424
Incandescent	200	Incandescent-Bug	75	24	8,825	292
Incandescent	200	High Pressure Sodium	79	2	1,971	65
Incandescent	250	Incandescent-Bug	75	1	639	21
Incandescent	250	Low Pressure Sodium	65	51	34,438	1,138
Incandescent	300	Incandescent-Bug	75	6	4,928	163
Incandescent	300	Low Pressure Sodium	65	19	13,900	459
Incandescent	500	High Pressure Sodium	130	20	27,010	893
Incandescent	500	Low Pressure Sodium	82	16	20,273	670
Incandescent	1,000	Low Pressure Sodium	173	3	9,056	299
Incandescent	1,500	Low Pressure Sodium	225	2	9,308	308
Metal Halide	460	High Pressure Sodium	365	28	665	22
Metal Halide	460	Low Pressure Sodium	225	46	2,702	89
Mercury Vapor	460	High Pressure Sodium	240	4	968	32
Mercury Vapor	460	Low Pressure Sodium	173	96	63,484	2,098
Mercury Vapor	1,080	High Pressure Sodium	465	7	15,713	519
Mercury Vapor	1,080	Low Pressure Sodium	225	34	106,105	3,506
MV/MH	460	High Pressure Sodium	365	10	3,468	115
MV/MH	460	Low Pressure Sodium	225	3	2,573	85
Quartz	200	Low Pressure Sodium	65	1	493	16
Quartz	250	Low Pressure Sodium	65	3	2,026	67
Quartz	500	High Pressure Sodium	188	2	2,277	75
Quartz	500	Low Pressure Sodium	135	13	18,286	604
TOTALS:					624,538	20,640

TABLE 2.11. Exterior Lighting Elimination Savings**Exterior Lighting Elimination Energy Savings**

Existing Characteristics		Quantity	First Year Savings	
Fixture	Watts Draw		Energy (kWh/yr)	Cost (\$/yr)
High Pressure Sodium	105	3	1,150	38
High Pressure Sodium	305	4	4,453	147
High Pressure Sodium	465	7	5,552	183
Incandescent	70	1	18	1
Incandescent	100	13	3,725	123
Incandescent	150	80	42,270	1,397
Incandescent	200	3	150	5
Incandescent	250	13	11,862	392
Incandescent	300	48	47,310	1,563
Incandescent	500	5	7,425	245
Incandescent	1,000	2	500	17
Mercury Vapor	460	31	6,693	221
Mercury Vapor	1,080	1	3,942	130
MV/MH	460	3	5,037	166
Quartz	250	2	1,825	60
Quartz	500	13	10,125	334
TOTALS:			152,037	5,022

Photocell Elimination Energy Savings

Existing Characteristics		Quantity	First Year Savings	
Fixture	Watts Draw		Energy (kWh/yr)	Cost (\$/yr)
High Pressure Sodium	55	17	3,078	102
Low Pressure Sodium	135	17	7,551	250
Incandescent	75	15	3,701	122
Incandescent	300	23	22,701	750
Quartz	200	5	3,290	109
TOTALS:			40,321	1,333

2.4 EXTERIOR LIGHTING CONTROLS

2.4.1 Replace Existing Photocells With Manual-Switch Applications

Description

Another portion of the lighting management plans for Cape Canaveral AFS is to replace existing photocells with manual-switch applications. Replacing photocells will reduce unnecessary lighting affecting federally protected sea turtle hatchlings on the Cape Canaveral AFS coastal areas.

This section describes the energy savings possible through the replacement of photocells with manual switches. The switches would be activated by designated personnel in conjunction with specific launch operations.

Assumptions

The technical assumptions are as follows:

- All information on the removal of photocells was obtained from the various draft lighting management plans for Cape Canaveral AFS.
- Operating hours were not specifically given in the light management plans; therefore, they were inferred from the written description of the area's operation characteristics.

Results

Qualitative results of the analysis appear in Table 2.11, which contains specific energy savings data.

Energy and Cost Savings. It is estimated that an annual energy savings of 40,321 kWh at a cost savings of \$1,333 will result from replacement of photocells.

Environmental Issues. Implementation of this ERO will assist in the mandated requirement to decrease the adverse effects from area lighting on the endangered sea turtle population. The energy savings resulting from this activity is not the primary reason for its implementation.

2.5 TRANSMISSION AND DISTRIBUTION EROs

Even with efficiencies near 95%, distribution transformers are the largest component of the transmission and distribution (T&D) system energy consumption. Thus, the reduction of transformer loss is the primary ERO in this section. A secondary ERO, conservation voltage reduction (CVR), is also discussed.

2.5.1 Install Energy-Efficient Transformers

Transformer losses can be reduced by replacing existing units with low-loss transformers. Low-loss transformers use improved magnetic circuit materials and design to reduce stand-by (no-load) losses and improved winding design to reduce losses that are primarily a function of load current. Analysis at other sites, including Ft. Drum (Dixon et al. 1992), Griffis AFB (Dixon et al. 1993), and Vandenberg AFB (Daellenbach et al. 1993), indicates that it may be cost-effective, in certain cases as a conservation measure alone, to replace transformers with properly sized low-loss transformer when replacing a failed transformer.

Description

Normally, replacement of all 5 kVA and larger distribution transformers by low-loss transformers should be considered. Since information was not readily available for Cape Canaveral AFS regarding the specifics of each transformer, a detailed analysis was not performed. Given Cape Canaveral's relatively reasonable cost of electricity, it is difficult to ascertain whether it is feasible to replace any transformer with an amorphous core unit. Specific pricing information from vendors would be needed to provide accurate results. Therefore, it is recommended that a detailed analysis with accurate pricing information on the transformer, along with labor estimates be conducted before opting to retrofit any transformer.

The methodology used at the above mentioned sites, Griffis AFB (Dixon et al. 1993) in particular, is generally assumed to be equally valid at Cape Canaveral. Therefore, this analysis method is used to illustrate the findings of transformer retrofit options in general.

Amorphous core transformer no-load loss is approximately 30% of a

conventional unit, with an estimated cost 1.4 times that of a conventional unit (Brooks et al. 1986). Because amorphous cores are not available for large transformers, this option is only available for sizes of 1000 KVA or smaller. Improved silicon steel transformers have approximately 75% of a conventional unit's no-load loss, and have an estimated capital cost of 1.2 times the present cost of a conventional distribution transformer (Brooks et al. 1986). For both of the above technologies, it is assumed that the load loss can be reduced by 20% with a 10% increase in the capital cost as compared to a conventional transformer, which is based on calculations in Westinghouse Electric Corporation technical data (1981).

Data and Assumptions

The general technical assumptions used in previous analyses are as follows:

- Load is distributed equally according to transformer size. This assumption is used to estimate average and peak load for each transformer.
- Each transformer is assumed to have a peak load of 75% of the nameplate capacity, and an average power factor of 0.85.

Previous cost estimates are based on the following:

- Transformer costs are based on Means data (Means 1991b) for dry transformers and a correction factor based on Means data for large oil-filled and dry transformers is included where appropriate. The Means data is used to create scaling relationships between transformer size and cost. The old transformer removed has some salvage value, albeit mainly as scrap material for transformers which are near the end-of-life. However, the Means labor cost estimate is only to install new transformers, not remove the old one. This analysis assumes that these antithetical costs and values are approximately equal and consequently ignored (any salvage value will be absorbed by the demolition labor cost).

Results

The results of typical transformer ERO analyses at other sites indicate that it is sometimes cost-effective to retrofit old transformers with amorphous core or improved silicon steel units upon failure of the old model. However, at Cape Canaveral, given the cost of electricity, the results are more questionable. An analysis with more accurate information would need to be made on a case by case basis to determine feasibility. The analysis needs

to include specific information on such items as size, primary and secondary voltages, number of phases, location, and price of the replacement equipment (amorphous core or improved silicon steel).

2.5.2 Install Conservation Voltage Reduction

Conservation voltage reduction regulates feeder voltage so the load farthest from the substation is maintained at the minimum acceptable voltage under all load conditions on the circuit. Installing CVR can reduce feeder voltage by several percent without reducing performance in end-use loads. Conservation voltage reduction used as a load management or demand-side management measure has shown that energy consumption is reduced by approximately 0.7% for each 1% reduction in voltage (Secrest et al. 1991).

The National Electric Code specifies the service voltage must remain within 5% of the nominal rating at all times (Early et al. 1989). For distribution feeders, the voltage drop is a function of loads and voltage taps at substations. These are set to provide minimum voltage at the end of the feeder during full-load conditions. Throughout most of the loading cycle, however, the voltage for much of the feeder is higher than the minimum allowable voltage because the voltage drop on the feeder is usually less than it is during full load.

A study performed by PNL for the Bonneville Power Administration in the Pacific Northwest indicated substantial cost-effective conservation potential using CVR at energy cost lower than \$0.05/kWh (De Steese et al. 1987). The best opportunities for CVR are dense energy-use areas with feeders 3 to 12 miles long. This situation occurs for several launch complexes at Cape Canaveral AFS. However, the largest areas of energy use at Cape Canaveral AFS, the industrial area and ROCC, Delta launch complex, and Port Canaveral area are close to the North and South substations, respectively. This would reduce the potential savings from implementing this ERO. The Idaho National Engineering Laboratory is conducting studies regarding the reliability of the current T&D system at Cape Canaveral AFS and should be consulted if implementation of this secondary ERO is envisioned.

2.6 BOILER EROs

This ERO analysis primarily considers replacing existing fuel oil-fired boilers with high efficiency fuel oil-fired boilers and fuel switching by replacing electric boilers with fuel oil boilers.

Because natural gas is not currently available at the Cape Canaveral AFS. However, there are on-going negotiations to bring natural gas onto the site. For this reason, natural-gas fired boilers was another option considered in this ERO analysis.

2.6.1 Replace Fuel Oil Boilers With High-Efficiency Fuel Oil Boilers

Description

There are several boilers at the station in a variety of mostly smaller sizes. This ERO considers replacing the existing fuel oil-fired boilers with high-efficiency fuel oil-fired boilers.

Assumptions

Table 2.12 identifies the major stationary boilers at the station, portable boilers are not included. Because the fuel oil boilers are not individually metered for fuel consumption, boiler fuel consumption is prorated based on the boiler output capacity.

TABLE 2.12. Cape Canaveral Boilers

Fac No.	Fac Name	Capacity (kBtu/h)	Make	Type	Agency	Status
44608	MNT PNT SHOP	84.0	BARD	HW ^(a)	USAF	N/C ^(b)
44603	PNT EQP STOR	84.0	CARR	HW	USAF	N/C
00320C	CX 46	90.0	ATLAN	HW	NAVY	N/C
44608	MNT PNT SHOP	112.0	SEARS	HW	USAF	N/C
87210	MK VI CK BLD	125.0	BURHM	HW	USAF	CRIT ^(c)
72665	MISS STR MAG	127.0	SN/RV	HW	USAF	CRIT
72680	MISS STR MAG	127.0	SN/RV	HW	USAF	N/C
50801	RCT STOR BLD	129.0	CRANE	HW	USAF	CRIT
60501	MACH SHP	150.0	INTL	HW	USAF	N/C
60501	MACH SHP	150.0	INTL	HW	USAF	N/C
01625	COM STOR BLD	178.0	KEWAN	HW	USAF	N/C
50803	RCT CKOT BLD	189.0	STEEL	HW	USAF	CRIT
67901	CTL BD SP TS	203.0	REIM	HW	USAF	CRIT
80505	MISS RSH BLD	212.0	SMITH	HW	USAF	CRIT
01428	NRC BLDG	219.0	PACIF	HW	USAF	N/C
01386	TIM-FIRE SHP	227.0	FEDER	HW	USAF	N/C
75251	MISS INSP ST	250.0	NW/YK	HW	USAF	N/C
78150	S/W CABLE BD	250.0	ATLAN	HW	USAF	CRIT
49639	CTL COMP COM	252.0	MD/EO	HW	USAF	CRIT
44625	GEN SHOP	252.0	WEIL	HW	USAF	N/C
47100R	CX 40	285.0	ALDRI	HW	USAF	CRIT
29100R	CX 41	285.0	NWYKR	HW	USAF	CRIT
40431	GET AWAY SPL	292.0	WEIL	HW	NASA	CRIT
81585	COMM CTL FAC	312.0	USNAT	HW	USAF	CRIT
77375	PROP INSP BD	350.0	SMITH	HW	USAF	N/C
70510	ITL WRHSE	351.0	ALDRI	HW	USAF	N/C
56921	CX 30 BLKHSE	400.0	ATLAN	HW	USAF	N/C
67900	DELTA SPN BD	420.0	WEIL	HW	USAF	CRIT
55840	GPS PROP FAC	423.0	SMITH	HW	USAF	CRIT
72650	MISS STR MAG	424.0	BURHM	HW	USAF	CRIT
55005	M ANNEX	480.0	SMITH	HW	NASA	CRIT
01385	MISSION CONT	486.0	USNAT	HW	NASA	N/C
49639	CTL COMP COM	500.0	WEIL	HW	USAF	CRIT
01726	SCAPE SUIT	500.0	SMITH	HW	NASA	CRIT
34706	TGSF	565.2	COLUM	HW	USAF	CRIT
70000	SMAB EAST	588.0	ALDRI	HW	USAF	CRIT
01619	JAN SER BLDG	598.0	SMITH	HW	USAF	CRIT
01385	MISSION CONT	648.0	KEWAN	HW	NASA	N/C
01724	PSL	694.0	SMITH	HW	USAF	CRIT
01635	RIGGING SHOP	702.0	ATLAN	HW	USAF	N/C
62640	EQ MNT BLDG	750.0	KEWAN	HW	NAVY	N/C
01728	HANGAR N	750.0	YKSHE	HW	NASA	CRIT
56920E	TRDT TST FAC	750.0	KEWAN	HW	NAVY	CRIT

TABLE 2.12. (Contd)

Fac No.	Fac Name	Capacity (kBtu/h)	Make	Type	Agency	Status
55815	M/ASMB BD-AD	835.0	PACIF	HW	USAF	N/C
70500	VIB EAST	837.0	YORK	HW	USAF	CRIT
01726	HANGAR S	900.0	SMITH	HW	NASA	CRIT
70500	VIB WEST	1,005.0	YORK	HW	USAF	CRIT
62980	MIS CK BD-AK	1,074.0	KEWAN	HW	NAVY	CRIT
44410	PHOTO OPS BD	1,120.0	CARR	HW	USAF	N/C
70000	SMAB WEST	1,200.0	THERM	HW	USAF	CRIT
70000	SMAB WEST	1,200.0	THERM	HW	USAF	CRIT
01605	RCDS STR BLD	1,250.0	CL/BK	HW	USAF	N/C
01648	RCC MECH BLD	1,300.0	THERM	HW	USAF	CRIT
60530	HANGAR AO-AM	1,301.0	SMITH	HW	NASA	CRIT
60530	HANGAR AO-AM	1,301.0	SMITH	HW	NASA	CRIT
60680	HANGAR AE	1,613.0	YKSHE	HW	NASA	CRIT
66250	HANGAR AF	1,673.0	WEIL	HW	NASA	N/C
55810	M/ASMB BD-AC	1,800.0	KEWAN	HW	USAF	CRIT
66257	HANGAR S	2,209.0	SMITH	HW	USAF	CRIT
01732	HANGAR L	127.0	YKSHE	ST ^(d)	NASA	CRIT
01732	HANGAR L	153.0	SIMON	ST	NASA	CRIT
01748	CAFE #2	204.0	HURST	ST	USAF	N/C
01748	CAFE #2	204.0	HURST	ST	USAF	N/C
01348	HANGAR C	216.0	PACIF	ST	USAF	N/C
01604	HANGAR H	36.0	CAM	E-HW ^(e)	USAF	CRIT
90302	DASO HDQ	282.6	CRMLX	E-HW	NAVY	N/C
01115	HANGAR-Y	282.6	CRMLX	E-HW	NAVY	N/C
54446	PROP LAB ESF	500.0		E-HW	NASA	CRIT
54445	S&A LAB	660.0	COLUM	E-HW	NASA	CRIT
01711	HANGAR I	819.0	HSI	E-HW	USAF	N/C
01708	HANGAR R&D	921.0	HYDRD	E-HW	USAF	N/C
29100	CX 41 AC SHR	2,252.6	FULTN	E-HW	USAF	CRIT
29100	CX 41 AC SHR	2,252.6	FULTN	E-HW	USAF	CRIT
29100	CX 41 AC SHR	2,275.0	FULTN	E-ST ^(f)	USAF	CRIT
29100	CX 41 AC SHR	2,275.0	FULTN	E-ST	USAF	CRIT

-
- (a) Hot Water
 - (b) Noncritical Activity
 - (c) Critical Activity
 - (d) Steam
 - (e) Electric - Hot Water
 - (f) Electric - Steam

The technical assumption are as follows:

- The boiler fuel consumption is 917,406 gal/yr or 127,336 MBtu/yr.
- The fuel oil energy content is 138,800 Btu/gal.
- The average boiler is 15 years old.
- The existing fuel oil-fired boilers are operating at 77% average efficiency.
- New high-efficiency fuel oil-fired boilers are available with an average 82% efficiency.
- Portable boilers are not considered in this analysis.

The cost assumptions are as follows:

- Fuel oil cost during 1992 is \$1.03/gal.
- O&M costs for fuel oil boilers are \$75/kBtuh-yr.
- Boiler costs, including installation for existing and high efficiency units, were derived from 1992 MEANS Mechanical Cost Data (Means 1991b).

Results

The results of the analysis for this ERO are provided in Table 2.13. The analysis separates boilers under the control of USAF, NASA, and the Navy. It also separates steam boilers and hot water boilers. Option 10, however, combines all boilers.

Budget Implications. Replacement options include RI and ROF. Replacing all fuel oil-fired boilers with high-efficiency fuel oil-fired boilers is estimated to cost \$595,075.

Energy and Cost Savings. Energy savings for replacing all fuel oil boilers is estimated to be 7,764 MBtu/yr with a cost savings of \$57,617/yr.

Energy Security. This ERO will have no impact on energy security.

Operations and Maintenance. O&M issues for the proposed high efficiency boilers are the same as for standard boilers, therefore there are no additional O&M costs. Combustion tests should be performed periodically to insure complete combustion without high amounts of excess air. Heat transfer surfaces and burner nozzles should be check and cleaned at least once per year to insure proper operation.

Environmental Issues. High efficiency boilers burn less fuel and therefore are responsible for lower emissions.

2.6.2 Replace Electric Boilers With Fuel Oil-Fired Boilers

Description

There are several boilers at the station in a variety of mostly smaller sizes. This ERO considers replacing the existing electric boilers with fuel oil-fired boilers.

Assumptions

Table 2.12 identifies the major boilers at the station. Boiler electricity consumption is estimated using the estimated duty cycles identified in a previous study performed at the station by the support contractor Johnson Controls (March 1992).

The technical assumption are as follows:

- Boiler electric consumption is 14,902,400 kWh/yr or 50,847 MBtu/yr.
- The average boiler is 15 years old.
- The existing electric boilers are operating at 97% average efficiency.
- New fuel oil-fired boilers are available with an average 77% efficiency.
- Portable boilers are not considered in this analysis.

The cost assumptions are as follows:

- Weighted average electrical cost, including on-peak, off-peak and demand charges are \$0.053/kWh.
- O&M costs for electric boilers are \$20/kBtuh-yr.
- Boiler and 30-day fuel storage tank costs, including installation, for the proposed fuel oil units and existing electric boilers were derived from 1992 MEANS Mechanical Cost Data (Means 1991b).

Results

The results of the analysis for this ERO are provided in Table 2.13. The analysis separates boilers under the control of USAF, NASA, and the U.S. Navy. It also separates steam boilers and hot-water boilers. Option 11a, however, combines all boilers.

Budget Implications. Replacement options include RI and ROF. Replacing all electric boilers with fuel oil-fired boilers is estimated to cost \$294,115.

Energy and Cost Savings. Fuel oil-fired boilers are less efficient than electric boilers, but the fuel is less expensive. Energy consumption for replacing all electric boilers with fuel oil boilers is estimated to increase 13,207 MBtu/yr with a cost savings of \$314,497/yr.

Energy Security. This ERO will have no impact on energy security.

Operations and Maintenance. O&M issues for the proposed fuel oil boilers are greater than for the electric boilers, therefore there are additional O&M costs. Combustion tests should be performed periodically to insure complete combustion without high amounts of excess air. Heat transfer surfaces and burner nozzles should be check and cleaned at least once per year to insure proper operation.

Environmental Issues. Fuel oil boilers burn fuel and therefore will result in increased local emissions. Because of federal and local Clean Air Act issues, there may be permitting requirements.

2.6.3 Replace Electric Boilers With High-Efficiency Fuel Oil-Fired Boilers

Description

There are several boilers at the station in a variety of mostly smaller sizes. This ERO considers replacing the existing electric boilers with high efficiency fuel oil-fired boilers.

Assumptions

Table 2.12 identifies the major boilers at the station. Boiler electricity consumption is estimated using the estimated duty cycles as in Section 2.6.2.

The technical assumption are as follows:

- Total boiler electricity consumption is 14,902,400 kWh/yr or 50,847 MBtu/yr.
- The average boiler is 15 years old.
- The existing electric boilers are operating at 97% average efficiency.

- New high-efficiency fuel oil-fired boilers are available with an average 82% efficiency.
- Portable boilers are not considered in this analysis.

The cost assumptions are as follows:

- Weighted average electrical cost, including on-peak, off-peak and demand charges are \$0.053/kWh.
- O&M costs for electric are \$20/kBtuh-yr, and \$75/kBtuh-yr for new fuel oil boilers.
- Boiler and 30-day fuel storage tank costs, including installation, for the proposed high efficiency fuel oil units and existing electric boilers were derived from 1992 MEANS Mechanical Cost Data (Means 1991b).

Results

The results of the analysis for this ERO are provided in Table 2.13. The analysis separates boilers under the control of USAF, NASA, and the U.S. Navy. It also separates steam boilers and hot-water boilers. Option 11b, however, combines all boilers.

Budget Implications. Replacement options include RI and ROF. Replacing all electric boilers with high efficiency fuel oil-fired boilers is estimated to cost \$329,875.

Energy and Cost Savings. Fuel oil-fired boilers are less efficient than electric boilers, but the fuel is less expensive. Energy consumption for replacing all electric boilers with fuel oil boilers is estimated to increase 9,301 MBtu/yr with a cost savings of \$343,481/yr.

Energy Security. This ERO will have no impact on energy security.

Operations and Maintenance. O&M issues for the proposed fuel oil boilers are greater than for the electric boilers, therefore there are additional O&M costs. Combustion tests should be performed periodically to insure complete combustion without high amounts of excess air. Heat transfer surfaces and burner nozzles should be check and cleaned at least once per year to insure proper operation.

Environmental Issues. Fuel oil boilers burn fuel and therefore will result in increased local emissions. Because of federal and local Clean Air

Act issues, there may be permitting requirements.

2.6.4 Replace Boilers With Natural-Gas-Fired Boilers

Discussion

Using natural gas to fuel boilers is one of the most obvious opportunities at Cape Canaveral AFS. There are currently 75 boilers at Cape Canaveral AFS, 59 fuel oil-fired hot-water boilers, 5 fuel oil-fired steam boilers, 9 electric hot-water boilers, and 2 electric steam boilers. Natural gas is an easier fuel to burn than fuel oil, it burns cleaner, and natural-gas boilers do not require as much maintenance as fuel oil boilers. In addition, natural gas is usually much less expensive than electricity as a boiler fuel.

This discussion ERO examines the possibility of replacing the existing steam boilers, both fuel oil and electric, with high efficiency natural-gas-fired boilers. It also examines the possibility of replacing the existing hot water boilers, both fuel oil and electric, with condensing natural-gas-fired boilers.

Because boilers are generally centrally located within a facility, this analysis assumes that natural gas is delivered to the boiler room, i.e. no additional gas piping is required in addition to that normally required for final hookup of the boiler. The same assumptions identified in the Boiler ERO, Section 2.6.1, also apply to this analysis. The efficiency of the natural-gas-fired is assumed to be 82% for high efficiency steam boilers and 92% for condensing boilers.

Table 2.14 indicates the break-even natural-gas cost required in order to achieve a 10 yr simple payback for this ERO. As is shown, if gas can be delivered for \$0.70/therm or less, then all boilers can be converted to natural gas within the economic criteria. Because it is likely that natural gas can be delivered at a cost lower than the calculated break-even cost, the station should proceed with the investigation of this opportunity.

TABLE 2.13. Boiler EROs at Cape Canaveral AFS

Existing Boiler Operating Parameters

ID	Existing Equipment					Est. Oper. Efficiency (%)	# of Units	Size Range (kBtu/h)	Present Energy Use				Total (MBtu/yr)
	Equipment Type	Type	Fuel Source	Agency	Avg. Age (yr)				Fuel Oil (gal/yr)	On-Peak (kWh/yr)	Off-Peak (kWh/yr)	Demand (kW-mo)	
1	Boiler	Hot Water	Fuel Oil	USAF	15	77	44	84-2,209	577,851	na	na	na	80,178
2	Boiler	Hot Water	Fuel Oil	NASA	15	77	11	290-1,673	250,036	na	na	na	34,705
3	Boiler	Hot Water	Fuel Oil	Navy	15	77	4	90-1,074	66,988	na	na	na	9,298
4	Boiler	Steam	Fuel Oil	USAF	15	77	3	204-216	15,692	na	na	na	2,178
5	Boiler	Steam	Fuel Oil	NASA	15	77	2	127-153	7,039	na	na	na	977
6	Boiler	Hot Water	Elec.	USAF	15	97	5	36-2,253	na	2,452,169	3,678,253	8,398	20,917
7	Boiler	Hot Water	Elec.	NASA	15	97	2	500-660	na	1,098,124	1,647,186	3,761	9,367
8	Boiler	Hot Water	Elec.	Navy	15	97	2	283	na	143,611	215,416	492	1,225
9	Boiler	Steam	Elec.	USAF	15	97	2	2,275	na	2,267,057	3,400,586	7,764	19,338
10	Boilers	All	Fuel Oil	All	15	77	64	84-2,209	917,406	na	na	na	127,336
11	Boilers	All	Elec.	All	15	97	11	36-2,253	na	5,960,961	8,941,442	20,414	50,847

Boiler ERO Operating Parameters

ID	ERO Description	Est. Oper. Efficiency (%)	# of Units	Size Range (kBtu/h)	Estimated Energy Use	
					Fuel Oil (gal/yr)	Total (MBtu/yr)
1	Replace F.O. boiler with high efficiency F.O. boiler	82	44	84-2,209	542,429	75,289
2	Replace F.O. boiler with high efficiency F.O. boiler	82	11	290-1,673	234,790	32,589
3	Replace F.O. boiler with high efficiency F.O. boiler	82	4	90-1,074	62,904	8,731
4	Replace F.O. boiler with high efficiency F.O. boiler	82	3	204-216	14,735	2,045
5	Replace F.O. boiler with high efficiency F.O. boiler	82	2	127-153	6,610	917
6a	Replace electric boiler with F.O. boiler	77	5	36-2,253	189,841	26,350
6b	Replace electric boiler with high eff. F.O. boiler	82	5	36-2,253	178,266	24,743
7a	Replace electric boiler with F.O. boiler	77	2	500-660	85,014	11,800
7b	Replace electric boiler with high eff. F.O. boiler	82	2	500-660	79,831	11,080
8a	Replace electric boiler with F.O. boiler	77	2	283	11,118	1,543
8b	Replace electric boiler with high eff. F.O. boiler	82	2	283	10,440	1,449
9a	Replace electric boiler with F.O. boiler	77	2	2,275	175,510	24,361
9b	Replace electric boiler with high eff. F.O. boiler	82	2	2,275	164,809	22,675
10	Replace F.O. boiler with high efficiency F.O. boiler	82	64	84-2,209	861,467	119,572
11a	Replace electric boiler with F.O. boiler	77	11	36-2,253	461,484	64,054
11b	Replace electric boiler with high eff. F.O. boiler	82	11	36-2,253	433,345	60,148

Boiler ERO Economic Parameters

ID	First Cost (1992\$)	Life (yr)	Existing O&M (\$/yr)	ERO O&M (\$/yr)	Energy Savings (MBtu/yr)	Energy Savings (\$/yr)	Life-Cycle Cost (RI)		Life-Cycle Cost (ROF)	
							NPV (\$)	SIR	NPV (\$)	SIR
1	379,225	25	3,300	3,300	4,889	36,279	556,206	2.47	336,089	2.31
2	150,575	25	825	825	2,116	15,703	250,568	2.66	150,891	2.48
3	42,675	25	300	300	567	4,207	64,864	2.52	38,907	2.35
4	15,900	25	225	225	133	986	10,452	1.67	6,196	1.59
5	7,000	25	150	150	60	442	5,177	1.74	3,268	1.66
6a	150,265	25	100	375	-5,433	67,432	757,520	6.04	31,283	1.31
6b	161,975	25	100	375	-3,826	79,355	998,860	7.17	163,666	2.50
7a	35,950	25	40	150	-2,433	30,197	363,981	11.12	28,576	2.18
7b	40,100	25	40	150	-1,713	35,536	472,886	12.79	88,318	4.26
8a	29,000	25	40	150	-318	3,949	26,892	1.93	-9,095	0.54
8b	30,700	25	40	150	-224	4,647	40,028	2.30	-2,019	0.90
9a	78,900	25	40	150	-5,023	62,341	756,202	10.58	65,315	2.23
9b	97,100	25	40	150	-3,537	73,364	971,969	11.01	182,724	3.79
10	550,075	25	4,800	4,800	7,764	57,618	887,278	2.49	535,362	2.33
11a	294,115	25	220	825	-13,207	163,919	1,904,518	7.48	116,051	1.58
11b	329,875	25	220	825	-9,301	192,903	2,483,952	8.53	432,938	2.94

TABLE 2.14. Break-Even Analysis for Natural-Gas Boilers

Existing Boiler Parameters						
Qty	Capacity (kBtuh)	Type	Fuel Type	Eff (%)	Existing Consumption	Present Fuel Cost (\$/yr)
59	35,881	HW	F.O.	77	894,678 gal/yr	921,518
5	904	ST	F.O.	77	22,731 gal/yr	23,413
9	8,006	HW	Elect	97	9,234,722 kWh/yr	396,131
2	4,550	ST	Elect	97	5,667,497 kWh/yr	243,117

Natural Gas Boiler Parameters					
Qty	Type	Eff (%)	Natural-Gas Consumption (therms/yr)	Installed Cost (\$)	Break-even Gas Cost (\$/therm)
59	Condensing	92	1,039,340	1,174,200	0.77
5	High Eff	82	30,370	22,600	0.70
9	Condensing	92	332,210	264,200	1.11
2	High Eff	82	234,470	97,100	1.00

2.7 BUILDING ENVELOPE EROs

2.7.1 Install Ceiling Insulation

Description

This ERO examines the savings associated with installing insulation in the ceiling in the following buildings at Cape Canaveral AFS:

<u>Facility No.</u>	<u>Facility</u>
1641	Range Comm. Bldg.
1645	Range Control Center
1704	E & L Building
1722	Programming Bldg.
1724	Physical Standards Lab.
1748	Cafeteria
49635	Dispensary
49750	Alternate Center Security Control
54915	Engineering Bldg.-MR1
55005	Hangar M Annex
60600	Engineering Office
60740	Base Commander's Office

Assumptions

The technical assumptions are as follows:

- The ceiling construction for the buildings analyzed are assumed to be heavy weight concrete deck construction with a suspended ceiling.
- The U-factor for the existing ceilings is $0.09 \text{ Btu/h-ft}^2\text{-}^\circ\text{F}$ assuming 1 in. of foam insulation. The U-factor with installation of 6 in. of insulation is $0.047 \text{ Btu/h-ft}^2\text{-}^\circ\text{F}$ (ASHRAE 1993).
- Average summer temperature from April to October is 79.6°F (USAF 1978).
- Indoor summer temperature is assumed to be 75°F .
- Acceptable indoor relative humidity is assumed to be 50%.
- Windows are equally distributed on all sides of the buildings, thus 25% of the windows face north, south, east, and west walls.
- 15% of the total wall area is assumed to be window area.
- All buildings are considered square with a wall height of 8 ft.
- All buildings are assumed to be two stories.
- Equipment COP and operating hours for existing equipment is taken from the efficient A/C ERO.

The cost assumptions are as follows:

- Material cost for the retrofit insulation is $\$0.39/\text{ft}^2$ (floor area) and $\$0.17/\text{ft}^2$ (floor area) for labor costs. Costs were obtained from MEANS Repair and Remodeling Cost Data (Means 1989).

Results

Qualitative results of the ERO analysis appear in Table 2.15. The table contains specific energy, cost, and economic data.

Budget Implications. The estimated initial cost of installation of additional ceiling insulation for the buildings listed above is \$78,184.

Energy and Cost Savings. It is estimated that an annual energy savings of 7,210 kWh, demand savings at 25 kW for a total savings of \$406 will be achieved. These estimates are based on 100% implementation of the ERO for a typical operating year.

Operations and Maintenance Impacts. There is no change in the O&M budget due to this ERO.

Energy Security. The security of energy supply and distribution to Cape Canaveral AFS will not be affected by implementation of this ERO.

Environmental Issues. This ERO investigates potential energy savings by reducing heat gain, reducing electrical power consumption, therefore reducing the burning of fossil fuel.

2.7.2 Install Multi-Glazed (Double-Pane) Windows

Description

Buildings at Cape Canaveral AFS are mainly equipped with single-paned windows. Single-paned windows allow a significant amount of heat transfer across the window when compared to double-paned windows. Double-paned windows have a dead air space that decreases the conductivity thus reducing the amount of heat transfer. By replacing the single-paned windows with multi-glazed windows at Cape Canaveral AFS, there would be a decrease in cooling requirements and energy consumption.

This ERO examines selected buildings for possible retrofit of replacing single-paned windows with double-paned glazing. The following table is a list of buildings which were selected for analysis.

<u>Facility</u>	<u>Facility Number</u>
1645	Range Control Center
1704	E & L Building
1722	Programming Bldg.
1724	Physical Standards Lab.
1748	Cafeteria
49635	Dispensary
49750	Alternate Security Control
54915	Engineering Bldg.-MR1
55005	Hangar M Annex
60600	Engineering Office
60740	Base Commander's Office

Assumptions

The technical assumptions are as follows:

- Windows are equally distributed on all sides of the buildings, thus 25% of the windows face north, south, east, and west walls.
- All buildings are considered square with a wall height of 8 ft.
- 15% of the total wall area is assumed to be window area.
- All buildings are assumed to be two stories.
- Single-paned windows have an U-value of 0.98 (Btu/h-ft²-°F) U-value for multi-glazed replacement windows is 0.7 (Btu/h-ft²-°F).
- Solar insolation attributing to heat gain through the windows was calculated from solar heat gain factor (SHGF) (British thermal unit per hour per square foot [Btu/h-ft²]) from ASHRAE Fundamentals, pp. 27.21-27.22, assuming Cape Canaveral AFS is at 28° latitude (ASHRAE 1993). Solar time, used by ASHRAE Fundamentals, was converted to eastern daylight-saving time to account for on- and off-peak energy consumption.
- This ERO only analyzes summer months, April through October, because the significant savings are attributed to reduced cooling loads.
- Air-conditioning (A/C) equipment COP for existing equipment are from efficient A/C ERO.

The cost assumptions are as follows:

- Double-paned windows are assumed to be \$9/ft² (window area) for materials and \$8/ft² (window area) for labor taken as an average from several sources. (Means 1991a; The Richardson Rapid System, Process Plant Construction Estimating Standards, Volume 2, 1992; cost estimate from a manufacturer of efficient window)

Results

Qualitative results of the ERO analysis appear in Table 2.15. The table contains specific energy, cost, and economic data.

Budget Implications. The estimated initial cost of replacing all the single-paned windows is \$212,025.

Energy and Cost Savings. It is estimated that an annual energy savings and savings at 164 kW for a total savings of \$15,340 will be achieved. These estimates are based on 100% implementation of the ERO for a typical operating year.

Operations and Maintenance Impacts. There is no change in the O&M budget because of this ERO.

Energy Security. The security of energy supply and distribution to Cape Canaveral AFS will not be affected by implementation of this ERO.

Environmental Issues. This ERO investigates potential energy savings by reducing the heat gain through the window space, reducing electrical power consumption, therefore reducing the burning of fossil fuel.

2.7.3 Install Reflective Window Film

Description

Reflective film reduces the amount of sunlight entering the windows thus, decreasing the radiative heat gain. Therefore, by installing reflective window film on windows at Cape Canaveral AFS, there would be a decrease in cooling requirements and energy consumption. This ERO examines selected buildings for possible retrofit of reflective film. The following table is a list of buildings which were selected for analysis.

<u>Facility</u>	<u>Facility Description</u>
1645	Range Control Center
1704	E & L Building
1722	Programming Bldg.
1724	Physical Standards Lab.
1748	Cafeteria
49635	Dispensary
49750	Alternate Center Sec
54915	Engineering Bldg.-MRI
55005	Hangar M Annex
60600	Engineering Office
60740	Base Commander's Office

Assumptions

The technical assumptions are as follows:

- Windows are equally distributed on all sides of the buildings, thus 25% of the windows face north, south, east, and west walls. This analysis only looks at east and west windows for retrofit. During summer months, solar insolation is mainly attributed to eastern and western windows.
- 15% of the total wall area is assumed to be window area.
- All buildings are considered square with a wall height of 8 ft.
- From on-site inspections, 25% of the windows are assumed to presently have tinting or shading.
- The present shading coefficient is assumed to be 1 (no shading) and the proposed shading coefficient is assumed to be 0.3.
- Solar insolation attributing to heat gain through the windows was calculated from SHGF (ASHRAE 1993) assuming Cape Canaveral AFS is at 28° latitude. Solar time was converted to eastern daylight-saving time to account for on- and off-peak energy consumption.
- This ERO only analyzes summer months, April through October, because the significant savings are attributed to reduced cooling loads.
- A/C equipment COP for existing equipment is taken from the efficient A/C ERO.

The cost assumptions are as follows:

- The cost of the reflective window film is assumed to be \$3.95/ft² (window area) including labor.

Results

Qualitative results of the ERO analysis appear in Table 2.15. The table contains specific energy, cost, and economic data.

Budget Implications. The estimated initial cost for installation of the window film is \$32,211.

Energy and Cost Savings. It is estimated that an annual energy savings of 186,847 kWh, demand savings at 70 kW at a total savings of \$6,870 will be achieved. These estimates are based on 100% implementation of the ERO for a typical operating year.

Operations and Maintenance Impacts. There is no change in the O&M

budget due to this ERO.

Energy Security. The security of energy supply and distribution to Cape Canaveral AFS will not be affected by implementation of this ERO.

Environmental Issues. This ERO investigates potential energy savings by reducing the radiative heat gain through the window space, reducing electrical power consumption, therefore reducing the burning of fossil fuel and the emission of pollutants to the atmosphere.

2.7.4 Install Weatherization Package

Description

Small cracks in windows and doors can cause a significant heat gain, thus increasing the cooling load in the building. By sealing the cracks with weather stripping, the infiltration of warm air into the building will be greatly reduced.

This ERO examines all administration buildings for possible retrofit. Heat gain due to infiltration was calculated on a building with average "tightness" and then compared the heat gain into a tightly sealed building (ASHRAE 1993), to predict the energy savings associated with installing weather stripping on the windows and doors.

Assumptions

The technical assumptions are as follows:

- Existing air leakage values at Cape Canaveral AFS is assumed to be average tightness in commercial buildings of 0.3 cfm/ft^2 , and proposed air leakage value are assumed to be tight commercial building of 0.1 cfm/ft^2 (ASHRAE 1993)
- Heat gain calculations for both sensible and latent heat gain is from ASHRAE Fundamentals (1993).
- Average summer temperature from April to October is 79.6°F from the Engineering Weather Data 1978.
- Indoor summer temperature is assumed to be 75°F .
- Acceptable indoor relative humidity is assumed to be 50%.

- Windows are equally distributed on all sides of the buildings, thus 25% of the windows face north, south, east, and west walls.
- 15% of the total wall area is assumed to be window area.
- All buildings are assumed to be square with a wall height of 8 ft.
- Equipment COP and operating hours for existing equipment is taken from the efficient A/C ERO.

The cost assumptions are as follows:

- The weather stripping to be applied to doors and windows is assumed to be a solid neoprene strip which is \$2.20/linear ft for material and \$1.92/linear ft for labor cost. A two piece stile protection will be applied to the bottom of the doors, which is \$2.60/linear ft for materials and \$3.84 for labor. Costs were obtained from MEANS Repair and Remodeling Cost Data (Means 1989).

Results

Qualitative results of the ERO analysis appear in Table 2.15. The table contains specific energy, cost, and economic data.

Budget Implications. The estimated initial cost of weather-stripping the windows and doors is \$17,462.

Energy and Cost Savings. It is estimated that an annual energy savings of 77,093 kWh, demand savings at 271 kW for a total savings of \$4,340 will be achieved. These estimates are based on 100% implementation of the ERO for a typical operating year.

Operations and Maintenance Impacts. There is no anticipated change in the O&M budget due to this ERO.

Energy Security. The security of energy supply and distribution to Cape Canaveral AFS will not be affected by implementation of this ERO.

Environmental Issues. This ERO investigates potential energy savings by reducing heat gain due to infiltration of warm air, reducing electrical power consumption and therefore reducing the burning of fossil fuel and the amount of pollutants emitted to the atmosphere.

TABLE 2.15. Envelope EROs at Cape Canaveral AFS

Existing Envelope Operating Parameters

ID	ERO Type	Affected Parameter	Existing Value	Energy Consumption (kWh)		Average Demand (kW-mo)
				on-peak	off-peak	
1	Window Film	shading coef	1.00	161,299	177,578	142
2	Double Paned Window	U value (Btu/hr-ft ² -F)	0.98	322,598	355,157	284
3	Weatherization Package	infiltration (cfm/ft ²)	0.30	45,968	69,671	406
4	Ceiling Insulation	U value (Btu/hr-ft ² -F)	0.09	6,049	9,169	53

Proposed Envelope ERO Parameters

ID	ERO Type	Affected Parameter	ERO Value	Energy Consumption (kWh)		Average Demand (kW-mo)
				on-peak	off-peak	
1	Window Film	shading coef	0.30	82,135	69,894	72
2	Double Paned Window	U value (Btu/hr-ft ² -F)	0.70	136,723	126,221	120
3	Weatherization Package	infiltration (cfm/ft ²)	0.10	15,323	23,224	135
4	Ceiling Insulation	U value (Btu/hr-ft ² -F)	0.05	3,184	4,826	28

Envelope ERO Economics

ID	First Cost (1993 \$)	First Year Savings					Life Cycle Cost	
		Energy (kWh)	Demand (kW-mo)	Energy (1993\$)	Demand (1993\$)	Total (1993\$)	NPV (1993 \$)	SIR
1	32,211	186,847	70	6,435	436	6,870	47,313	2.54
2	212,025	414,810	164	14,318	1,023	15,340	196,507	2.39
3	17,462	77,093	271	2,649	1,693	4,342	57,896	6.15
4	78,184	7,209	25	248	158	406	(47,986)	0.12

2.8 VEHICLE ERO

2.8.1 Convert Vehicles to Compressed Natural Gas

Description

The motor vehicle fleet at Cape Canaveral AFS consists of 404 vehicles that presently operate on unleaded gasoline and 112 diesel vehicles as identified in the Cape Canaveral AFS baseline report (Wahlstrom et al. 1993). All of these vehicles could be converted to compressed natural gas (CNG) as a primary fuel source if natural gas were available at the station.

Most gasoline powered cars and trucks can be converted to operate on CNG in either single fuel (CNG only) or a dual fuel (either gasoline or CNG) configuration. Modifications include changes to the fuel delivery and carburetion system. Fuel injected cars can also be easily converted. The conversion equipment consists of fuel storage cylinders, a pressure regulator, a gas/air mixer, a fuel selector control (for dual fuel use), and a fuel gauge. A typical vehicle can usually be converted to CNG in less than a day.

One of the primary advantages of diesel fuel is its high centane rating which allows the fuel to autoignite when sufficiently compressed. Compression ignition simplifies the diesel engine, as compared to spark plug engines, by eliminating the spark plugs, distributors, and other electrical components. Ordinarily natural gas will not autoignite due to its low centane rating. Therefore, some means of igniting the alternative fuel must be provided. Some of the proven means of ignition methods are to add spark plugs, glow plugs, or use a fumigation system. Rather than make the extensive engine modification of adding spark plugs, a fumigation system can be used. A fumigation system burns natural gas in tandem with diesel fuel. For this type of conversion, diesel fuel is used as a "pilot fuel" for starting and for low engine revolutions per minute (rpm) operation. The amount of natural gas is increased as engine speed increases. Retrofitting a diesel engine to CNG using a fumigation system is very similar to converting a gasoline engine to CNG. The major difference is the need for an revolutions per minute monitoring device to control the mixture of diesel and natural gas. The mixture of fuels is controlled by either mechanical or solenoid switches. Diesel is used to start the engine and is decreased as engine speed increases.

When engine speed drops off during gear changes, diesel again becomes the primary fuel.

Implementation of the ERO is relatively straightforward. Natural gas need only be delivered to a central fueling station located where the existing gasoline station is located. The central CNG fueling station is assumed to consist of both rapid-fill and slow-fill stations. Rapid-fill stations can refuel a typical vehicle in approximately 5 minutes, or the same amount of time required to fill a comparable gasoline vehicle. Slow-fill stations are more economical but require 10-12 hours (overnight) to completely refuel the vehicle. The compressor station is sized similarly to the station considered at Patrick Air Force Base (Sandusky et al. 1993). It is also assumed that the electrical energy consumed to compress the natural gas would cost an estimated \$29,800/yr. Other assumptions made for this analysis are identified below:

- There are 404 gasoline vehicles.
- The energy content of the fuel is 110,000 Btu/gal for gasoline.
- Gasoline fuel consumption is 503,079 gal.
- The cost of gasoline is \$0.84/gal.
- The CNG compressor stations' cost is \$300,000 in addition to the conversion costs of the vehicles.
- The conversion cost of standard gasoline sedans, station wagons, vans, and telephone maintenance is \$2,000/vehicle.
- The conversion cost of gasoline panel trucks, carry-alls, stake and platform, winch trucks, and pickups is \$3,000/vehicle.

Because the diesel fuel consumption per vehicle from the baseline report is questionable, this analysis only considers converting the gasoline vehicles to CNG. Table 2.16 indicates the break-even natural-gas cost required in order to achieve a 10-year simple payback for this ERO is \$0.48/therm. Because this is a likely cost for natural gas, this ERO may be a cost-effective measure at the station. Cape Canaveral AFS should proceed with the investigation of this opportunity.

Several others factors need to be considered, but were not included in this analysis. First, the USAF currently purchases their vehicles instead of

leasing them from General Services Administration. If the USAF decided to lease vehicles instead of purchase the conversion cost may be eliminated. This could make this ERO more attractive. Second, since KSC is going to CNG vehicles, there may be an opportunity to negotiate lower prices with the gas company for fuel. The cost of the refueling stations could be shared with NASA. This also would make the alternative more attractive. Third, the inclusion of diesel vehicles may offset the fixed costs of the CNG compressor station and further reduce the break-even natural-gas cost. A more detailed analysis of this ERO would require consideration of all the factors noted above.

TABLE 2.16. Break-Even Analysis for CNG Vehicles

Qty	Fuel Type	Existing		Conversion Cost		Proposed CNG (therm/yr)
		Fuel (gal/yr)	Fuel (\$/yr)	Unit (\$/veh)	Total (\$)	
59	G	73,469	61,714	2,000	118,000	75,159
<u>345</u>	<u>G</u>	<u>429,610</u>	<u>360,872</u>	<u>3,000</u>	<u>1,035,000</u>	<u>439,491</u>
404		503,079	422,586		1,153,000	514,650

2.9 ENERGY MANAGEMENT AND CONTROL SYSTEM ERO

2.9.1 Expand Use of Energy Management Control System

Description

The present Energy Management and Control System (EMCS) at Cape Canaveral AFS is being replaced. The new system can be used to provide real-time information regarding environmental conditions, mainly temperature, at facilities and control the operation of chillers and/or air handlers at noncritical facilities. The system is being installed along with a new Supervisory Control and Decision Analysis (SCADA) system under a MILCON project. The SCADA system will primarily be used for load control at the transformer level, while the EMCS has the ability to control the function of equipment within a facility. The difference between the two systems is the SCADA system does not contain advanced application software needed for the control functions. Both systems can co-exist, but only recently has this type of system been available to the market. This ERO recommends utilizing the

EMCS system to control a larger number of facilities.

Assumptions

The technical assumptions are as follows:

- Facilities are currently controlled by use of simple thermostats for on/off control of the chillers and air handlers, resulting in 24-hour operation of the system to maintain a constant indoor temperature.
- Neither night setback nor night shutoff of HVAC equipment is currently practiced in facilities.
- The balance temperature for the buildings is 65°F, but the thermostat is set for a temperature of 76°F to 78°F.
- Air-conditioning equipment in facilities affected by this ERO would be switched on early enough each morning to cool the building to 78°F before the bulk of the occupants arrive. The increased consumption during this recovery period is neglected.
- A typical SCADA/EMS system has a life of 15 years (Paula 1992).

Results

Complete details of this ERO appear in Table 2.17. Buildings which are affected by this ERO are those which have at least 15 tons of chiller or direct expansion unit capacity. Facilities with a series of small chiller or direct expansion units of 3 tons or smaller that amount to more than 15 tons are not addressed. Systems located in designated critical facilities would not be controlled since there is a need to maintain humidity control or 24-hour activities occur in those facilities. The initial estimate by site personnel is that 85 to as many as 115 buildings have equipment that can be controlled. It is believed that each facility has been outfitted with RTUs that collect information and perform the control functions and interface with the central computer system. However, this was not verified. A survey is now underway to determine if RTU's do exist in the buildings that can be controlled.

A review of the master list of HVAC units on site indicates a total of 57 separate facilities comprising 305,854 ft² qualify for this ERO. Some of those facilities have more than one HVAC unit that can be controlled, while others have both designated critical and noncritical HVAC units located in the same facility. The ERO analysis is based on controlling only these 60

buildings. If more buildings can be controlled, the ERO would be more attractive.

To provide control of the chillers and air handling units in all of these facilities, an estimated 200 control points are required. The required number of points per facility ranges from 2 to 10. An additional 10% are added to account for those facilities which may require more points than initially estimated.

An LCC analysis was not completed for this ERO because of the inaccuracy of the data regarding the number of buildings to be controlled, required control points, etc. More and better data is required to fully analyze this ERO.

Budget Implications. Implementation of this ERO will cost \$200,000. This is assuming an average installed cost of \$1,000 per control point. This figure could be higher considering the type and amount of equipment to be controlled. It is based on general information from vendors, but does not include procurement cost and other indirect cost associated with installation of this type of system.

Energy and Cost Savings. This ERO will save an estimated 5,527,982 kWh/yr or \$284,236/yr at an average electricity cost of 5.1 cents per kWh (based on 1991 cost information).

Energy Security. This recommendation will have little impact to energy security. The likelihood of the EMCS system malfunctioning is considered to be no higher than the likelihood of the existing thermostatic control system malfunctioning.

Environmental Issues. This ERO will reduce electricity consumption. In turn, the environment will be affected less by generating facilities which have environmental impacts.

TABLE 2.17. Expand EMCS ERO at Cape Canaveral AFS

Existing Chiller/AHU Operation/Characteristics

ID	Application		Energy Consumption (kWh)	
	Building Type	# of Bldgs	on-peak	off-peak
1	ADMIN	6	280,299	686,250
2	HGR	6	146,035	357,534
3	R & D	14	1,141,649	2,795,071
4	SHOP	3	134,946	330,385
5	PLT-EQ	3	23,530	57,609
6	MTR-POOL	1	7,764	19,009
7	OTHER	22	696,210	1,704,515

Chiller/AHU Operation/Characteristics with EMCS Control

ID	Application		# of points	Energy Consumption (kWh)	
	Building Type	# of Bldgs		on-peak	off-peak
1	ADMIN	6	12	246,663	82,350
2	HGR	6	16	128,511	42,905
3	R & D	14	30	1,004,651	335,409
4	SHOP	3	10	118,752	39,646
5	PLT-EQ	3	6	20,706	6,913
6	MTR-POOL	1	4	6,832	2,281
7	OTHER	22	54	612,664	204,541

EMCS Control Economic Parameters

ID	Economic Parameters		First Year Energy Savings	
	First Cost RIS (1993)	Life (yr)	Energy (Kwh)	Energy (1993\$)
1	13,200	20	637,536	32,780
2	17,600	20	332,153	17,079
3	33,000	20	2,596,660	133,514
4	11,000	20	306,933	15,782
5	6,600	20	53,520	3,752
6	4,400	20	17,660	908
7	59,400	20	1,583,520	81,421

2.10 PROCESS SYSTEMS EROs

The largest single process energy use at Cape Canaveral AFS is the maintenance of environmentally conditioned air spaces for launch activities. The usual requirements are that the temperature be between 50°F and 60°F and the relative humidity be kept between 35% and 50%. Given the coastal location of Cape Canaveral, the latter requirement is difficult to maintain without great energy expense. In addition, the pressure and/or airflow requirements can be very great, depending on the size and type of conditioned air space. Given these requirements, recommendations made by the ASHRAE Heating, Ventilating, and Air-Conditioning Applications Handbook (ASHRAE 1991), were considered in the areas of humidity control, conditioned air recirculation for clean rooms. In addition, the potential installation of heat pipes for use in the dehumidification process were analyzed.

The study of process energy load at launch facilities is complex. PNL recently completed a resource assessment for Vandenberg AFB, California, which is the other major launch facility for the USAF Space Command (Daellenbach et al. 1993). In that study, the evaluation of process energy use was limited to a single launch complex because a complete assessment would require a detailed energy analysis of 150 process facilities that was well beyond the scope of that assessment.

While the assessment at Vandenberg AFB was limited to a single complex, the personnel at the launch site were very responsive in providing information necessary to complete the assessment. The frequency of launch activities at Cape Canaveral AFS is far greater than Vandenberg AFB and the station supports all of the manned launches from Kennedy Space Center. This eliminated the opportunity to obtain detailed information regarding HVAC equipment at the launch facilities to complete a detailed analysis. Therefore, the evaluation of process energy EROs is limited and discussed in a general sense. Information regarding the heat pipe ERO is more extensive than the others since it is evaluated on reducing the energy requirements associated with boilers to reheat conditioned air after humidity levels have been reduced and

did not require the same level of information to evaluate.

2.10.1 Provide Dehumidifier Bypass in Payload A/C System

Typically, there is no supply air bypass around the desiccant dehumidifier in the payload A/C system. The dehumidifier is sized and configured such that it reduces the RH of the air leaving the dehumidifier to approximately 10%, so steam is added downstream to bring the RH up to the desired 40%. This is inefficient, and puts an unnecessary load on the dehumidifiers as well as the humidifiers downstream.

This ERO would add a bypass around the dehumidifiers in the system. Dampers would modulate the "dry" and "humid" air flows based on feedback from a humidistat, such that the supply air is only dehumidified to the extent required. The humidification downstream would then be required only when the outside air RH is low, which is infrequent. Each bypass kit would consist of the following:

- face and bypass plenum
- face and bypass dampers
- motorized damper actuator
- master and slave power controllers
- temperature controller
- remote-mounted humidity sensor
- analog process controller.

This approach requires a more complicated control scheme, and there is some doubt about the ability of the existing A/C control system to perform adequately in this situation. This obviously has a bearing on the successful implementation of this ERO, but a simple bypass offers little in the way of energy savings unless the existing steam humidifiers are retained. Thus, to optimize the energy efficiency of the dehumidification system as a whole, this ERO will assume that the bypass will be supplied with reactivation heat modulation.

Typically, a manufacturer of a bypass system can supply a reactivation heat recovery kit. Heat recovery of this nature would not be cost-effective given the temperate climate at the site.

The lack of detailed necessary information regarding the various A/C systems associated with the clean rooms at the site precludes a rigorous analysis of the estimated energy savings. Given the frequency of launches at Cape Canaveral AFS, probable condition of the existing clean room systems, and climatic conditions at the site, implementation of this ERO would be cost-effective. However, specific energy savings would require more detailed information regarding the A/C systems, frequency of use, and current configuration. This generally requires a detailed inspection of the various systems.

2.10.2 Provide Recirculation Path for Payload Air-Conditioned Air

The volume of air required to be supplied to the payload actually varies considerably from user to user during the launch. At the beginning of the launch cycle the air flow requirements are lower than at the end of the cycle. To accomplish this with a constant volume fan, typically there is a damper arrangement upstream of the payload which diverts the excess air volume to the atmosphere. This practice wastes a considerable amount of energy because the air that is dumped to the atmosphere has already been fully conditioned. If this air could be recirculated, at least a portion of the energy loss could be recovered.

To determine if this ERO has merit, detailed calculations must be done on a system-by-system basis. This ERO was evaluated for Vandenberg AFB, CA (Daellenbach et al. 1993) and not considered cost-effective due to the relatively low amount of launch activity and initial indication of the large amount of energy required to recirculate the payload air than vent it to the atmosphere. A similar situation most likely would occur at Cape Canaveral AFS. Determination of the actual results would require extensive information regarding the A/C systems at the launch sites. This information currently is not readily available.

2.10.3 Install Heat Pipes

This analysis considers installing heat pipes to facilities using reheat type HVAC systems. The installation of heat pipes provides an increased ability to dehumidify buildings without lowering the chilled-water temperature and without increasing energy consumption. Heat pipes can be installed to

supplement the reheat coil, thereby reducing the load on both the A/C system and the reheat system. Since the amount of reheat is usually a function of humidity rather than temperature, heat pipes are proposed in addition to existing systems to provide a precool and preheat cycle, rather than a full replacement of the existing systems.

Description

There are several facilities at the station that use reheat for humidity control. This ERO considers installing heat pipes to reduce the load on the cooling and reheat coils, thereby saving energy in both the A/C equipment and the reheat equipment. The heat pipes are installed similar to the schematic shown in Figure 2.3. Return air and outside make-up air is precoolled by the heat pipe, thereby reducing the load on the cooling coil and enhancing the removal of humidity. The cooled air then passes through the other side of the heat pipe preheating the air, thereby reducing the load on the reheat coil. Heat pipes are passive and closed systems requiring no maintenance other than that of a standard coil.

Assumptions

Table 2.18 identifies the facilities at the station that utilize boilers for reheat energy under consideration of this recommendation. Additional

FIGURE 2.3. Heat Pipe-Assisted HVAC System Schematic

facilities that utilize electrical resistance reheat coils are also very good candidates for heat pipes; however, these facilities could not be identified for this analysis.

The technical assumptions are as follows:

- The majority of the technical assumptions are identified in Table 2.18.
- The efficiency of fuel oil-fired boilers is 77%.
- The efficiency of electric boilers is 97%.
- Fuel oil energy content is 138,800 Btu/gal.
- Heat pipes will reduce re-heat energy by an estimated seasonal average 75% (Allen and Dinh 1992).
- Boiler and A/C energy consumption was determined in previous EROs.
- Additional fan motor energy due to increased pressure drop caused by heat pipe is assumed to be negligible.
- Although the heat pipes may reduce the peak electric demand for the electric boilers and A/C refrigeration equipment, this can not be guaranteed without a considerably more detailed analysis. Therefore demand reduction is not included in the savings estimate.

The cost assumptions are as follows:

- Fuel oil cost during 1992 is \$1.03/gal.
- Electricity costs during 1992 are \$0.04043/kWh (on-peak) and \$0.03710/kWh (off-peak). No demand savings are claimed.
- Additional O&M costs for the entire HVAC system as a result of the addition of heat pipes is assumed to be negligible.
- The cost of heat pipes, including installation and duct work modifications, is \$100/kBtuh related to boiler capacity. This estimate is based on relating the total project cost to the reheat capacity replaced in a Florida case study (Gahran 1993) plus an additional 50% for duct work modifications, engineering, design fees and contingency.

Results

The results of the analysis for this ERO are provided in Table 2.18. This ERO has considerable interaction with both the boiler EROs and A/C EROs. There is a significant overlap of claimed energy savings with both high efficiency chillers, direct expansion A/C units, and boilers. In addition,

the effect of this ERO may be to significantly reduce the required A/C and boiler equipment size. The extent of this interaction can not be determined in this level of analysis, detailed load calculations on a case by case basis should be performed.

Budget Implications. Table 2.18 identifies the estimated cost of implementing this ERO at each facility under consideration. Total implementation cost is estimated to be \$2,631,580.

Energy and Cost Savings. Energy savings for all facilities identified are estimated to be 56,040 MBtu/yr due to reduced boiler load and 12,873 MBtu/yr because of reduced air-conditioning load for a total of 68,913 MBtu/yr. Cost savings for all facilities identified are estimated to be \$441,754/yr due to reduced boiler load and \$129,510/yr due to reduced A/C load for a total of \$571,264/yr.

Energy Security. This ERO will have no impact on energy security.

Operations and Maintenance. Heat pipes are passive and closed systems, thereby requiring no special maintenance. The heat pipe coil surfaces should be cleaned as other heating and cooling coils.

Environmental Issues. Heat pipes are closed systems and therefore should not leak. However, additional precautions can be taken by specifying an environmentally friendly heat transfer media (non-CFC material). A significant portion of the energy savings is through reduced boiler fuel oil consumption, therefore local emissions will be reduced.

TABLE 2.18. Heat Pipes ERO at Cape Canaveral AFS

Existing HVAC System Operating Parameters

ID	Fac No	Existing Boiler Data					Existing Boiler Consumption			Est. Reheat Energy (MBtu/yr)	Existing A/C Data				Total Energy (MBtu/yr)
		Capacity (kBtu/h)	Type	Agency	Status	Area	Fuel Oil (Gal)	On-Peak (kWh/yr)	Off-Peak (kWh/yr)		Capacity (tons)	Type	On-Peak (kWh/yr)	Off-Peak (kWh/yr)	
1	01619	598.0	HW	USAF	CRIT	3A	15,037	NA	NA	804	60	CW & DX	69,365	105,132	2,682
2	01646	1,300.0	HW	USAF	CRIT	3A	32,688	NA	NA	3,494	500	CW	289,019	438,049	7,018
3	01708	921.0	E-HW	USAF	N/C	3A	NA	91,776	137,664	759	160	DX & CW	217,141	329,108	2,647
4	01724	694.0	HW	USAF	CRIT	3A	17,450	NA	NA	933	60	DX	69,365	105,132	3,017
5	01726	1,400.0	HW	NASA	CRIT	3A	35,203	NA	NA	3,762	670	CW & DX	472,986	716,876	8,946
6	01728	750.0	HW	NASA	CRIT	3A	18,859	NA	NA	2,016	108	DX	144,683	219,288	3,859
7	01732	280.0	ST	NASA	CRIT	3A	7,041	NA	NA	752	375	CW & DX	391,015	592,638	4,333
8	29100	4,527.6	Elect	USAF	CRIT	1N	NA	2,255,838	3,383,757	9,333	1,172	CW & DX	765,499	1,160,220	25,813
9	29100R	285.0	HW	USAF	CRIT	1N	7,168	NA	NA	766	100	CW & DX	115,608	175,219	1,987
10	34708	565.2	HW	USAF	CRIT	3	14,212	NA	NA	1,519	136	DX	157,226	238,299	3,322
11	49639	752.0	HW	USAF	CRIT	3A	18,908	NA	NA	2,021	285	CW & DX	291,443	441,723	5,126
12	50801	129.0	HW	USAF	CRIT	5	3,244	NA	NA	347	30	DX	40,714	61,708	800
13	54445	660.0	E-HW	NASA	CRIT	3A	NA	624,795	937,192	2,585	210	CW	211,450	320,482	7,144
14	55005	480.0	HW	NASA	CRIT	3A	12,069	NA	NA	1,290	90	DX	104,047	157,698	2,568
15	55810	1,800.0	HW	USAF	CRIT	5	45,260	NA	NA	4,837	320	CW & DX	322,210	488,354	9,048
16	55840	423.0	HW	USAF	CRIT	6	10,636	NA	NA	568	40	CW	46,243	70,088	1,673
17	56921	400.0	HW	USAF	N/C	6	10,058	NA	NA	1,075	90	CW	90,621	137,349	2,174
18	60530	1,301.0	HW	NASA	CRIT	3A	32,713	NA	NA	3,496	404	CW & DX	250,869	380,226	6,594
19	60680	1,613.0	HW	NASA	CRIT	3A	40,558	NA	NA	4,335	585	CW & DX	589,040	892,772	10,685
20	62980	1,074.0	HW	NAVY	CRIT	7	27,005	NA	NA	1,443	75	CW	75,518	114,458	4,397
21	66250	1,673.0	HW	NASA	N/C	3A	42,067	NA	NA	2,248	205	CW	206,416	312,852	7,611
22	67210	125.0	HW	USAF	CRIT	6	3,143	NA	NA	336	20	DX	23,122	35,044	635
23	67900	420.0	HW	USAF	CRIT	6	10,561	NA	NA	564	50	CW	57,804	87,610	1,962
24	67901	203.0	HW	USAF	CRIT	6	5,104	NA	NA	273	25	CW	28,902	43,805	957
25	70000	1,788.0	HW	USAF	CRIT	1W	44,959	NA	NA	4,805	520	CW	523,581	793,575	10,734
26	70500	1,842.0	HW	USAF	CRIT	1W	46,317	NA	NA	4,950	1,105	CW & DX	765,901	1,160,829	13,003
27	81585	312.0	HW	USAF	CRIT	6	7,845	NA	NA	838	50	DX	57,804	87,610	1,585

TABLE 2.18. (contd)

Proposed Heat Pipe ERO HVAC System Operating Parameters

ID	Fac No	Estimated Boiler Consum.		n	Estimated A/C Consumption		Total Energy (MBtu/yr)
		Fuel Oil (Gal)	On-Peak (kWh/yr)		On-Peak (kWh/yr)	Off-Peak (kWh/yr)	
1	01619	9,398	NA	NA	43,361	65,719	1,677
2	01646	8,172	NA	NA	232,489	352,369	3,130
3	01708	NA	22,944	34,416	188,293	285,384	1,812
4	01724	10,907	NA	NA	39,186	59,392	1,850
5	01726	8,801	NA	NA	398,636	604,188	4,643
6	01728	4,715	NA	NA	69,096	104,728	1,247
7	01732	1,760	NA	NA	369,052	559,349	3,412
8	29100	NA	1,409,899	2,114,848	594,863	901,598	17,132
9	29100R	1,792	NA	NA	90,821	137,652	1,028
10	34706	3,553	NA	NA	108,071	163,797	1,421
11	49639	4,727	NA	NA	233,593	354,042	2,661
12	50801	811	NA	NA	27,544	41,746	349
13	54445	NA	390,497	585,745	138,593	210,057	4,521
14	55005	3,017	NA	NA	62,302	94,427	954
15	55810	11,315	NA	NA	185,864	281,703	3,166
16	55840	6,648	NA	NA	27,849	42,209	1,162
17	56921	2,514	NA	NA	60,322	91,427	867
18	60530	8,178	NA	NA	190,094	288,114	2,767
19	60680	10,140	NA	NA	466,859	707,590	5,415
20	62980	16,878	NA	NA	34,841	52,807	2,642
21	66250	26,292	NA	NA	143,053	216,816	4,877
22	67210	786	NA	NA	12,250	18,567	214
23	67900	6,600	NA	NA	39,540	59,929	1,256
24	67901	3,190	NA	NA	20,075	30,426	615
25	70000	11,240	NA	NA	388,154	588,302	4,892
26	70500	11,579	NA	NA	682,334	1,034,173	7,464
27	81585	1,961	NA	NA	30,669	46,464	535

TABLE 2.18. (contd)

Heat Pipe ERO Savings and Economic Parameters

ID	Fac No	Heat Pipe First Cost (1993 \$)	Boiler Consumption Savings				A/C Consumption Savings			Total Savings		Life-Cycle Cost	
			Fuel Oil (Gal)	Electric (kWh/yr)	Energy (MBtu/yr)	Dollars (\$/yr)	Total (kWh/yr)	Energy (MBtu/yr)	Dollars (\$/yr)	Energy (MBtu/yr)	Dollars (\$/yr)	NPV (1993 \$)	SIR
1	01619	59,800	5,639	NA	783	5,808	65,416	223	2,245	1,006	8,053	99,243	2.66
2	01646	130,000	24,516	NA	3,403	25,252	142,209	485	4,881	3,888	30,133	483,731	4.72
3	01708	92,100	NA	172,080	587	5,908	72,573	248	2,491	835	8,399	72,986	1.79
4	01724	69,400	6,544	NA	908	6,740	75,918	259	2,806	1,167	9,346	115,174	2.66
5	01726	140,000	26,402	NA	3,665	27,194	187,038	638	6,420	4,303	33,614	539,471	4.85
6	01728	75,000	14,144	NA	1,963	14,568	190,145	649	6,527	2,612	21,095	338,184	5.51
7	01732	28,000	5,280	NA	733	5,439	55,252	189	1,897	921	7,335	117,651	5.20
8	29100	452,760	NA	2,114,848	7,216	72,811	429,257	1,465	14,735	8,680	87,346	1,323,149	3.92
9	29100R	28,500	5,375	NA	746	5,536	62,353	213	2,140	959	7,676	123,096	5.32
10	34706	56,520	10,659	NA	1,479	10,979	123,657	422	4,245	1,901	15,223	244,116	5.32
11	49639	75,200	14,182	NA	1,968	14,607	145,531	497	4,985	2,485	19,603	314,414	5.18
12	50801	12,900	2,433	NA	338	2,506	33,131	113	1,137	451	3,643	58,401	5.53
13	54445	66,000	NA	585,745	1,999	20,111	183,282	625	6,291	2,624	26,402	461,078	7.99
14	55005	48,000	9,052	NA	1,256	9,324	105,016	358	3,605	1,615	12,928	207,319	5.32
15	55810	180,000	33,945	NA	4,712	34,964	342,996	1,170	11,774	5,882	46,737	749,662	5.16
16	55840	42,300	3,989	NA	554	4,108	46,273	158	1,588	711	5,697	70,200	2.66
17	56921	40,000	7,543	NA	1,047	7,770	78,221	260	2,616	1,307	10,386	166,592	5.16
18	60530	130,100	24,535	NA	3,405	25,271	152,887	522	5,248	3,927	30,519	489,881	4.77
19	60680	161,300	30,419	NA	4,222	31,331	307,363	1,049	10,551	5,271	41,882	671,780	5.16
20	62980	107,400	10,127	NA	1,406	10,431	102,327	349	3,512	1,755	13,943	189,949	2.58
21	66250	167,300	15,775	NA	2,190	16,248	159,398	544	5,471	2,733	21,720	264,735	2.58
22	67210	12,500	2,357	NA	327	2,428	27,348	93	939	421	3,367	53,989	5.32
23	67900	42,000	3,960	NA	550	4,079	45,945	157	1,577	706	5,656	69,702	2.66
24	67901	20,300	1,914	NA	286	1,972	22,207	76	762	341	2,734	33,689	2.66
25	70000	178,800	33,719	NA	4,680	34,731	340,710	1,163	11,695	5,843	46,426	744,664	5.16
26	70500	184,200	34,737	NA	4,822	35,780	210,223	717	7,216	5,539	42,966	690,179	4.75
27	81585	31,200	5,884	NA	817	6,060	68,280	233	2,343	1,050	8,403	134,757	5.32

2.11 GENERATING PLANT EROs

2.11.1 Peak Savings With Existing Diesel Generators

Description

About 35% of Cape Canaveral AFS's monthly electric bill is demand charges. These charges can be reduced by using existing generators to carry part of the on-site electric load whenever demand approaches the monthly peak (peak savings). The most reliable and effective way to accomplish this is to convert a given generator from emergency service to a power source that can feed back into the distribution system. A generator in a building or other facility served by 480 V three-phase power is generally a good candidate for conversion if the capacity (kilovoltampere[s]) of the existing transformer serving the facility is at least 1.25 times the generator capacity.

The cost per unit energy generated on site is generally higher than the electric utility's on-peak price per unit energy. However, savings can be realized if the average increase in monthly energy cost due to on-site power generation is outweighed by the average reduction in monthly demand charge.

A mix of generator sizes exist at the site. This diversity is useful because it facilitates modulation of the on-post power resource to just maintain the monthly peak demand target that the outside utility sees. It also helps in spreading the load (in terms of annual full-load-equivalent operating hours) equally among the generators.

A frequency synchronizer, capacity control, power factor control, and contractor must be added to convert a generator from emergency service to a power source that can feed back into the distribution system. Additional components, including larger circuit breakers for the generator and other equipment and distribution panels connected to the transformer secondary, must be added in cases where the generator is capable of producing larger fault currents than the existing electric service. The throttle actuator may also have to be replaced to be compatible with the new capacity control system.

Control of generators has to be centrally coordinated by a dedicated network or as part of an EMCS system. The demand at the revenue meter (in this case, sum of demands at the North, South, and Titan Substations) must be

monitored, a monthly peak limit predicted, and a strategy for starting, stopping, and modulating the output of each generator in the system implemented.

Assumptions

The technical assumptions are as follows:

- The generator sizes analyzed for peak shaving are those shown in Tables 2.19 to 2.21. This list does not represent the level of generators that currently exist at the site, but a range of possible options. The cost are for retrofit activities and do not include the cost to purchase additional generators.
- Generators will be controlled to operate at unity power factor. This maximizes the capacity of the generating resource and minimizes fuel needed to prevent the peak demand at the utility meter from exceeding a given target demand. Reductions in reactive power crossing the utility meter are probably best achieved by fixed or switched capacitors, rather than by power factor control of the diesel generators.
- The generators on line at any given time can be modulated to just meet the target demand. This assumption is not very realistic for a one-generator system but is very reasonable for a system consisting of three or more different (by factors of 1.3 to 2) size generators.
- Target demand (monthly peak minus aggregate generator capacity) is correctly predicted each month.
- The full nominal aggregate capacity is always available when needed.

Costs of the ERO are based on the following cost elements:

- The first-year fuel price is \$0.69/gal (diesel). The fuel price in future years will vary according to the NIST schedules that apply to DOD facilities. The engine-generator efficiency is 32% resulting in a conversion factor of 12.9 kWh/gal based on 135,000 HHV Btu/gal. This yields a fuel cost of \$0.054/kWh.
- An example of the costs of controls, switches, sensors, and communications for a system with one 600 kVA generator are tabulated below (Dixon et al. 1993).

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<u>Description</u>	<u>Material (\$)</u>	<u>Labor(\$)</u>	<u>Per</u>	<u>Source</u>
Fused PT (2)	1200	250	2/kVA	Means (1991b)
Current Transformer (3)	1200	150	2/kVA	Means (1991b)
Switch	1900	250	3/kVA	Means (1991b)
Speed Control	3200	600	generator	Woodward Governor
Load and PF Control	2600	500	generator	Woodward Governor
Actuator	1100	250	generator	Woodward Governor
Field Panel	2000	500	site	Novar Controls
Phone Line (3 mi)	3000	-	site	-
Substn kW monitor	8000	2000	system	Novar Controls

Material estimates for phone lines includes labor costs.
Cost estimates are approximate because of unknown conditions.

- The foregoing costs can be partially aggregated so that total implementation cost can be expressed as \$5,500 per generator site plus \$9,000 per generator plus \$7 per generator (480 V three-phase) kVA.
- Maintenance costs include routine service required every 200 to 300 hours of full-load equivalent operation and engine rebuilding every 10,000 to 15,000 hours of full-load equivalent operation. Routine maintenance includes valve lash adjustment and replacement of fluids, filters and belts.
- Maintenance costs for a typical (three-generator) system running 600 full-load-equivalent hours per year (50 h/mo) are given below. The nominal engine overhaul interval is $10,000/600 = 16.7$ years for this system. The costs shown are the rebuilding costs averaged over the expected 16.7-year interval between rebuilds. This simple annualization is conservative because overhauling is a deferred cost that escalates at a lower rate than the site's discount rate (Dixon et al. 1993).

<u>Size (kW)</u>	<u>Cost per Engine-Generator Set</u>		<u>Routine+Rebuild (\$/kWh)</u>
	<u>Routine (\$/yr)</u>	<u>Engine Rebuild (\$/yr)</u>	
600	1018	1854	0.00798
450	796	1396	0.00812
350	645	1090	0.00826

kilowatt-weighted average:

0.00809

- When full-load equivalent operating hours exceed about 100 h/yr the fuel tank refill frequency with many of the existing tanks becomes excessive. For tank sizes of 2000 gal or more, a one-month refill interval and corresponding storage capacity of 0.0065 gal per annual kWh is assumed. For tank sizes under 2000 gal, a two-month refill interval and corresponding storage capacity of 0.013 gal per annual kWh is assumed. This results

in average tank costs of about 2.25/gal for units under 100 kW and \$1.50/gal for units of 100 kW and larger capacity.

- The generators will only peak shave the actual load on site. It is assumed no power will be returned to the FPL grid outside of Cape Canaveral AFS.
- Given the relatively few hours per year operation, the generators life will be 25 years.
- There is no salvage value at the end of the 25 years.
- Peak shaving only occurs during the on-peak time frame.
- Costs associated with obtaining emission permits, if required, are not included in the analysis.

Results

Quantitative results of the ERO analysis are presented in Table 2.19 to Table 2.21. The "boxed" row in each table marks the most LCC-effective option. The economics of the systems, ranging in peak shaving capacity from 200 to 12,000 kW (North Substation), 200 to 6,000 kW (South Substation), and 200 to 5,000 kW (Titan Substation), are presented. Note that this measure does not involve a change in efficiency of existing end-use equipment. The results are therefore presented in terms of costs and savings due to the generator system as configured and operated after the retrofit. (The relatively small energy and O&M costs associated with the existing generators as operated [i.e., during occasional power outages and tests] are considered to be zero.) The results for the most cost-effective option for each substation are discussed below.

Budget Implications. The first cost for the North Substation is estimated to be \$225,050. Likewise, the South Substation first cost is estimated to be \$102,050. Finally, the Titan Substation generator first cost estimate is \$46,060.

Energy, Demand and Cost Savings. Overall energy consumption for the North Substation will increase by 10,527 MBtu, but will result in savings of \$122,885 due to reduced demand charges of 24,000 kW-mo. Similarly for the South Substation, energy use will increase by 4,333 MBtu, but savings will be \$48,839 due to reduced demand charges of 9,600 kW-mo. For the Titan

Substation, energy use will increase by 2,189 MBtu, but savings will be \$24,362 because of reduced demand charges of 4,800 kW-mo.

Energy Security. This ERO has a very positive impact on energy security because it provides an emergency power source that can, in principle, be used anywhere on the existing distribution system. The procedure for an extended power outage would be to have building monitors shut off all but essential, predetermined circuits and to have utility crews shut down street light and domestic water well pumps that don't have backup generators. Well and lift stations equipped with generators that have not been converted to feed the grid would continue to function on generator power.

Operations and Maintenance. The control system will track operating hours of each generator and alert the operator when refueling and maintenance are due. Maintenance is dominated by oil and filter changes and is roughly proportional to kilowatt-hour produced. Maintenance costs are offset to some extent by the labor for testing the converted generators, which is no longer needed. The O&M costs presented in the table do not account for this and are therefore conservative.

Environmental Issues. Extensive operation of the generators may be environmentally objectionable. Environmental permits may need to be obtained if the hours of operation exceed the limits established by the state.

2.11.2 Peak Savings With Natural-Gas Generators

Description

Another option for Cape Canaveral is to consider natural-gas driven generators for the peak shaving operation when natural gas becomes available on site. Just as in the diesel generator analysis, various size natural-gas-driven generators were considered. The sizes ranged from 200 kW up to 12000 kW for the North Substation, 6000 kW for the South Substation and 5000 kW for the Titan Substation.

Assumptions

The technical assumptions are as follows:

- The generators available for peak shaving are those shown in Tables 2.22 through 2.24.

- Generators will be controlled to operate at unity power factor. This maximizes the capacity of the generating resource and minimizes fuel needed to prevent the peak demand at the utility meter from exceeding a given target demand.
- Existing buildings could possibly be used to locate these new natural-gas driven generators. However, for this analysis, a cost of \$60,000 was included to initially set up the generator system associated with each substation.
- The heat rates (British thermal unit per kilowatt-hour [Btu/kWh]) for the generators are as follows (Orlando 1988):

200 kW:	11,170 (Btu/kWh)
400 kW:	10,030 (Btu/kWh)
500 kW:	11,470 (Btu/kWh)
1,000 kW:	10,870 (Btu/kWh)
3,000 kW:	10,290 (Btu/kWh)

- The generators will only peak shave the actual load on site. It is assumed that no power will be returned to the FPL grid outside of Cape Canaveral.
- Given the relatively few hours per year operation, the generators life will be 25 years.
- There is no salvage value at the end of the 25 years.
- Peak shaving only occurs during the on-peak time frame.

The cost assumptions are as follows:

- The cost of the generators were grouped in bins as follows (Somasundaram et al. 1989):

< 400 kW:	\$2,000/kW installed cost
400 kW < x < 1200 kW:	\$1,700/kW installed cost
1200 kW < x < 5000 kW:	\$1,500/kW installed cost

- O&M costs are \$0.015/kWh produced by the generator(s).
- The price of natural gas is assumed to be \$0.43289/therm (the firm price currently being paid by Patrick AFB for natural gas). This also assumes that natural gas becomes available at Cape Canaveral AFS. No costs were included for bringing gas lines to Cape Canaveral AFS.
- The on-peak price of electricity is \$0.03626/kWh.
- The on-peak demand charge is \$6.25/kW.
- Costs associated with obtaining emission permits, if required, were not included in the analysis.

Results

Quantitative results of the ERO analysis are presented in Tables 2.22 to Table 2.24. The economics of the systems, ranging in peak shaving capacity from 200 to 12,000 kW (North Substation), 200 to 6,000 kW (South Substation), and 200 to 5,000 kW (Titan Substation), are presented.

For all three substations range NPV values are negative for all generator sizes consider. This results in all SIR values being less than 1.0. Therefore, none of the possible options are considered cost-effective.

TABLE 2.19. North Substation Diesel Generator Peak Shaving EROs

Existing System Operating Parameters

ID	Location	Total kW	No. of Units	Operating Schedule (Full-Load Equivalent Hrs)		Energy Consumption (kWh)		Sum of Monthly Coincident Demands (kW-mo)		Fuel (MBtu)
				On-Peak	Off-Peak	On-Peak	Off-Peak	On-Peak	Off-Peak	
	North Substation	#N/A	0	#N/A	#N/A	24,443,451	64,939,259	166,313	#N/A	0

Peak-Shaving System Operating Parameters

ID	Location	Generator Facility Makeup (kW)	Total kW	No. of Units	Operating Schedule (Full-Load Equivalent Hrs)		Energy Consumption (kWh)		Sum of Monthly Coincident Demands (kW-mo)		Fuel (MBtu)
					On-Peak	Off-Peak	On-Peak	Off-Peak	On-Peak	Off-Peak	
1	DGEN-1	1-200 kW unit	200	1	167	#N/A	24,410,008	64,939,259	163,913	#N/A	362
2	DGEN-2	2-200 kW units	400	2	332	#N/A	24,310,678	64,939,259	161,513	#N/A	1,439
3	DGEN-3	3-200 kW units	600	3	446	#N/A	24,175,923	64,939,259	159,113	#N/A	2,899
4	DGEN-4	4-200 kW units	800	4	517	#N/A	24,029,798	64,939,259	156,713	#N/A	4,482
5	DGEN-5	5-200 kW units	1,000	5	563	#N/A	23,880,748	64,939,259	154,313	#N/A	6,097
6	DGEN-6	5-200, 1-500 kW units	1,500	6	646	#N/A	23,475,171	64,939,259	148,313	#N/A	10,491
7	DGEN-7	5-200, 2-500 kW units	2,000	7	709	#N/A	23,025,215	64,939,259	142,313	#N/A	15,366
8	DGEN-8	5-200, 3-500 kW units	2,500	8	769	#N/A	22,520,367	64,939,259	136,313	#N/A	20,836
9	DGEN-9	5-200, 4-500 kW units	3,000	9	849	#N/A	21,897,800	64,939,259	130,313	#N/A	27,582
10	DGEN-10	5-200, 5-500 kW units	3,500	10	993	#N/A	20,967,721	64,939,259	124,313	#N/A	37,559
11	DGEN-11	5-200, 6-500 kW unit	4,000	11	1,130	#N/A	19,924,868	64,939,259	118,313	#N/A	48,958
12	DGEN-12	5-200, 6-500, 1-1000 kW units	5,000	12	1,336	#N/A	17,761,199	64,939,259	106,313	#N/A	72,402
13	DGEN-13	5-200, 6-500, 2-1000 kW units	6,000	13	1,474	#N/A	15,597,199	64,939,259	94,313	#N/A	95,848
14	DGEN-14	5-200, 6-500, 2-1000, 1-3000 kW units	9,000	14	1,704	#N/A	9,105,199	64,939,259	58,313	#N/A	166,189
15	DGEN-15	5-200, 6-500, 2-1000, 2-3000 kW units	12,000	15	1,819	#N/A	2,613,199	64,939,259	22,313	#N/A	236,529

Peak-Shaving System Economics

ID	First Cost	Total	O&M (\$/yr)		Life (Yr)	First Year Energy Savings (Costs)						Life Cycle Cost		
	Incremental (\$)	First Cost (\$)	Before	After		Energy (kWh)	Demand (kW-mo)	Fuel (MBtu)	Energy (1993 \$)	Demand (1993 \$)	Fuel (1993 \$)	Net (1993 \$)	NPV \$	SIR
1	25,900	25,900	0	667	25	33,443	2,400	-362	1,213	15,000	-1,852	14,361	187,851	8.25
2	17,300	44,486	0	2,450	25	132,773	4,800	-1,439	4,814	30,000	-7,353	27,462	326,108	8.33
3	22,713	66,506	0	5,426	25	267,529	7,200	-2,899	9,701	45,000	-14,815	39,885	417,503	7.09
4	26,305	96,230	0	9,493	25	413,653	9,600	-4,482	14,999	60,000	-22,907	52,092	480,029	5.99
5	29,941	127,616	0	14,802	25	562,703	12,000	-8,097	20,404	75,000	-31,162	64,242	520,067	5.08
6	39,524	171,075	0	23,910	25	966,280	18,000	-10,491	35,110	112,500	-53,622	93,988	688,602	5.03
7	49,586	225,025	0	36,612	25	1,418,236	24,000	-15,366	51,425	150,000	-78,540	122,885	766,485	4.41
8	60,471	290,394	0	53,631	25	1,923,065	30,000	-20,836	69,731	187,500	-106,498	150,734	732,564	3.52
9	73,122	369,555	0	77,481	25	2,545,652	36,000	-27,582	92,305	225,000	-140,974	176,331	508,333	2.38
10	89,313	485,934	0	115,593	25	3,475,730	42,000	-37,659	126,030	282,500	-192,481	196,049	-157,785	0.68
11	107,196	623,477	0	163,787	25	4,518,583	48,000	-48,958	163,844	300,000	-250,232	213,612	-1,070,275	-0.72
12	146,516	832,956	0	241,336	25	6,682,253	60,000	-72,402	242,298	375,000	-370,053	247,245	-2,584,026	-2.10
13	185,766	1,081,695	0	329,036	25	8,846,253	72,000	-95,848	320,785	450,000	-489,892	280,873	-4,297,971	-2.97
14	303,711	1,574,323	0	488,711	25	15,338,253	108,000	-166,189	556,165	675,000	-849,409	381,758	-7,576,234	-3.81
15	420,929	2,184,169	0	675,555	25	21,830,253	144,000	-236,529	791,565	900,000	-1,208,926	482,639	-11,399,759	-4.22

TABLE 2.20. South Substation Diesel Generator Peak Shaving EROs

Existing System Operating Parameters

ID	Location	Total kW	No. of Units	Operating Schedule (Full-Load Equivalent Hrs)		Energy Consumption (kWh)		Sum of Monthly Coincident Demands (kW-mo)		Fuel (MBtu)
				On-Peak	Off-Peak	On-Peak	Off-Peak	On-Peak	Off-Peak	
	South Substation	#N/A	0	0	#N/A	14,784,466	41,992,322	107,073	#N/A	0

Peak-Shaving System Operating Parameters

ID	Location	Generator Facility Makeup (kW)	Total kW	No. of Units	Operating Schedule (Full-Load Equivalent Hrs)		Energy Consumption (kWh)		Sum of Monthly Coincident Demands (kW-mo)		Fuel (MBtu)
					On-Peak	Off-Peak	On-Peak	Off-Peak	On-Peak	Off-Peak	
1	DGEN-1	1-200 kW unit	200	1	361	#N/A	14,712,249	41,992,322	104,673	#N/A	782
2	DGEN-2	2-200 kW units	400	2	532	#N/A	14,571,796	41,992,322	102,273	#N/A	2,304
3	DGEN-3	3-200 kW units	600	3	637	#N/A	14,402,438	41,992,322	99,873	#N/A	4,139
4	DGEN-4	4-200 kW units	800	4	730	#N/A	14,200,681	41,992,322	97,473	#N/A	6,325
5	DGEN-5	5-200 kW units	1000	5	830	#N/A	13,954,065	41,992,322	95,073	#N/A	8,997
6	DGEN-6	5-200, 1-500 kW units	1500	6	1230	#N/A	12,939,352	41,992,322	89,073	#N/A	19,992
7	DGEN-7	5-200, 2-500 kW units	2000	7	1464	#N/A	11,857,352	41,992,322	83,073	#N/A	31,715
8	DGEN-8	5-200, 3-500 kW units	2500	8	1604	#N/A	10,775,352	41,992,322	77,073	#N/A	43,438
9	DGEN-9	5-200, 4-500 kW units	3000	9	1697	#N/A	9,693,352	41,992,322	71,073	#N/A	55,162
10	DGEN-10	5-200, 5-500 kW units	3500	10	1764	#N/A	8,611,352	41,992,322	65,073	#N/A	66,885
11	DGEN-11	5-200, 6-500 kW unit	4000	11	1814	#N/A	7,529,352	41,992,322	59,073	#N/A	78,609
12	DGEN-12	5-200, 6-500, 1-1000 kW units	5000	12	1884	#N/A	5,365,352	41,992,322	47,073	#N/A	102,055
13	DGEN-13	5-200, 6-500, 2-1000 kW units	6000	13	1931	#N/A	3,201,352	41,992,322	35,073	#N/A	125,502

Peak-Shaving System Economics

ID	First Cost Incremental (\$)	Total First Cost (\$)	O&M (\$/yr)		Life (Yr)	First Year Energy Savings (Costs)						Life Cycle Cost		
			Before	After		Energy (kWh)	Demand (kW-mo)	Fuel (MBtu)	Energy (1993 \$)	Demand (1993 \$)	Fuel (1993 \$)	Net (1993 \$)	NPV \$	SIR
1	25,900	25,900	0	719	25	72,217	2,400	-782	2,619	15,000	-3,999	13,619	158,634	7.12
2	17,300	45,263	0	2,860	25	212,670	4,800	-2,304	7,711	30,000	-11,777	25,934	260,761	6.76
3	24,430	71,336	0	6,475	25	382,028	7,200	-4,139	13,852	45,000	-21,156	37,696	315,879	5.43
4	28,857	102,150	0	11,938	25	583,785	9,600	-6,325	21,168	60,000	-32,329	48,839	318,008	4.11
5	33,956	138,498	0	19,888	25	830,401	12,000	-8,997	30,110	75,000	-45,986	59,124	248,927	2.80
6	52,677	201,018	0	43,102	25	1,845,114	18,000	-19,992	66,904	112,500	-102,180	77,224	-185,726	0.08
7	72,219	283,732	0	72,636	25	2,927,114	24,000	-31,715	106,137	150,000	-162,099	94,038	-779,559	-1.75
8	91,762	385,989	0	108,599	25	4,009,114	30,000	-43,438	145,370	187,500	-222,019	110,852	-1,493,354	-2.87
9	111,304	507,789	0	151,562	25	5,091,114	36,000	-55,162	184,604	225,000	-281,938	127,666	-2,336,063	-3.60
10	129,774	669,049	0	201,773	25	6,173,114	42,000	-66,885	223,837	262,500	-341,858	144,479	-3,331,439	-3.98
11	148,244	848,780	0	259,352	25	7,255,114	48,000	-78,609	263,070	300,000	-401,777	161,293	-4,460,410	-4.26
12	187,569	1,099,321	0	336,413	25	9,419,114	60,000	-102,055	341,537	375,000	-521,616	194,921	-6,014,260	-4.47
13	226,819	1,386,113	0	426,973	25	11,583,114	72,000	-125,502	420,004	450,000	-641,455	228,548	-7,818,240	-4.63

TABLE 2.21. Titan Substation Diesel Generator Peak Shaving EROs

Existing System Operating Parameters

ID	Location	Total kW	No. of Units	Operating Schedule (Full-Load Equivalent Hrs)		Energy Consumption (kWh)		Sum of Monthly Coincident Demands (kW-mo)		Fuel (MBtu)
				On-Peak	Off-Peak	On-Peak	Off-Peak	On-Peak	Off-Peak	
0	Titan Substation	#N/A	0	0	#N/A	11,979,586	33,934,454	79,877	#N/A	0

Peak-Shaving System Operating Parameters

ID	Location	Generator Facility Makeup (kW)	Total kW	No. of Units	Operating Schedule (Full-Load Equivalent Hrs)		Energy Consumption (kWh)		Sum of Monthly Coincident Demands (kW-mo)		Fuel (MBtu)
					On-Peak	Off-Peak	On-Peak	Off-Peak	On-Peak	Off-Peak	
1	DGEN-1	1-200 kW unit	200	1	461	#N/A	11,887,486	33,934,454	77,477	#N/A	998
2	DGEN-2	2-200 kW units	400	2	737	#N/A	11,684,693	33,934,454	75,077	#N/A	3,195
3	DGEN-3	3-200 kW units	600	3	905	#N/A	11,436,369	33,934,454	72,677	#N/A	5,886
4	DGEN-4	4-200 kW units	800	4	1,047	#N/A	11,142,164	33,934,454	70,277	#N/A	9,073
5	DGEN-5	5-200 kW units	1,000	5	1,214	#N/A	10,765,306	33,934,454	67,877	#N/A	13,157
6	DGEN-6	5-200, 1-500 kW units	1,500	6	1,517	#N/A	9,704,471	33,934,454	61,877	#N/A	24,651
7	DGEN-7	5-200, 2-500 kW units	2,000	7	1,679	#N/A	8,622,471	33,934,454	55,877	#N/A	36,374
8	DGEN-8	5-200, 3-500 kW units	2,500	8	1,776	#N/A	7,540,471	33,934,454	49,877	#N/A	48,097
9	DGEN-9	5-200, 4-500 kW units	3,000	9	1,840	#N/A	6,458,471	33,934,454	43,877	#N/A	59,821
10	DGEN-10	5-200, 5-500 kW units	3,500	10	1,887	#N/A	5,376,471	33,934,454	37,877	#N/A	71,544
11	DGEN-11	5-200, 6-500 kW unit	4,000	11	1,921	#N/A	4,294,471	33,934,454	31,877	#N/A	83,268
12	DGEN-12	5-200, 6-500, 1-1000 kW units	5,000	12	1,970	#N/A	2,130,471	33,934,454	19,877	#N/A	106,714

Peak-Shaving System Economics

First Year Energy Savings (Costs)														Life Cycle Cost	
ID	First Cost Incremental (\$)	Total First Cost (\$)	O&M (\$/Yr)		Life (Yr)	Energy (kWh)	Demand (kW-mo)	Fuel (MBtu)	Energy (1993 \$)	Demand (1993 \$)	Fuel (1993 \$)	Net (1993 \$)	NPV \$	SIR	
			Before	After											
1	25,900	25,900	0	916	25	92,101	2,400	-998	3,340	15,000	-5,100	13,239	143,652	6.55	
2	17,300	46,060	0	3,966	25	294,894	4,800	-3,195	10,693	30,000	-16,331	24,362	193,513	5.20	
3	26,848	75,317	0	9,208	25	543,217	7,200	-5,886	19,697	45,000	-30,083	34,615	172,814	3.29	
4	32,661	110,833	0	17,125	25	837,422	9,600	-9,073	30,365	60,000	-46,375	43,990	76,604	1.69	
5	39,714	154,202	0	29,082	25	1,214,280	12,000	-13,157	44,030	75,000	-67,245	51,785	-139,989	0.09	
6	59,127	223,619	0	53,147	25	2,275,115	18,000	-24,651	82,496	112,500	-125,992	69,003	-622,416	-1.78	
7	78,669	312,784	0	83,307	25	3,357,115	24,000	-36,374	121,729	150,000	-185,912	85,817	-1,232,473	-2.94	
8	98,212	421,491	0	120,247	25	4,439,115	30,000	-48,097	160,962	187,500	-245,831	102,631	-1,967,987	-3.67	
9	117,754	549,741	0	164,364	25	5,521,115	36,000	-59,821	200,196	225,000	-305,751	119,445	-2,835,162	-4.16	
10	136,224	717,451	0	215,828	25	6,603,115	42,000	-71,544	239,429	262,500	-365,671	136,258	-3,856,575	-4.38	
11	154,694	903,831	0	274,724	25	7,685,115	48,000	-83,268	278,662	300,000	-425,590	153,072	-5,012,563	-4.55	
12	194,019	1,160,623	0	351,771	25	9,849,115	60,000	-106,714	357,129	375,000	-545,429	166,700	-6,572,651	-4.66	

TABLE 2.22. North Substation Natural-Gas Generator Peak Shaving EROs

Existing System Operating Parameters

ID	Location	kW	No. of Units	Operating Schedule (Full-Load Equivalent Hrs)		Energy Consumption (kWh)		Sum of Monthly Coincident Demand (kW-mo)		Fuel (MBtu)
				On-Peak	Off-Peak	On-Peak	Off-Peak	On-Peak	Off-Peak	
	North Substation	0	0	0	#N/A	24,443,451	84,939,259	166,313	#N/A	0

Peak-Shaving System Operating Parameters

ID	Config Code	Generator Facility Makeup (kW)	kW	No. of Units	Operating Schedule (Full-Load Equivalent Hrs)		Energy Consumption (kWh)		Sum of Monthly Coincident Demand (kW-mo)		Fuel (MBtu)
					On-Peak	Off-Peak	On-Peak	Off-Peak	On-Peak	Off-Peak	
1	NG-GEN-1	1-200 kW unit	200	1	167	#N/A	24,410,008	84,939,259	163,913	#N/A	374
2	NG-GEN-2	2-200 kW units	400	2	332	#N/A	24,310,678	84,939,259	161,513	#N/A	1,483
3	NG-GEN-3	3-200 kW units	600	3	446	#N/A	24,175,923	84,939,259	159,113	#N/A	2,988
4	NG-GEN-4	4-200 kW units	800	4	517	#N/A	24,029,798	84,939,259	156,713	#N/A	4,621
5	NG-GEN-5	5-200 kW units	1,000	5	563	#N/A	23,880,748	84,939,259	154,313	#N/A	6,285
6	NG-GEN-6	5-200, 1-500 kW units	1,500	6	646	#N/A	23,475,171	84,939,259	148,313	#N/A	10,864
7	NG-GEN-7	5-200, 2-500 units	2,000	7	709	#N/A	23,025,215	84,939,259	142,313	#N/A	15,963
8	NG-GEN-8	5-200, 3-500 units	2,500	8	769	#N/A	22,520,367	84,939,259	136,313	#N/A	21,697
9	NG-GEN-9	5-200, 4-500 units	3,000	9	849	#N/A	21,897,800	84,939,259	130,313	#N/A	28,774
10	NG-GEN-10	5-200, 5-500 units	3,500	10	993	#N/A	20,967,721	84,939,259	124,313	#N/A	39,345
11	NG-GEN-11	5-200, 6-500 units	4,000	11	1,130	#N/A	19,924,868	84,939,259	118,313	#N/A	51,212
12	NG-GEN-12	5-200, 6-500, 1-1000 units	5,000	12	1,336	#N/A	17,761,199	84,939,259	106,313	#N/A	75,476
13	NG-GEN-13	5-200, 6-500, 2-1000 units	6,000	13	1,474	#N/A	15,597,199	84,939,259	94,313	#N/A	99,629
14	NG-GEN-14	5-200, 6-500, 2-1000, 1-3000 units	9,000	14	1,704	#N/A	9,105,199	84,939,259	58,313	#N/A	171,679
15	NG-GEN-15	5-200, 6-500, 2-1000, 2-3000 units	12,000	15	1,819	#N/A	2,613,199	84,939,259	22,313	#N/A	243,029
4a	NG-GEN-4	2-400 kW units	800	2	517	#N/A	24,029,798	84,939,259	156,713	#N/A	4,149
5a	NG-GEN-5	2-500 kW units	1,000	2	563	#N/A	23,880,748	84,939,259	154,313	#N/A	6,454
6a	NG-GEN-6	3-500 kW units	1,500	3	646	#N/A	23,475,171	84,939,259	148,313	#N/A	11,106
7a	NG-GEN-7	2-1000 kW units	2,000	2	709	#N/A	23,025,215	84,939,259	142,313	#N/A	15,416
8a	NG-GEN-8	2-1000, 1-500 kW	2,500	3	769	#N/A	22,520,367	84,939,259	136,313	#N/A	21,289
9a	NG-GEN-9	3-1000 kW units	3,000	3	849	#N/A	21,897,800	84,939,259	130,313	#N/A	27,671
10a	NG-GEN-10	3-1000, 1-500 kW units	3,500	4	993	#N/A	20,967,721	84,939,259	124,313	#N/A	38,303
11a	NG-GEN-11	4-1000 kW units	4,000	4	1,130	#N/A	19,924,868	84,939,259	118,313	#N/A	49,117
12a	NG-GEN-12	5-1000 kW units	5,000	5	1,336	#N/A	17,761,199	84,939,259	106,313	#N/A	72,636
13a	NG-GEN-13	2-3000 kW units	6,000	2	1,474	#N/A	15,597,199	84,939,259	94,313	#N/A	91,028
14a	NG-GEN-14	3-3000 kW units	9,000	3	1,704	#N/A	9,105,199	84,939,259	58,313	#N/A	157,831
15a	NG-GEN-15	4-3000 kW units	12,000	4	1,819	#N/A	2,613,199	84,939,259	22,313	#N/A	224,633

Peak-Shaving System Economics

First Year Energy Savings (Costs)														Life Cycle Cost	
ID	First Cost (\$)	First Cost (\$)	O&M (\$/yr)		Life (Yr)	Energy (kWh)	Demand (kW-mo)	Fuel (MBtu)	Energy (1993 \$)	Demand (1993 \$)	Fuel (1993 \$)	Net (1993 \$)	NPV	SIR	
			Before	After									\$		
1	460,000	460,000	0	502	25	33,443	2,400	-374	1,213	15,000	-1,817	14,596	-242,396	0.47	
2	400,000	860,000	0	1,992	25	132,773	4,800	-1,483	4,814	30,000	-6,420	28,394	-468,848	0.46	
3	400,000	1,260,000	0	4,013	25	267,529	7,200	-2,988	9,701	45,000	-12,936	41,765	-713,911	0.43	
4	400,000	1,660,000	0	6,205	25	413,653	9,600	-4,621	14,999	60,000	-20,002	54,997	-968,231	0.42	
5	400,000	2,060,000	0	8,441	25	562,703	12,000	-6,285	20,404	75,000	-27,209	68,195	-1,224,419	0.41	
6	850,000	2,910,000	0	14,524	25	968,280	18,000	-10,864	35,110	112,500	-47,030	100,580	-1,740,175	0.40	
7	850,000	3,760,000	0	21,274	25	1,418,236	24,000	-15,963	51,425	150,000	-69,103	132,322	-2,286,431	0.39	
8	850,000	4,610,000	0	28,846	25	1,923,085	30,000	-21,697	69,731	187,500	-93,925	163,306	-2,869,626	0.38	
9	850,000	5,460,000	0	38,185	25	2,545,652	36,000	-28,774	92,305	225,000	-124,561	192,744	-3,530,446	0.35	
10	850,000	6,310,000	0	52,136	25	3,475,730	42,000	-39,345	126,030	262,500	-170,322	218,208	-4,392,720	0.30	
11	850,000	7,160,000	0	67,779	25	4,518,583	48,000	-51,212	163,844	300,000	-221,692	242,152	-5,330,151	0.26	
12	1,700,000	8,860,000	0	100,234	25	6,682,253	60,000	-75,476	242,298	375,000	-326,728	290,570	-7,224,879	0.18	
13	1,700,000	10,560,000	0	132,694	25	8,846,253	72,000	-99,629	320,765	450,000	-431,285	339,480	-9,109,749	0.14	
14	4,500,000	15,060,000	0	230,074	25	15,338,253	108,000	-171,679	556,165	675,000	-743,181	487,984	-14,128,339	0.06	
15	4,500,000	19,560,000	0	327,454	25	21,830,253	144,000	-243,029	791,565	900,000	-1,052,048	639,517	-19,085,452	0.02	
4a	1,360,000	1,420,000	0	6,205	25	413,653	9,600	-4,149	14,999	60,000	-17,960	57,039	-886,792	0.52	
5a	1,700,000	1,700,000	0	8,441	25	562,703	12,000	-6,454	20,404	75,000	-27,940	67,464	-879,253	0.48	
6a	2,550,000	2,550,000	0	14,524	25	968,280	18,000	-11,106	35,110	112,500	-48,078	99,532	-1,401,447	0.45	
7a	3,400,000	3,400,000	0	21,274	25	1,418,236	24,000	-15,416	51,425	150,000	-66,735	134,690	-1,878,359	0.45	
8a	4,250,000	4,250,000	0	28,846	25	1,923,085	30,000	-21,289	69,731	187,500	-92,156	165,075	-2,473,715	0.42	
9a	5,100,000	5,100,000	0	38,185	25	2,545,652	36,000	-27,671	92,305	225,000	-119,786	197,519	-3,073,507	0.40	
10a	5,950,000	5,950,000	0	52,136	25	3,475,730	42,000	-38,303	126,030	262,500	-165,808	222,722	-3,941,090	0.34	
11a	6,800,000	6,800,000	0	67,779	25	4,518,583	48,000	-49,117	163,844	300,000	-212,623	251,221	-4,786,051	0.30	
12a	8,500,000	8,500,000	0	100,234	25	6,682,253	60,000	-72,636	242,298	375,000	-314,434	302,864	-6,615,313	0.22	
13a	9,000,000	9,000,000	0	132,694	25	8,846,253	72,000	-91,028	320,765	450,000	-394,051	376,714	-6,793,897	0.25	
14a	13,500,000	13,500,000	0	230,074	25	15,338,253	108,000	-157,831	556,165	675,000	-683,233	547,932	-11,351,401	0.16	
15a	18,000,000	18,000,000	0	327,454	25	21,830,253	144,000	-224,633	791,565	900,000	-972,415	719,150	-15,908,906	0.12	

TABLE 2.23. South Substation Natural-Gas Generator Peak Shaving EROs

Existing System Operating Parameters

ID	Location	kW	No. of Units	Operating Schedule (Full-Load Equivalent Hrs)		Energy Consumption (kWh)		Sum of Monthly Coincident Demand (kW-mo)		Fuel (MBtu)
				On-Peak	Off-Peak	On-Peak	Off-Peak	On-Peak	Off-Peak	
	South Substation	0	0	0	#N/A	14,784,466	41,992,322	107,073	#N/A	0

Peak-Shaving System Operating Parameters

ID	Config Code	Generator Facility Makeup (kW)	kW	No. of Units	Operating Schedule (Full-Load Equivalent Hrs)		Energy Consumption (kWh)		Sum of Monthly Coincident Demand (kW-mo)		Fuel (MBtu)
					On-Peak	Off-Peak	On-Peak	Off-Peak	On-Peak	Off-Peak	
1	NG-GEN-1	1-200 kW unit	200	1	361	#N/A	14,712,249	41,992,322	104,673	#N/A	807
2	NG-GEN-2	2-200 kW units	400	2	532	#N/A	14,571,796	41,992,322	102,273	#N/A	2,376
3	NG-GEN-3	3-200 kW units	600	3	637	#N/A	14,402,438	41,992,322	99,873	#N/A	4,267
4	NG-GEN-4	4-200 kW units	800	4	730	#N/A	14,200,681	41,992,322	97,473	#N/A	6,521
5	NG-GEN-5	5-200 kW units	1,000	5	830	#N/A	13,954,065	41,992,322	95,073	#N/A	9,276
6	NG-GEN-6	5-200, 1-500 kW	1,500	6	1,230	#N/A	12,939,352	41,992,322	89,073	#N/A	20,702
7	NG-GEN-7	5-200, 2-500 units	2,000	7	1,464	#N/A	11,857,352	41,992,322	83,073	#N/A	32,947
8	NG-GEN-8	5-200, 3-500 units	2,500	8	1,604	#N/A	10,775,352	41,992,322	77,073	#N/A	45,233
9	NG-GEN-9	5-200, 4-500 units	3,000	9	1,697	#N/A	9,693,352	41,992,322	71,073	#N/A	57,547
10	NG-GEN-10	5-200, 5-500 units	3,500	10	1,764	#N/A	8,611,352	41,992,322	65,073	#N/A	69,880
11	NG-GEN-11	5-200, 6-500 units	4,000	11	1,814	#N/A	7,529,352	41,992,322	59,073	#N/A	82,227
12	NG-GEN-12	5-200, 6-500, 1-1000 units	5,000	12	1,884	#N/A	5,365,352	41,992,322	47,073	#N/A	106,389
13	NG-GEN-13	5-200, 6-500, 2-1000 units	6,000	13	1,931	#N/A	3,201,352	41,992,322	35,073	#N/A	130,453
4a	NG-GEN-4	2-400 kW units	800	2	730	#N/A	14,200,681	41,992,322	97,473	#N/A	5,855
5a	NG-GEN-5	2-500 kW units	1,000	2	830	#N/A	13,954,065	41,992,322	95,073	#N/A	9,525
6a	NG-GEN-6	3-500 kW units	1,500	3	1,230	#N/A	12,939,352	41,992,322	89,073	#N/A	21,163
7a	NG-GEN-7	2-1000 kW units	2,000	2	1,464	#N/A	11,857,352	41,992,322	83,073	#N/A	31,818
8a	NG-GEN-8	2-1000, 1-500 kW units	2,500	3	1,604	#N/A	10,775,352	41,992,322	77,073	#N/A	44,381
9a	NG-GEN-9	3-1000 kW units	3,000	3	1,697	#N/A	9,693,352	41,992,322	71,073	#N/A	55,340
10a	NG-GEN-10	3-1000, 1-500 kW units	3,500	4	1,764	#N/A	8,611,352	41,992,322	65,073	#N/A	68,028
11a	NG-GEN-11	4-1000 kW units	4,000	4	1,814	#N/A	7,529,352	41,992,322	59,073	#N/A	78,863
12a	NG-GEN-12	5-1000 kW units	5,000	5	1,884	#N/A	5,365,352	41,992,322	47,073	#N/A	102,386
13a	NG-GEN-13	2-3000 kW units	6,000	2	1,931	#N/A	3,201,352	41,992,322	35,073	#N/A	119,190

Peak-Shaving System Economics

ID	First Cost (\$)		O&M (\$/Yr)		Life (Yr)	First Year Energy Savings (Costs)						Life Cycle Cost		
	Incremental		Before	After		Energy (kWh)	Demand (kW-mo)	Fuel (MBtu)	Energy (1993 \$)	Demand (1993 \$)	Fuel (1993 \$)	Net (1993 \$)	NPV \$	SIR
1	460,000	460,000	0	1,083	25	72,217	2,400	-807	2,619	15,000	-5,566	12,053	-267,146	0.42
2	400,000	860,000	0	3,190	25	212,670	4,800	-2,376	7,711	30,000	-16,391	21,320	-517,846	0.40
3	400,000	1,260,000	0	5,730	25	382,028	7,200	-4,267	13,852	45,000	-29,444	29,408	-786,995	0.38
4	400,000	1,660,000	0	8,757	25	583,785	9,600	-6,521	21,168	60,000	-44,994	36,174	-1,076,825	0.35
5	400,000	2,060,000	0	12,456	25	830,401	12,000	-9,276	30,110	75,000	-64,002	41,109	-1,395,288	0.32
6	850,000	2,910,000	0	27,677	25	1,845,114	18,000	-20,702	66,904	112,500	-142,845	36,559	-2,303,703	0.21
7	850,000	3,760,000	0	43,907	25	2,927,114	24,000	-32,947	106,137	150,000	-227,333	28,805	-3,260,901	0.13
8	850,000	4,610,000	0	60,137	25	4,009,114	30,000	-45,233	145,370	187,500	-312,107	20,764	-4,221,744	0.08
9	850,000	5,460,000	0	76,367	25	5,091,114	36,000	-57,547	184,604	225,000	-397,071	12,533	-5,185,018	0.05
10	850,000	6,310,000	0	92,597	25	6,173,114	42,000	-69,880	223,837	262,500	-482,170	4,168	-6,149,994	0.03
11	850,000	7,160,000	0	108,827	25	7,255,114	48,000	-82,227	263,070	300,000	-567,365	-4,295	-7,116,207	0.01
12	1,700,000	8,860,000	0	141,287	25	9,419,114	60,000	-106,389	341,537	375,000	-734,083	-17,546	-9,001,858	-0.02
13	1,700,000	10,560,000	0	173,747	25	11,583,114	72,000	-130,453	420,004	450,000	-900,123	-30,119	-10,878,865	-0.03
4a	1,360,000	1,420,000	0	8,757	25	583,785	9,600	-5,855	21,168	60,000	-40,402	40,766	-778,342	0.45
5a	1,700,000	1,700,000	0	12,456	25	830,401	12,000	-9,525	30,110	75,000	-65,720	39,390	-1,057,180	0.38
6a	2,550,000	2,550,000	0	27,677	25	1,845,114	18,000	-21,163	66,904	112,500	-146,028	33,376	-1,984,239	0.22
7a	3,400,000	3,400,000	0	43,907	25	2,927,114	24,000	-31,818	106,137	150,000	-219,542	36,595	-2,801,685	0.18
8a	4,250,000	4,250,000	0	60,137	25	4,009,114	30,000	-44,381	145,370	187,500	-306,228	26,642	-3,786,879	0.11
9a	5,100,000	5,100,000	0	76,367	25	5,091,114	36,000	-55,340	184,604	225,000	-381,849	27,755	-4,631,149	0.09
10a	5,950,000	5,950,000	0	92,597	25	6,173,114	42,000	-68,028	223,837	262,500	-469,391	16,946	-5,627,252	0.05
11a	6,800,000	6,800,000	0	108,827	25	7,255,114	48,000	-78,863	263,070	300,000	-544,155	18,915	-6,460,613	0.05
12a	8,500,000	8,500,000	0	141,287	25	9,419,114	60,000	-102,386	341,537	375,000	-706,462	10,075	-8,290,077	0.02
13a	9,000,000	9,000,000	0	173,747	25	11,583,114	72,000	-119,190	420,004	450,000	-822,413	47,591	-8,329,167	0.07

TABLE 2.24. Titan Substation Natural-Gas Generator Peak Shaving EROs

Existing System Operating Parameters

ID	Location	kW	No. of Units	Operating Schedule (Full-Load Equivalent Hrs)		Energy Consumption (kWh)		Sum of Monthly Coincident Demand (kW-mo)		Fuel (MBtu)
				On-Peak	Off-Peak	On-Peak	Off-Peak	On-Peak	Off-Peak	
	Titan Substation	0	0	0	#N/A	11,979,586	33,934,454	79,877	#N/A	0

Peak-Shaving System Operating Parameters

ID	Config Code	Generator Facility Makeup (kW)	kW	No. of Units	Operating Schedule (Full-Load Equivalent Hrs)		Energy Consumption (kWh)		Sum of Monthly Coincident Demand (kW-mo)		Fuel (MBtu)
					On-Peak	Off-Peak	On-Peak	Off-Peak	On-Peak	Off-Peak	
1	NG-GEN-1	1-200 kW unit	200	1	481	#N/A	11,887,486	33,934,454	77,477	#N/A	1,029
2	NG-GEN-2	2-200 kW units	400	2	737	#N/A	11,684,693	33,934,454	75,077	#N/A	3,294
3	NG-GEN-3	3-200 kW units	600	3	905	#N/A	11,436,369	33,934,454	72,677	#N/A	6,068
4	NG-GEN-4	4-200 kW units	800	4	1,047	#N/A	11,142,164	33,934,454	70,277	#N/A	9,354
5	NG-GEN-5	5-200 kW units	1,000	5	1,214	#N/A	10,765,308	33,934,454	67,877	#N/A	13,564
6	NG-GEN-6	5-200, 1-500 kW	1,500	6	1,517	#N/A	9,704,471	33,934,454	61,877	#N/A	25,527
7	NG-GEN-7	5-200, 2-500 kW units	2,000	7	1,679	#N/A	8,622,471	33,934,454	55,877	#N/A	37,787
8	NG-GEN-8	5-200, 3-500 kW units	2,500	8	1,776	#N/A	7,540,471	33,934,454	49,877	#N/A	50,084
9	NG-GEN-9	5-200, 4-500 kW units	3,000	9	1,840	#N/A	6,458,471	33,934,454	43,877	#N/A	62,407
10	NG-GEN-10	5-200, 5-500 kW units	3,500	10	1,887	#N/A	5,376,471	33,934,454	37,877	#N/A	74,747
11	NG-GEN-11	5-200, 6-500 kW units	4,000	11	1,921	#N/A	4,294,471	33,934,454	31,877	#N/A	87,100
12	NG-GEN-12	5-200, 6-500, 1-1000 kW units	5,000	12	1,970	#N/A	2,130,471	33,934,454	19,877	#N/A	111,246
4a	NG-GEN-4	2-400 kW units	800	2	1,047	#N/A	11,142,164	33,934,454	70,277	#N/A	8,399
5a	NG-GEN-5	2-500 kW units	1,000	2	1,214	#N/A	10,765,308	33,934,454	67,877	#N/A	13,928
6a	NG-GEN-6	3-500 kW units	1,500	3	1,517	#N/A	9,704,471	33,934,454	61,877	#N/A	26,096
7a	NG-GEN-7	2-1000 kW units	2,000	2	1,679	#N/A	8,622,471	33,934,454	55,877	#N/A	36,492
8a	NG-GEN-8	2-1000, 1-500 kW units	2,500	3	1,776	#N/A	7,540,471	33,934,454	49,877	#N/A	49,141
9a	NG-GEN-9	3-1000 kW units	3,000	3	1,840	#N/A	6,458,471	33,934,454	43,877	#N/A	60,015
10a	NG-GEN-10	3-1000, 1-500 kW units	3,500	4	1,887	#N/A	5,376,471	33,934,454	37,877	#N/A	72,766
11a	NG-GEN-11	4-1000 kW units	4,000	4	1,921	#N/A	4,294,471	33,934,454	31,877	#N/A	83,537
12a	NG-GEN-12	5-1000 kW units	5,000	5	1,970	#N/A	2,130,471	33,934,454	19,877	#N/A	107,060

Peak-Shaving System Economics

ID	First Cost (\$)	First Cost (\$)	O&M (\$/yr)		Life (Yr)	First Year Energy Savings (Costs)						Life Cycle Cost		
	Incremental		Before	After		Energy (kWh)	eman (kW-mo)	Fuel (MBtu)	Energy (1993 \$)	Demand (1993 \$)	Fuel (1993 \$)	Net (1993 \$)	NPV \$	SIR
1	460,000	460,000	0	1,382	25	92,101	2,400	-1,029	3,340	15,000	-4,453	13,886	-279,837	J.39
2	400,000	860,000	0	4,423	25	294,894	4,800	-3,294	10,693	30,000	-14,259	26,434	-570,328	0.34
3	400,000	1,260,000	0	8,148	25	543,217	7,200	-6,068	19,697	45,000	-26,267	38,430	-889,881	0.29
4	400,000	1,660,000	0	12,561	25	837,422	9,600	-9,354	30,365	60,000	-40,493	49,872	-1,238,720	0.25
5	400,000	2,060,000	0	18,214	25	1,214,280	12,000	-13,564	44,030	75,000	-58,715	60,315	-1,640,315	0.20
6	850,000	2,910,000	0	34,127	25	2,275,115	18,000	-25,527	82,496	112,500	-110,503	84,493	-2,580,059	0.11
7	850,000	3,760,000	0	50,357	25	3,357,115	24,000	-37,787	121,729	150,000	-163,575	108,154	-3,538,806	0.08
8	850,000	4,610,000	0	66,587	25	4,439,115	30,000	-50,084	160,962	187,500	-216,810	131,652	-4,500,462	0.02
9	850,000	5,460,000	0	82,817	25	5,521,115	36,000	-62,407	200,196	225,000	-270,154	155,042	-5,464,523	0.00
10	850,000	6,310,000	0	99,047	25	6,603,115	42,000	-74,747	239,429	262,500	-323,573	178,356	-6,430,128	-0.02
11	850,000	7,160,000	0	115,277	25	7,685,115	48,000	-87,100	278,662	300,000	-377,048	201,614	-7,396,857	-0.03
12	1,700,000	8,860,000	0	147,737	25	9,849,115	60,000	-111,246	357,129	375,000	-481,572	250,557	-9,281,048	-0.05
4a	1,360,000	1,420,000	0	12,561	25	837,422	9,600	-8,399	30,365	60,000	-36,360	54,005	-914,827	0.36
5a	1,700,000	1,700,000	0	18,214	25	1,214,280	12,000	-13,928	44,030	75,000	-60,292	58,738	-1,312,327	0.23
6a	2,550,000	2,550,000	0	34,127	25	2,275,115	18,000	-26,096	82,496	112,500	-112,965	82,031	-2,270,041	0.11
7a	3,400,000	3,400,000	0	50,357	25	3,357,115	24,000	-36,492	121,729	150,000	-157,970	113,759	-3,064,816	0.10
8a	4,250,000	4,250,000	0	66,587	25	4,439,115	30,000	-49,141	160,962	187,500	-212,727	135,736	-4,057,566	0.05
9a	5,100,000	5,100,000	0	82,817	25	5,521,115	36,000	-60,015	200,196	225,000	-259,797	165,399	-4,894,279	0.04
10a	5,950,000	5,950,000	0	99,047	25	6,603,115	42,000	-72,766	239,429	262,500	-314,998	186,931	-5,896,050	0.01
11a	6,800,000	6,800,000	0	115,277	25	7,685,115	48,000	-83,537	278,662	300,000	-361,624	217,038	-6,723,743	0.01
12a	8,500,000	8,500,000	0	147,737	25	9,849,115	60,000	-107,060	357,129	375,000	-463,452	268,677	-8,553,207	-0.01

3.0 ENERGY RESOURCE OPPORTUNITY IMPACT STUDY

All EROs identified in Section 2.0 of this report are subject to economic analysis to determine their cost-effectiveness. The economic analysis is part of the FEDS process for developing fuel-neutral assessments of facilities to identify and quantify major efficiency resources, supply alternatives, and fuel-switching opportunities. The intent of the assessment is to identify the major resource alternatives available to decision makers. The economic analysis provides an estimate of the magnitude of the cost-effective resources available at a facility using the most realistic assumptions possible. Individual projects should be examined more thoroughly at a project level at the implementation stage.

Section 3.1 discusses the methodology and assumptions used in the economic analysis, and Section 3.2 defines the analysis metrics. Section 3.3 describes the LCC evaluation method. Section 3.4 presents the results of the evaluation. Section 3.5 provides additional notes regarding the analysis.

3.1 ECONOMIC ANALYSIS METHODOLOGY AND ASSUMPTIONS

According to the provisions of 10 CFR Part 436, federal agencies are required to analyze all potential energy investments using an LCC methodology developed by the National Institute of Standards and Technology (NIST). The NIST LCC methodology calculates all relevant costs of a project and discounts them into present dollars, and then subtracts that sum from a similarly constructed LCC of baseline, current conditions, or technology. The difference of these numbers is called the NPV of the action being considered. Actions are cost-effective if the NPV is positive and greater than the NPV of alternative actions. Following this methodology minimizes the LCC of energy services at a site.

This economic analysis is central to the FEMP model approach for federal energy efficiency using the FEDS system to develop a fuel-neutral assessment of facilities to identify and quantify energy efficiency resources, supply alternatives, and fuel switching opportunities.

All EROs identified by the FEDS assessment and described in this report

are therefore subjected to the LCC economic analysis to determine their cost-effectiveness. The purpose of the FEDS assessment is to identify the facility energy efficiency resource alternatives available to decision makers; the economic analysis provides an estimate of the installed cost and energy savings of the cost-effective resource available at a facility using the most current and realistic assumptions possible. Individual projects and actions considered for implementation should be examined and analyzed more thoroughly at a project level prior to design and implementation.

Under the NIST methodology, energy prices are escalated and costs and benefits are discounted using factors taken from the current edition of Energy Prices and Discount Factors for Life-Cycle Cost Analysis (NIST 1992). Costs and benefits are analyzed over a 25-year period, reflecting the average expected remaining life of a typical building. Other key assumptions in the methodology are:

- Prices for all goods and services (e.g., installed cost of a technology) will vary at the same rate as the inflation rate; therefore the "real" rate of inflation is zero.
- Energy or fuel prices vary at a rate different than that of the inflation rate. NIST reports the value by which the energy prices vary from the real rate of inflation (the escalation rate).
- All costs and benefits are discounted using the current federal discount rate (4.0% real for CY 1993).
- All EROs are analyzed for a 25-year period. This does not mean that a 25-year life is assumed for all installed equipment: actual estimates of equipment life are used, and the costs of replacing worn out equipment over a 25-year period are incorporated. The 25-year analysis period also does not mean that all streams of savings from EROs are assumed to endure 25 years: many are assumed to disappear as the existing equipment is replaced with more efficient equipment as part of the baseline.
- The analysis assumes that upfront unconstrained federal financing (at the federal discount rate) is available for all potential energy efficiency improvements and actions.

The last assumption, unconstrained (unlimited) federal financing, is incorporated into the LCC analysis to determine the total cost-effective energy efficiency resource at a site. Therefore, the analysis (under the unconstrained funding assumption) results in a menu of all identified energy

project opportunities whose benefits exceed their costs.

In the presence of constraints on the funding available to implement these projects, some method of prioritizing the projects is needed. It is for this reason that a savings-to-investment ratio (SIR) is calculated to rank order projects starting with the project with the highest SIR. This ranking allows available capital to be allocated to those cost-effective projects in an order that results in the greatest savings per dollar of investment.

For most agencies or facilities, the entire list of cost-effective projects from the LCC analysis is significant and cannot be financed from a single source. Rather, all available funding sources need to be determined. Funding sources include federal funds (MILCON, ECIP, Federal Energy Efficiency Fund); utility financing including utility offered rebates or other financial assistance; and energy services industry-financed projects. Each of these funding sources has its own requirements and its own costs and therefore, the cost-effectiveness of individual projects needs to be evaluated using the LCC analysis adjusted for each potential funding source's costs and constraints.

Many assumptions in addition to those listed above are required in the course of a FEDS assessment. In every case, the analysis team attempts to make the most realistic and defensible assumption. Where uncertainty exists, the team attempts to err on the side of conservatism. Therefore, the resulting estimate of the total cost-effective energy efficiency resource is a minimum estimate of the total potential resource, given the above assumptions. A more exact estimate and/or the development and design of projects may require a detailed facility audit which is beyond the scope of a FEDS assessment.

3.2 ECONOMIC ANALYSIS METRICS USED

The EROs described in Section 2.0 were analyzed in a number of ways, with the intent of presenting a variety of analysis metrics. An analysis metric is a numerical measure of the attractiveness of an ERO as an investment. Different analysis metrics are used for different purposes. Some economic metrics commonly used to evaluate measure effectiveness include NPV and the SIR.

3.2.1 Net Present Value

The most useful analysis metric is the NPV, expressed in dollars. The NPV, as described earlier, is the difference between the LCCs of a project and its baseline. This is equivalent to saying that the NPV is the present value of all of the benefits associated with an ERO, less the present value of all of the costs of the ERO. The concept of present value is discussed in more detail in the following paragraphs. The NPV is used to define the cost-effectiveness of an ERO: a negative NPV means that the costs of an ERO outweigh its benefits, while a positive NPV means that the benefits are greater than the costs. The higher the NPV, the better.

The costs and the benefits of an efficiency investment occur at different periods of time, which must be accounted for in the analysis. The timing of the streams of costs and benefits is accounted for in an LCC analysis by converting all streams to present values. Present values account for the fact that a dollar today is worth more than a dollar tomorrow, for two primary reasons: general price inflation and the time value of money. In the face of general price inflation, the purchasing power of a dollar declines over time, and since the true value of money lies in what it is capable of purchasing, inflation causes its value to decline. The time value of money refers to the fact that even in the absence of general price inflation, money received sooner is preferred to money received later.

It is this preference for consuming sooner rather than later that leads to the existence of positive rates of interest, even in the absence of price level inflation. Individuals and firms are willing to pay a premium to obtain goods and services sooner rather than later: the premium they are willing to pay is the "real rate of interest". (Although interest rates are generally positive, negative rates can exist for short periods of time, but can not persist.) The market rate of interest, or the "nominal" rate, is the real rate plus the rate of inflation (this is a slight simplification).

3.2.2 Savings-to-Investment Ratio

The SIR is used to prioritize a group of minimum LCC EROs. For example, suppose a total of 100 EROs were evaluated. Of these, suppose 25 had negative NPVs, leaving 75 EROs to consider. Of these, say that there are 5 groups of

mutually exclusive pairs, and that the highest NPV ERO of each group is selected. This results in the elimination of 5 EROs, for a grand total of 70 EROs to be implemented. Suppose the total cost of implementing all 70 is \$5 million, and the facility has an annual budget for energy modernization projects of \$1 million. The SIR would be used to determine which of the 70 EROs provide the greatest "return on investment," thereby deserving immediate implementation. It is important to note that selection of cost-effective EROs should not be done on the basis of the SIR. That would not minimize the LCC. Rather, it is necessary to select the cost-effective set of EROs on the basis of their NPVs. The SIR should only be used for prioritization.

3.3 LIFE-CYCLE COST EVALUATION METHOD

Federal agencies are required to evaluate energy-related investments on the basis of minimum LCCs (10 CFR 436). A LCC-evaluation computes the total long-run costs of a number of potential actions, and selects the action that minimizes the long-run costs. The LCC of a potential investment is the present value of all of the costs associated with the investment over time. The first step in calculating the LCC is the identification of the relevant costs, which are listed in Table 3.1.

TABLE 3.1. Cost Elements in a Life-Cycle Cost Analysis

Cost Element	Description	Example
Installed Cost	Cost of materials purchased and the labor required to install them.	Price of an energy efficient lighting fixture, plus cost of labor to install it.
Energy Cost	Annual expenditures on energy to operate equipment.	A lighting fixture that draws 100 W and operates 2,000 hours annually requires 200,000 watt-hours (200 kWh) annually. At an electricity price of \$0.10/kWh, this fixture has an annual energy cost of \$20.
Nonfuel O&M	Annual expenditures on parts and activities required to operate equipment.	Replacing burned out light bulbs.
Replacement Costs	Expenditures to replace equipment upon failure.	Replacing an oil furnace when it is no longer usable.

3.3.1 Life-Cycle Cost Calculation

The LCC of an alternative is calculated by summing the present values of the installed cost, the annual energy cost, the annual O&M cost, and the replacement cost, as shown in Equation 3.1.

$$LCC = PV(IC) + PV(EC) + PV(OM) + PV(REP) \quad (3.1)$$

where LCC = life-cycle cost
 PV(IC) = present value of installed cost
 PV(EC) = present value of annual energy cost
 PV(OM) = present value of annual O&M cost
 PV(REP) = present value of future replacement cost.

3.3.2 Installed Cost

The installed cost is the one-time, first cost of an ERO. Replacement of existing equipment in the baseline case is covered by the replacement cost category. The present value of installed cost is used because not all EROs are RI actions. In those cases where the ERO is to be implemented immediately, the present value of the installed cost is equal to the installed cost. When implementation of an ERO is scheduled for some future time, however, as in the case of ROF EROs, the installed cost paid at that time must be discounted back to the present.

The calculation for the present value of installed cost is equal to

$$PV(IC) = \frac{IC}{(1+d)^N} \quad (3.2)$$

where PV(IC) = present value of installed cost
IC = installed cost
d = discount rate
N = number of years until failure or removal of existing equipment.

3.3.3 Energy Cost

The present value of the annual energy cost is composed of both energy and demand costs. Energy costs represent the recurring annual expenditures on energy to operate equipment. These costs include both the fuel costs for consumption and the demand charges. The estimated stream of annual energy and demand costs (AECs) over the analysis period is adjusted to account for increasing real energy prices, and is discounted to determine the present value of the future cost stream. This adjustment for price escalation and discounting is accomplished through the use of a modified uniform present worth factor (UPW*). The UPW* incorporates the discount rate and the projected energy price rates of change. For ROF measures, the existing stream of costs is assumed to continue until failure of the existing equipment, at which time the ERO cost stream replaces it. The UPW* is calculated using Equation 3.3.

$$UPW^*_N = \sum_{n=1}^N \frac{I_{(1992+n)}}{(1+d)^n} \quad (3.3)$$

where UPW^* = modified uniform present worth factor
 n = counter used to designate each year, with $n=1$ for the year 1993;
 N = number of periods over which energy costs or savings accrue;
 $I_{(1992+n)}$ = projected average fuel price index, provided by NIST
 d = discount rate.

The present value of energy costs is then calculated using Equation 3.4:

$$PV(EC) = AEC \times UPW^*_N \quad (3.4)$$

where $PV(EC)$ = present value of energy cost
 AEC = annual energy and demand cost
 UPW^*_N = modified uniform present worth factor.

3.3.4 Operations and Maintenance Cost

The present value of the annual O&M cost is the discounted stream of annual nonfuel expenditures on parts and activities required to operate the equipment. The present value of the stream of expenditures is calculated using the UPW. As with energy costs, for ROF measures the existing stream of costs is assumed to continue until failure of the existing equipment, at which time the ERO cost stream replaces it. The UPW is calculated using Equation 3.5.

$$UPW_N = \frac{(1+d)^N - 1}{d(1+d)^N} \quad (3.5)$$

where UPW = uniform present worth factor
 d = discount rate
 N = number of periods over which the costs or savings accrue.

The present value of O&M savings is then given by Equation 3.6.

where $PV(OM)$ = present value of annual O&M costs

$$PV(OM) = OM \times UPW_N \quad (3.6)$$

OM = annual O&M expenditures
 UPW_N = uniform present worth factor.

3.3.5 Replacement Cost

Although the installed cost category covers the first cost of implementing an ERO, subsequent equipment installations fall into the replacement cost category, as do all equipment costs associated with the baseline case. Unlike energy and O&M expenditures, replacement costs are not regular, annual expenses. The present value of the replacement cost is the discounted stream of expenditures to replace equipment upon failure. While the cost to replace a piece of equipment is actually borne in the year in which the equipment is bought, the replacement costs are annualized for this analysis. Any part of the annualized cost that would be borne after the analysis period is then subtracted off of the total, in effect adding a salvage value. If the remaining time in the analysis period is less than the life of equipment installed for the ERO, the installed cost will overstate the true cost. The replacement cost calculation corrects for this overstatement. In this type of situation, the present value (Replacement Cost) is negative, corresponding to negative replacement costs (salvage value).

Existing equipment is assumed to have no salvage value or disposal cost. While these may not be entirely accurate assumptions, they partially offset each other. If salvage value is to be included for existing equipment, a few requirements must be met. First, it must be likely that the base will actually carry out a salvage process rather than dispose of the equipment. Regardless of value, if the base does not carry out this process, no savings will be accrued. Second, the salvage value should be the actual value of the equipment in its existing condition, less all costs associated with preparing it for sale and selling it. If this resulting net value is not greater than the disposal cost, then it should be ignored for analysis purposes. The replacement cost is annualized as shown in Equation 3.7, and the present value (Replacement Cost) is calculated using Equation 3.8.

$$REP_A = REP \times \frac{d}{1 - (d + 1)^{-L}} \quad (3.7)$$

$$PV(REP) = REP_A \times UPW_{25-N} \quad (3.8)$$

where REP_A = annualized replacement cost
 REP = replacement cost
 d = discount rate
 L = life of ERO equipment
 N = number of periods until replacement
 $PV(REP)$ = present value of annualized replacement cost
 UPW_N = uniform present worth factor, as discussed in Section 3.3.5.

Equation 3.8 yields a present value at the time of replacement, rather than at the beginning of the analysis period. This value must be discounted to current dollars using the single present worth factor (SPW). While the UPW is used to calculate the present value of a stream of annual costs or savings, the SPW is used to find the present value of a single nonannual amount. The SPW is calculated using Equation 3.9, and the present value of replacement costs in current dollars is represented by Equation 3.10.

$$SPW_N = \frac{1}{(1 + d)^N} \quad (3.9)$$

$$PV_c(REP) = PV(REP) \times SPW_N \quad (3.10)$$

where $PV_c(REP)$ = current dollar present value
 REP = replacement cost
 d = discount rate
 N = number of periods until replacement
 SPW_N = single present worth factor.

3.3.6 Net Present Value Calculation

Energy resource opportunities are selected for implementation on the basis of their NPV. The NPV of an ERO is the life-cycle savings of the ERO as compared to not implementing the ERO:

$$NPV = LCC - LCC' \quad (3.11)$$

where NPV = the net present value of the ERO
 LCC = the life-cycle cost of the existing situation
 LCC' = the life-cycle cost if the ERO is implemented.

Most EROs are selected according to a very simple rule: if the NPV is positive, then the project should be undertaken. If the NPV is zero or negative, then the ERO should not be implemented. A positive NPV means the long-run costs of the ERO are less than the long-run costs of the existing situation.

The selection criteria can be complicated by a number of factors. If the ERO is part of a set of mutually exclusive options, then only the option with the highest NPV is selected. For example, in some cases, motors can be replaced with energy-efficient models, or a variable-speed drive (VSD) can be added to the existing motor, or the existing motor can be replaced with an energy-efficient model with a VSD. The analysis would proceed by calculating the LCC of the existing motors, the LCC of energy-efficient motors, and the LCC of VSDs added to both the existing and the energy-efficient motor. Depending on the level of operation, any of the EROs might be chosen, or it may be optimal to do nothing. If the NPV of two or more EROs considered is positive, then the highest NPV ERO would be selected.

3.3.7 Savings-to-Investment Ratio Calculation

The SIR is equal to the total savings of an ERO divided by the installed cost of that ERO. Any ERO with an SIR greater than 1 indicates that the savings outweigh the costs. Thus, an SIR of 1 denotes an NPV of 0. As noted earlier, the SIR is only to be used as a prioritization measure, rather than a selection device. The following equation defines the SIR.

where SIR = savings-to-investment ratio of an ERO
 PV(ES) = present value of energy savings of an ERO
 PV(OMS) = present value of O&M savings of an ERO

$$SIR = \frac{PV(ES) + PV(OMS) + PV(REPS)}{PV(IC)} \quad (3.12)$$

PV(REPS) = present value of replacement savings of an ERO

PV(IC) = present value of the installed cost of an ERO.

3.4 SUMMARY OF ERO IMPACT STUDY

Table 3.2 defines the assumptions that are common to all of the EROs analyzed. The rates in effect are straight-forward, however, mention should be made as to the calculation of the full cost of energy. In a forthcoming PNL report, "Determining Appropriate Energy Costs for Federal Residential Building Standards Analysis," (Shankle et al. 1993) the authors note that the appropriate cost of energy to use in determining the correct level of investment in energy-efficient construction should include the following elements:

- energy rates paid to the supplier by the federal facility
- avoidable demand charges
- avoidable distribution system losses
- avoidable distribution system capital costs
- avoidable external costs of energy supply and distribution.

The incorporation of the above elements is referred to as the "full cost" of energy. Current federal life-cycle costing methods do not include the cost of environmental externalities unless they are reflected in some manner within the utility bill. The external cost of energy will increasingly become internalized within the LCC process, however, due to such factors as utility least-cost planning, the 1990 Amendments to the Clean Air Act, and emissions trading. As these costs become internalized, they will be reflected in the actual cost of energy paid by the facility, and will no longer need to receive separate consideration.

TABLE 3.2. Assumptions Used in Life-Cycle Cost Analysis

Discount Rate: 4.0% real
Analysis Period: 25 years

Current Fuel Prices and Conversion Factors:

<u>Fuel</u>	<u>Purchase Units</u>	<u>Conversion Factor (Purchase Units/MBtu)</u>	<u>Price (1993 \$/ Purchase Unit)</u>	<u>Price (1993 \$/MBtu)</u>
Natural Gas	therms	10.0000	0.43289 firm 0.35422 interrupt.	4.3289 3.5422
Unleaded Gasoline	gal	9.0909	See Sec. 3.5	
Diesel	gal	7.4074	See Sec. 3.5	
No.2 Fuel Oil	gal	7.1429	0.69	4.93
Electricity	kWh	292.9974	0.03626 on pk. 0.03305 off pk.	10.6241 9.6836
	kW	none	6.25	na

Table 3.3 defines the column headings used in the remaining tables in this section. One of the distinctions made is between first year energy savings and full implementation energy savings. First year energy savings are those savings that should be experienced after the first year of the analysis. These savings will be zero for EROs that will not be implemented immediately. Full implementation energy savings are those savings that should be experienced after the ERO has been fully implemented; either after the first year, or sometime in the future. Differences in these numbers can be caused when an ERO is implemented in steps; for example, when a VSD is added immediately to an existing motor, there are immediate savings associated with that action (first year savings); however, the second part of the ERO is to replace the existing motor when it fails with an energy-efficient motor. Once this has been done, the equipment should experience the full savings of the ERO action, that is the full implementation savings.

TABLE 3.3. Description of Column Headings

All Tables (Except Summaries)

Column Heading	Description	Unit
ERO Category	Designates the general end-use of an ERO.	End Use
Facility Type	Designates the specific equipment or facility affected.	Facility or Facility Number
Equipment	Equipment that is affected by the ERO.	Equipment
Description of ERO	Describes the ERO. See Section 2 of this document for complete descriptions of each ERO.	Description
RI or ROF	Indicates whether the ERO is to be done now or in the future (RI vs. ROF).	RI or ROF
ID	Descriptive field - designates the specific equipment or facility affected.	ID
Existing Fuel	Fuel type used before ERO is implemented.	Existing Fuel
Resulting Fuel	Fuel type used after ERO is implemented.	Resulting Fuel

Annual Energy and Demand Reduction Tables

Column Heading	Description	Unit
First Year Energy Savings	Energy savings that will be realized in the first year.	kWh/yr
First Year Demand Savings	Demand savings that will be realized in the first year.	kW-mo/yr
Full Implementation Energy Savings	Energy savings that will be realized once the ERO is fully implemented.	kWh/yr
Full Implementation Demand Savings	Demand savings that will be realized once the ERO is fully implemented.	kW-mo/yr
NPV	Reduction in LCC due to ERO; equals present value of total savings less present value of installed cost.	1993 constant dollars
SIR	Present value of total savings divided by present value of installed cost.	None

TABLE 3.3. (contd)

Present Value of Costs and Savings Tables

Column Heading	Description	Unit
Present Value of Installed Cost	Present value of the labor and materials cost of implementing the ERO; equals actual cost for immediate EROs, discounted cost for ROF EROs.	1993 Constant dollars
Present Value of Energy Savings	Present value of the energy cost savings that will be realized after implementation of ERO.	1993 Constant dollars
Present Value of Demand Savings	Present value of the electricity demand cost savings that will be realized after implementation of the ERO.	1993 Constant dollars
Present Value of O&M Savings	Present value of the stream of maintenance cost reductions attributable to the ERO; may be negative, indicating ERO has higher maintenance costs than the current equipment.	1993 Constant dollars
Present Value of Replacement Cost Savings	Present value of the stream of replacement cost savings attributable to the ERO; may be negative, indicating that the ERO has higher replacement costs than the current equipment.	1993 Constant dollars
Present Value of Total Savings	Sum of energy, demand, O&M, and replacement savings associated with the ERO.	1993 Constant dollars
NPV	Reduction in LCC due to ERO; equals present value of total savings less present value of installed cost.	1993 Constant dollars
SIR	Present value of total savings divided by present value of installed cost.	None

TABLE 3.3. (contd)

Annualized Values of Costs and Savings Tables

Column Heading	Description	Unit
Annualized Installed Cost	Annualized value of the labor and materials cost of implementing the ERO; equals actual cost for immediate EROs, discounted cost for ROF EROs; calculated from the present value.	1993 Constant dollars
Annualized Energy Savings	Annualized value of the energy cost savings that will be realized after implementation of ERO; calculated from the present value.	1993 Constant dollars
Annualized Demand Savings	Annualized value of the electricity demand cost savings that will be realized after implementation of the ERO; calculated from the present value.	1993 Constant dollars
Annualized O&M Savings	Annualized value of the stream of maintenance cost reductions attributable to the ERO; may be negative, indicating ERO has higher maintenance costs than the current equipment; calculated from the present value.	1993 Constant dollars
Annualized Replacement Cost Savings	Annualized value of the stream of replacement cost savings attributable to the ERO; may be negative, indicating that the ERO has higher replacement costs than the current equipment; calculated from the present value.	1993 Constant dollars
Annualized Total Savings	Sum of energy, demand, O&M, and replacement savings associated with the ERO.	1993 Constant dollars
Annualized Net Savings	Annualized reduction in LCC due to ERO; equals annualized total savings less annualized installed cost.	1993 Constant dollars
SIR	Annualized total savings divided by present value of installed cost.	None

TABLE 3.3. (contd)

Cumulative Annual Energy and Demand Reduction Tables

Column Heading	Description	Unit
Cumulative First Year Energy Savings	Energy savings that would be realized in the first year if all EROs with equal and higher SIRs were implemented.	kWh/yr
Cumulative First Year Demand Savings	Demand savings that would be realized in the first year if all EROs with equal and higher SIRs were implemented.	kW-mo/yr
Cumulative Full Implementation Energy Savings	Energy savings that would be realized once the ERO is fully implemented, if all EROs with equal and higher SIRs were implemented.	kWh/yr
Cumulative Full Implementation Demand Savings	Demand Savings that would be realized once the ERO is fully implemented, if all EROs with equal and higher SIRs were implemented.	kW-mo/yr
Cumulative NPV	Reduction in LCC if all EROs with equal and higher SIRs were implemented; equals cumulative value of total savings less cumulative value of installed cost.	1993 constant dollars
Cumulative SIR	SIR of entire project if all EROs with equal and higher SIRs were implemented; equals cumulative value of total savings divided by cumulative value of installed cost.	None
Individual ERO SIR	Present value of total savings divided by present value of installed cost for individual ERO.	None

TABLE 3.3. (contd)

Cumulative Present Value of Costs and Savings Tables

Column Heading	Description	Unit
Cumulative Present Value of Installed Cost	Present value of the labor and materials cost of implementing entire project, if all EROs with equal and higher SIRs were implemented	1993 Constant dollars
Cumulative Present Value of Energy Savings	Present value of the energy cost savings that would be realized after implementation of ERO, if all EROs with equal and higher SIRs were implemented.	1993 Constant dollars
Cumulative Present Value of Demand Savings	Present value of the electricity demand cost savings that would be realized after implementation of the ERO, if all EROs with equal and higher SIRs were implemented.	1993 Constant dollars
Cumulative Present Value of O&M Savings	Present value of the stream of maintenance cost reductions, if all EROs with equal and higher SIRs were implemented.	1993 Constant dollars
Cumulative Present Value of Replacement Cost Savings	Present value of the stream of replacement cost savings, if all EROs with equal and higher SIRs were implemented.	1993 Constant dollars
Cumulative Present Value of Total Savings	Sum of energy, demand, O&M, and replacement savings if all EROs with equal and higher SIRs were implemented	1993 Constant dollars
Cumulative NPV	Reduction in LCC if all EROs with equal and higher SIRs were implemented; equals cumulative value of total savings less cumulative value of installed cost.	1993 Constant dollars
Cumulative SIR	SIR of entire project if all EROs with equal and higher SIRs were implemented; equals cumulative value of total savings divided by cumulative value of installed cost.	None
Single ERO SIR	Present value of total savings divided by present value of installed cost for individual ERO.	None

The annual energy and demand reductions and the present values of costs and savings for all EROs for each building type are presented in Tables 3.4 and 3.5, respectively. Many EROs have negative NPVs; thus, they are not cost-effective. Many others are cost-effective, but are inferior to an alternative ERO. Tables 3.6 and 3.7 present the annual energy and demand reductions and the present values of costs and savings for all cost-effective EROs not excluded by an ERO with a higher NPV. The annualized values of the costs and savings for these EROs are given in Table 3.8. Tables 3.9 and 3.10 present cumulative values for the energy and demand reductions and the costs and savings for the cost-effective EROs. The cumulative values are calculated by sorting the EROs by their SIRs, and then summing the values over the EROs. The resulting table allows for a comparison of the total energy, demand, and dollar savings available for any given level of total investment. A cumulative SIR is calculated as well. The cumulative SIR shows the SIR of all EROs up to that point if all were implemented as a single project. The SIR of each individual ERO is also shown to illustrate how the EROs were sorted.

The cost-effective ERO results have been aggregated by ERO category. The ERO category results are presented in Table 3.11, and the annualized values are in Table 3.12. Two ERO categories, lighting and heatpipes, are responsible for nearly 151,00 MBtu in savings, which actually exceeds the net total full-implementation energy savings of almost 130,000 MBtu. This is explained by the fact that some ERO categories show a net increase in annual energy consumption. The largest demand savings were achieved in the A/C and lighting ERO categories. Air conditioning EROs reduced demand by 71,565 kW-mo, and lighting EROs reduced demand by 47,654 kW-mo. Combined, these two categories represent a 66% share of the total demand savings.

As previously mentioned, some ERO categories show a net increase in energy use. With the goal to minimize energy expenditures in mind, it is sometimes appropriate to decrease monthly electric demand at the expense of increasing total energy consumption. This process is known as "peak shaving" and can be accomplished either by shifting electricity consumption from on-peak to off-peak periods or by using alternative fuels during on-peak hours. Thermal energy storage EROs and generator EROs, respectively, are examples of peak-shaving opportunities.

Therefore, the true energy cost savings is represented by the sum of the annual energy cost savings and the annual demand cost savings. At Cape Canaveral AFS this combined savings is greatest in the heatpipe and lighting categories. The present value of energy and demand savings from heatpipe EROs is \$11.4 million over the analysis period, and the present value of energy and demand savings from lighting EROs is \$17.7 million. Combined, these two categories are responsible for 67% of the total energy and demand cost savings at Cape Canaveral AFS. To understand the magnitude of savings on an annual basis, the present values of savings are annualized. The annualized savings are \$730,000 for heat pipe EROs and \$1.14 million for lighting EROs.

The total energy, demand, and dollar savings, as well as the overall NPV and SIR, are presented in Table 3.13. The total cost-effective efficiency resource at Cape Canaveral AFS is estimated to be roughly 143,000 MBtu during the first year and 130,000 MBtu upon full implementation of all EROs. Full implementation energy savings is less than first-year energy savings because some of the ROF EROs actually increase overall energy consumption, but significantly reduce monthly demand. Annual demand savings are estimated to be approximately 110,360 kW-mo during the first year, and 180,780 kW-mo upon full implementation. The energy-use reduction is equivalent to over 13% of typical 1991 total energy consumption, and the demand reduction is equivalent to 50% of 1991 annual demand in kilowatt-months (see Section 2 in the Cape Canaveral AFS Volume 2 report for annual totals [Wahlstrom et al. 1993]).

The total cost-effective resource would require an investment with a present value of approximately \$16.6 million, would generate energy and demand savings with a present value of over \$43.5 million, and would produce overall savings with a present value of over \$48.9 million. The NPV of the investment would be over \$32.3 million, with an overall SIR of 2.95. On an annualized basis, the energy and demand savings would be worth over \$2.8 million; equivalent to 27% of current energy and demand expenditures. (1991 expenditures from the Cape Canaveral AFS Volume 2 report, adjusted with prices used in the LCC analysis, were used to calculate this percentage; see Section 3.5 for an explanation of this adjustment process [Wahlstrom et al. 1993].) The annualized total savings is nearly \$3.1 million.

The LCC results have also been combined into a fuel balance table (see

Table 3.14). This table shows the existing energy use of each fuel, the impact on each fuel's consumption of energy conservation measures, and the new load associated with fuels that are substituted for more expensive fuels. The table gives the resulting use of each fuel, calculated as the existing use, less the conservation, plus the new load. The difference between the existing use and the resulting use is the net conservation for each fuel. Similar information is provided for demand. New-load information is provided because some EROs actually increase energy use. For example, diesel fuel consumption increases by nearly 25,000 MBtu/yr as a result of electricity cogeneration EROs. Generally, EROs requiring increased consumption of a fossil fuel derive their savings from avoided electricity and demand costs.

Table 3.4
All EROs: Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW mo)	Full Implement Energy Savings (MBtu)	Full Implement Demand Savings (kW mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 1	direct expansion	efficient chiller	RI	1	Elect.	Elect.	202	27.4	202	27.4	-\$4,927	0.85
AC	Area 2	chilled water	efficient chiller	RI	2	Elect.	Elect.	483	155.7	483	155.7	-\$6,437	0.92
AC	Area 2	direct expansion	efficient chiller	RI	3	Elect.	Elect.	10	1.0	10	1.0	-\$1,163	0.61
AC	Area 2	direct expansion	efficient chiller	RI	4	Elect.	Elect.	29	4.0	29	4.0	-\$3,460	0.61
AC	Area 2	direct expansion	efficient chiller	RI	5	Elect.	Elect.	120	19.0	120	19.0	-\$9,414	0.66
AC	Area 2	direct expansion	efficient chiller	RI	6	Elect.	Elect.	96	15.0	96	15.0	-\$5,698	0.70
AC	Area 2	direct expansion	efficient chiller	RI	7	Elect.	Elect.	72	11.0	72	11.0	-\$3,560	0.72
AC	Area 2	direct expansion	efficient chiller	RI	8	Elect.	Elect.	402	129.8	402	129.8	-\$6,114	0.91
AC	Area 3	chilled water	efficient chiller	RI	9	Elect.	Elect.	283	38.4	283	38.4	-\$2,903	0.93
AC	Area 3	chilled water	efficient chiller	RI	10	Elect.	Elect.	563	181.7	563	181.7	-\$3,047	1.04
AC	Area 3	direct expansion	efficient chiller	RI	11	Elect.	Elect.	96	14.9	96	14.9	-\$11,492	0.61
AC	Area 3	direct expansion	efficient chiller	RI	12	Elect.	Elect.	115	17.9	115	17.9	-\$13,790	0.61
AC	Area 3	direct expansion	efficient chiller	RI	13	Elect.	Elect.	115	17.9	115	17.9	-\$11,696	0.63
AC	Area 3	direct expansion	efficient chiller	RI	14	Elect.	Elect.	72	11.2	72	11.2	-\$5,655	0.66
AC	Area 3	direct expansion	efficient chiller	RI	15	Elect.	Elect.	29	4.5	29	4.5	-\$2,089	0.67
AC	Area 3	direct expansion	efficient chiller	RI	16	Elect.	Elect.	34	5.2	34	5.2	-\$2,293	0.68
AC	Area 3	direct expansion	efficient chiller	RI	17	Elect.	Elect.	154	23.8	154	23.8	-\$9,945	0.69
AC	Area 3	direct expansion	efficient chiller	RI	18	Elect.	Elect.	192	29.8	192	29.8	-\$11,402	0.70
AC	Area 3	direct expansion	efficient chiller	RI	19	Elect.	Elect.	173	26.8	173	26.8	-\$9,397	0.71
AC	Area 3	direct expansion	efficient chiller	RI	20	Elect.	Elect.	144	22.3	144	22.3	-\$7,111	0.72
AC	Area 3	direct expansion	efficient chiller	RI	21	Elect.	Elect.	486	65.8	486	65.8	-\$31,162	0.73
AC	Area 3	direct expansion	efficient chiller	RI	22	Elect.	Elect.	202	27.4	202	27.4	-\$10,304	0.76
AC	Area 3	direct expansion	efficient chiller	RI	23	Elect.	Elect.	507	163.5	507	163.5	-\$5,598	0.93
AC	Area 4	chilled water	efficient chiller	RI	24	Elect.	Elect.	101	13.7	101	13.7	-\$4,056	0.79
AC	Area 4	direct expansion	efficient chiller	RI	25	Elect.	Elect.	77	11.9	77	11.9	-\$9,193	0.61
AC	Area 4	direct expansion	efficient chiller	RI	26	Elect.	Elect.	43	6.7	43	6.7	-\$5,171	0.61
AC	Area 4	direct expansion	efficient chiller	RI	27	Elect.	Elect.	77	11.9	77	11.9	-\$7,931	0.63
AC	Area 4	direct expansion	efficient chiller	RI	28	Elect.	Elect.	265	40.9	265	40.9	-\$20,734	0.66
AC	Area 4	direct expansion	efficient chiller	RI	29	Elect.	Elect.	29	4.5	29	4.5	-\$2,089	0.67
AC	Area 4	direct expansion	efficient chiller	RI	30	Elect.	Elect.	192	29.8	192	29.8	-\$12,431	0.69
AC	Area 4	direct expansion	efficient chiller	RI	31	Elect.	Elect.	289	44.6	289	44.6	-\$17,103	0.70
AC	Area 4	direct expansion	efficient chiller	RI	32	Elect.	Elect.	216	33.5	216	33.5	-\$10,666	0.72
AC	Area 4	direct expansion	efficient chiller	RI	33	Elect.	Elect.	405	54.8	405	54.8	-\$25,968	0.73
AC	Area 4	direct expansion	efficient chiller	RI	34	Elect.	Elect.	364	49.3	364	49.3	-\$14,294	0.80
AC	Area 4	direct expansion	efficient chiller	RI	35	Elect.	Elect.	402	129.8	402	129.8	-\$6,114	0.91
AC	Area 5	chilled water	efficient chiller	RI	36	Elect.	Elect.	101	13.7	101	13.7	-\$4,056	0.79
AC	Area 5	chilled water	efficient chiller	RI	37	Elect.	Elect.	142	19.2	142	19.2	-\$2,936	0.87
AC	Area 5	chilled water	efficient chiller	RI	38	Elect.	Elect.	805	259.5	805	259.5	-\$2,887	1.03
AC	Area 5	chilled water	efficient chiller	RI	39	Elect.	Elect.	630	120.3	630	120.3	-\$19,517	0.85
AC	Area 5	chilled water	efficient chiller	RI	40	Elect.	Elect.	672	128.4	672	128.4	-\$18,172	0.86
AC	Area 5	direct expansion	efficient chiller	RI	41	Elect.	Elect.	5	0.7	5	0.7	-\$575	0.61
AC	Area 5	direct expansion	efficient chiller	RI	42	Elect.	Elect.	29	4.5	29	4.5	-\$3,447	0.61
AC	Area 5	direct expansion	efficient chiller	RI	43	Elect.	Elect.	115	17.9	115	17.9	-\$13,790	0.61
AC	Area 5	direct expansion	efficient chiller	RI	44	Elect.	Elect.	96	14.9	96	14.9	-\$9,914	0.63
AC	Area 5	direct expansion	efficient chiller	RI	45	Elect.	Elect.	216	33.5	216	33.5	-\$16,965	0.66
AC	Area 5	direct expansion	efficient chiller	RI	46	Elect.	Elect.	115	17.9	115	17.9	-\$7,459	0.69
AC	Area 5	direct expansion	efficient chiller	RI	47	Elect.	Elect.	337	52.1	337	52.1	-\$19,954	0.70
AC	Area 5	direct expansion	efficient chiller	RI	48	Elect.	Elect.	58	8.9	58	8.9	-\$3,132	0.71
AC	Area 5	direct expansion	efficient chiller	RI	49	Elect.	Elect.	216	33.5	216	33.5	-\$10,666	0.72

Table 3.4
All EROs: Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW mo)	Full Implement Energy Savings (MBtu)	Full Implement Demand Savings (kW mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 5	direct expansion	efficient chiller	RI	50	Elect	Elect	486	65.8	486	65.8	\$31,162	0.73
AC	Area 5	direct expansion	efficient chiller	RI	51	Elect	Elect	101	13.7	101	13.7	\$5,152	0.76
AC	Area 5	direct expansion	efficient chiller	RI	52	Elect	Elect	121	16.4	121	16.4	\$4,765	0.80
AC	Area 5	direct expansion	efficient chiller	RI	53	Elect	Elect	162	21.9	162	21.9	\$4,654	0.83
AC	Area 5	direct expansion	efficient chiller	RI	54	Elect	Elect	644	207.6	644	207.6	\$10,862	0.90
AC	Area 5	heat pump	efficient chiller	RI	55	Elect	Elect	9	1.3	9	1.3	\$793	0.66
AC	Area 5	heat pump	efficient chiller	RI	56	Elect	Elect	109	15.2	109	15.2	\$7,728	0.69
AC	Area 5	heat pump	efficient chiller	RI	57	Elect	Elect	73	10.1	73	10.1	\$5,282	0.69
AC	Area 6	chilled water	efficient chiller	RI	58	Elect	Elect	81	11.0	81	11.0	\$4,184	0.76
AC	Area 6	chilled water	efficient chiller	RI	59	Elect	Elect	101	13.7	101	13.7	\$4,056	0.79
AC	Area 6	chilled water	efficient chiller	RI	60	Elect	Elect	121	16.4	121	16.4	\$3,928	0.82
AC	Area 6	chilled water	efficient chiller	RI	61	Elect	Elect	162	21.9	162	21.9	\$3,186	0.87
AC	Area 6	chilled water	efficient chiller	RI	62	Elect	Elect	243	32.9	243	32.9	\$1,864	0.94
AC	Area 6	chilled water	efficient chiller	RI	63	Elect	Elect	362	116.8	362	116.8	\$867	1.02
AC	Area 6	chilled water	efficient chiller	RI	64	Elect	Elect	756	144.4	756	144.4	\$3,099	0.97
AC	Area 6	direct expansion	efficient chiller	RI	65	Elect	Elect	5	0.7	5	0.7	\$575	0.61
AC	Area 6	direct expansion	efficient chiller	RI	66	Elect	Elect	10	1.5	10	1.5	\$1,149	0.61
AC	Area 6	direct expansion	efficient chiller	RI	67	Elect	Elect	29	4.5	29	4.5	\$3,447	0.61
AC	Area 6	direct expansion	efficient chiller	RI	68	Elect	Elect	101	15.6	101	15.6	\$12,066	0.61
AC	Area 6	direct expansion	efficient chiller	RI	69	Elect	Elect	115	17.9	115	17.9	\$11,896	0.63
AC	Area 6	direct expansion	efficient chiller	RI	70	Elect	Elect	96	14.9	96	14.9	\$7,540	0.66
AC	Area 6	direct expansion	efficient chiller	RI	71	Elect	Elect	29	4.5	29	4.5	\$2,089	0.67
AC	Area 6	direct expansion	efficient chiller	RI	72	Elect	Elect	154	23.8	154	23.8	\$9,945	0.69
AC	Area 6	direct expansion	efficient chiller	RI	73	Elect	Elect	289	44.6	289	44.6	\$17,103	0.70
AC	Area 6	direct expansion	efficient chiller	RI	74	Elect	Elect	144	22.3	144	22.3	\$7,111	0.72
AC	Area 6	direct expansion	efficient chiller	RI	75	Elect	Elect	162	21.9	162	21.9	\$10,387	0.73
AC	Area 6	direct expansion	efficient chiller	RI	76	Elect	Elect	202	27.4	202	27.4	\$10,304	0.76
AC	Area 6	direct expansion	efficient chiller	RI	77	Elect	Elect	202	27.4	202	27.4	\$4,927	0.85
AC	Area 6	heat pump	efficient chiller	RI	78	Elect	Elect	82	11.4	82	11.4	\$5,796	0.69
AC	Area 7	chilled water	efficient chiller	RI	79	Elect	Elect	101	13.7	101	13.7	\$3,948	0.80
AC	Area 7	chilled water	efficient chiller	RI	80	Elect	Elect	603	194.6	603	194.6	\$1,127	0.99
AC	Area 7	chilled water	efficient chiller	RI	81	Elect	Elect	422	136.3	422	136.3	\$1,678	1.03
AC	Area 7	chilled water	efficient chiller	RI	82	Elect	Elect	441	84.2	441	84.2	\$27,553	0.76
AC	Area 7	direct expansion	efficient chiller	RI	83	Elect	Elect	87	13.4	87	13.4	\$10,342	0.61
AC	Area 7	direct expansion	efficient chiller	RI	84	Elect	Elect	14	2.2	14	2.2	\$1,724	0.61
AC	Area 7	direct expansion	efficient chiller	RI	85	Elect	Elect	192	29.8	192	29.8	\$15,080	0.66
AC	Area 7	direct expansion	efficient chiller	RI	86	Elect	Elect	192	29.8	192	29.8	\$12,431	0.69
AC	Area 7	direct expansion	efficient chiller	RI	87	Elect	Elect	337	52.1	337	52.1	\$19,954	0.70
AC	Area 7	direct expansion	efficient chiller	RI	88	Elect	Elect	58	8.9	58	8.9	\$3,132	0.71
AC	Area 7	direct expansion	efficient chiller	RI	89	Elect	Elect	125	19.3	125	19.3	\$6,547	0.72
AC	Area 7	direct expansion	efficient chiller	RI	90	Elect	Elect	67	10.4	67	10.4	\$3,414	0.72
AC	Area 7	direct expansion	efficient chiller	RI	91	Elect	Elect	505	78.1	505	78.1	\$24,888	0.72
AC	Area 7	direct expansion	efficient chiller	RI	92	Elect	Elect	728	98.7	728	98.7	\$46,742	0.73
AC	Area 7	direct expansion	efficient chiller	RI	93	Elect	Elect	202	27.4	202	27.4	\$10,304	0.76
AC	Area 7	direct expansion	efficient chiller	RI	94	Elect	Elect	243	32.9	243	32.9	\$9,529	0.80
AC	Area 7	direct expansion	efficient chiller	RI	95	Elect	Elect	283	38.4	283	38.4	\$9,419	0.82
AC	Area 7	direct expansion	efficient chiller	RI	96	Elect	Elect	405	54.8	405	54.8	\$9,854	0.85
AC	Area 8	chilled water	efficient chiller	RI	97	Elect	Elect	243	32.9	243	32.9	\$1,864	0.94
AC	Area 8	chilled water	efficient chiller	RI	98	Elect	Elect	3,304	846.6	3,304	846.6	\$5,752	0.99

Table 3.4
All EROs: Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First Year Demand Savings (kW mo)	Full Implement Energy Savings (MBtu)	Full Implement Demand Savings (kW mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 8	direct expansion	efficient chiller	RI	99	Elect	Elect	5	0.7	5	0.7	-\$575	0.61
AC	Area 8	direct expansion	efficient chiller	RI	100	Elect	Elect	19	3.0	19	3.0	-\$2,298	0.61
AC	Area 8	direct expansion	efficient chiller	RI	101	Elect	Elect	43	6.7	43	6.7	-\$5,171	0.61
AC	Area 8	direct expansion	efficient chiller	RI	102	Elect	Elect	38	6.0	38	6.0	-\$3,965	0.63
AC	Area 8	direct expansion	efficient chiller	RI	103	Elect	Elect	144	22.3	144	22.3	-\$11,310	0.66
AC	Area 8	direct expansion	efficient chiller	RI	104	Elect	Elect	29	4.5	29	4.5	-\$2,089	0.67
AC	Area 8	direct expansion	efficient chiller	RI	105	Elect	Elect	43	6.7	43	6.7	-\$2,660	0.69
AC	Area 8	direct expansion	efficient chiller	RI	106	Elect	Elect	289	44.6	289	44.6	-\$17,103	0.70
AC	Area 8	direct expansion	efficient chiller	RI	107	Elect	Elect	361	55.8	361	55.8	-\$17,777	0.72
AC	Area 8	direct expansion	efficient chiller	RI	108	Elect	Elect	87	13.4	87	13.4	-\$3,476	0.75
AC	Area 8	direct expansion	efficient chiller	RI	109	Elect	Elect	162	21.9	162	21.9	-\$10,387	0.73
AC	Area 8	direct expansion	efficient chiller	RI	110	Elect	Elect	101	13.7	101	13.7	-\$5,152	0.76
AC	Area 8	direct expansion	efficient chiller	RI	111	Elect	Elect	243	32.9	243	32.9	-\$9,529	0.80
AC	Area 8	heat pump	efficient chiller	RI	112	Elect	Elect	5	0.6	5	0.6	-\$941	0.56
AC	Area 8	heat pump	efficient chiller	RI	113	Elect	Elect	27	3.8	27	3.8	-\$2,379	0.66
AC	Area 8	heat pump	efficient chiller	RI	114	Elect	Elect	18	2.5	18	2.5	-\$1,586	0.66
AC	Area 8	heat pump	efficient chiller	RI	115	Elect	Elect	68	9.5	68	9.5	-\$4,830	0.69
AC	Area 8	heat pump	efficient chiller	RI	116	Elect	Elect	18	2.5	18	2.5	-\$1,321	0.69
AC	Area 1W	chilled water	efficient chiller	RI	117	Elect	Elect	162	21.9	162	21.9	-\$3,186	0.87
AC	Area 1W	chilled water	efficient chiller	RI	118	Elect	Elect	243	32.9	243	32.9	-\$1,864	0.94
AC	Area 1W	chilled water	efficient chiller	RI	119	Elect	Elect	483	155.7	483	155.7	-\$2,920	1.05
AC	Area 1W	chilled water	efficient chiller	RI	120	Elect	Elect	563	181.7	563	181.7	-\$3,047	1.04
AC	Area 1W	chilled water	efficient chiller	RI	121	Elect	Elect	724	233.6	724	233.6	-\$316	1.00
AC	Area 1W	chilled water	efficient chiller	RI	122	Elect	Elect	525	100.3	525	100.3	-\$22,894	0.81
AC	Area 1W	chilled water	efficient chiller	RI	123	Elect	Elect	578	110.3	578	110.3	-\$21,220	0.83
AC	Area 1W	chilled water	efficient chiller	RI	124	Elect	Elect	630	120.3	630	120.3	-\$19,517	0.85
AC	Area 1W	direct expansion	efficient chiller	RI	125	Elect	Elect	14	2.2	14	2.2	-\$1,724	0.61
AC	Area 1W	direct expansion	efficient chiller	RI	126	Elect	Elect	87	13.4	87	13.4	-\$10,342	0.61
AC	Area 1W	direct expansion	efficient chiller	RI	127	Elect	Elect	144	22.3	144	22.3	-\$17,237	0.61
AC	Area 1W	direct expansion	efficient chiller	RI	128	Elect	Elect	77	11.9	77	11.9	-\$7,931	0.63
AC	Area 1W	direct expansion	efficient chiller	RI	129	Elect	Elect	241	37.2	241	37.2	-\$18,850	0.66
AC	Area 1W	direct expansion	efficient chiller	RI	130	Elect	Elect	58	8.9	58	8.9	-\$4,178	0.67
AC	Area 1W	direct expansion	efficient chiller	RI	131	Elect	Elect	67	10.4	67	10.4	-\$4,586	0.68
AC	Area 1W	direct expansion	efficient chiller	RI	132	Elect	Elect	38	6.0	38	6.0	-\$2,486	0.69
AC	Area 1W	direct expansion	efficient chiller	RI	133	Elect	Elect	72	11.2	72	11.2	-\$3,555	0.72
AC	Area 1W	direct expansion	efficient chiller	RI	134	Elect	Elect	81	11.0	81	11.0	-\$5,194	0.73
AC	Area 1W	direct expansion	efficient chiller	RI	135	Elect	Elect	243	32.9	243	32.9	-\$9,529	0.80
AC	Area 1W	direct expansion	efficient chiller	RI	136	Elect	Elect	607	82.2	607	82.2	-\$14,781	0.85
AC	Area 1W	direct expansion	efficient chiller	RI	137	Elect	Elect	486	65.8	486	65.8	-\$18,573	0.80
AC	Area 1W	direct expansion	efficient chiller	RI	138	Elect	Elect	402	129.8	402	129.8	-\$6,114	0.91
AC	Area 1W	heat pump	efficient chiller	RI	139	Elect	Elect	18	2.5	18	2.5	-\$1,321	0.69
AC	Area 1W	heat pump	efficient chiller	RI	140	Elect	Elect	456	63.4	456	63.4	-\$29,872	0.70
AC	Area 3A	chilled water	efficient chiller	RI	141	Elect	Elect	4	0.2	4	0.2	-\$3,496	0.48
AC	Area 3A	chilled water	efficient chiller	RI	142	Elect	Elect	22	1.2	22	1.2	-\$2,662	0.61
AC	Area 3A	chilled water	efficient chiller	RI	143	Elect	Elect	35	2.0	35	2.0	-\$4,149	0.61
AC	Area 3A	chilled water	efficient chiller	RI	144	Elect	Elect	81	11.0	81	11.0	-\$4,184	0.76
AC	Area 3A	chilled water	efficient chiller	RI	145	Elect	Elect	101	13.7	101	13.7	-\$4,056	0.79
AC	Area 3A	chilled water	efficient chiller	RI	146	Elect	Elect	486	65.8	486	65.8	-\$15,712	0.82
AC	Area 3A	chilled water	efficient chiller	RI	147	Elect	Elect	223	30.1	223	30.1	-\$2,316	0.93

Table 3.4
All EROs: Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	Rt or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW-mo)	Full Implement Energy Savings (MBtu)	Full Implement Demand Savings (kW-mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 3A	chilled water	efficient chiller	Rt	148	Elect	Elect	971	131.5	971	131.5	-\$7,455	0.94
AC	Area 3A	chilled water	efficient chiller	Rt	149	Elect	Elect	283	38.4	283	38.4	-\$2,903	0.93
AC	Area 3A	chilled water	efficient chiller	Rt	150	Elect	Elect	322	103.8	322	103.8	-\$87	1.00
AC	Area 3A	chilled water	efficient chiller	Rt	151	Elect	Elect	342	110.3	342	110.3	-\$390	1.01
AC	Area 3A	chilled water	efficient chiller	Rt	152	Elect	Elect	805	259.5	805	259.5	\$2,887	1.03
AC	Area 3A	chilled water	efficient chiller	Rt	153	Elect	Elect	442	142.7	442	142.7	\$1,912	1.03
AC	Area 3A	chilled water	efficient chiller	Rt	154	Elect	Elect	925	298.5	925	298.5	\$4,832	1.04
AC	Area 3A	chilled water	efficient chiller	Rt	155	Elect	Elect	1,006	324.4	1,006	324.4	\$5,903	1.05
AC	Area 3A	chilled water	efficient chiller	Rt	156	Elect	Elect	644	207.6	644	207.6	\$4,793	1.06
AC	Area 3A	chilled water	efficient chiller	Rt	157	Elect	Elect	420	80.2	420	80.2	-\$26,241	0.76
AC	Area 3A	chilled water	efficient chiller	Rt	158	Elect	Elect	473	90.3	473	90.3	-\$29,521	0.76
AC	Area 3A	chilled water	efficient chiller	Rt	159	Elect	Elect	504	96.3	504	96.3	-\$31,489	0.76
AC	Area 3A	chilled water	efficient chiller	Rt	160	Elect	Elect	672	128.4	672	128.4	-\$18,172	0.86
AC	Area 3A	chilled water	efficient chiller	Rt	161	Elect	Elect	786	150.0	786	150.0	-\$17,105	0.88
AC	Area 3A	chilled water	efficient chiller	Rt	162	Elect	Elect	1,291	330.7	1,291	330.7	\$21,719	1.13
AC	Area 3A	chilled water	efficient chiller	Rt	163	Elect	Elect	1,342	343.9	1,342	343.9	\$22,588	1.13
AC	Area 3A	direct expansion	efficient chiller	Rt	164	Elect	Elect	43	6.7	43	6.7	-\$5,171	0.61
AC	Area 3A	direct expansion	efficient chiller	Rt	165	Elect	Elect	10	1.5	10	1.5	-\$1,149	0.61
AC	Area 3A	direct expansion	efficient chiller	Rt	166	Elect	Elect	14	2.2	14	2.2	-\$1,724	0.61
AC	Area 3A	direct expansion	efficient chiller	Rt	167	Elect	Elect	260	40.2	260	40.2	-\$31,027	0.61
AC	Area 3A	direct expansion	efficient chiller	Rt	168	Elect	Elect	29	4.5	29	4.5	-\$3,447	0.61
AC	Area 3A	direct expansion	efficient chiller	Rt	169	Elect	Elect	635	98.2	635	98.2	-\$75,845	0.61
AC	Area 3A	direct expansion	efficient chiller	Rt	170	Elect	Elect	115	17.9	115	17.9	-\$11,896	0.63
AC	Area 3A	direct expansion	efficient chiller	Rt	171	Elect	Elect	770	119.0	770	119.0	-\$60,318	0.66
AC	Area 3A	direct expansion	efficient chiller	Rt	172	Elect	Elect	29	4.5	29	4.5	-\$2,089	0.67
AC	Area 3A	direct expansion	efficient chiller	Rt	173	Elect	Elect	34	5.2	34	5.2	-\$2,293	0.68
AC	Area 3A	direct expansion	efficient chiller	Rt	174	Elect	Elect	616	95.2	616	95.2	-\$39,780	0.69
AC	Area 3A	direct expansion	efficient chiller	Rt	175	Elect	Elect	2,502	386.8	2,502	386.8	-\$148,228	0.70
AC	Area 3A	direct expansion	efficient chiller	Rt	176	Elect	Elect	462	71.4	462	71.4	-\$25,060	0.71
AC	Area 3A	direct expansion	efficient chiller	Rt	177	Elect	Elect	1,588	245.4	1,588	245.4	-\$78,219	0.72
AC	Area 3A	direct expansion	efficient chiller	Rt	178	Elect	Elect	77	11.9	77	11.9	-\$3,529	0.73
AC	Area 3A	direct expansion	efficient chiller	Rt	179	Elect	Elect	87	13.4	87	13.4	-\$3,476	0.75
AC	Area 3A	direct expansion	efficient chiller	Rt	180	Elect	Elect	809	109.6	809	109.6	\$51,936	0.73
AC	Area 3A	direct expansion	efficient chiller	Rt	181	Elect	Elect	607	82.2	607	82.2	-\$30,911	0.76
AC	Area 3A	direct expansion	efficient chiller	Rt	182	Elect	Elect	1,092	148.0	1,092	148.0	\$42,882	0.80
AC	Area 3A	direct expansion	efficient chiller	Rt	183	Elect	Elect	142	19.2	142	19.2	\$4,709	0.82
AC	Area 3A	direct expansion	efficient chiller	Rt	184	Elect	Elect	647	87.7	647	87.7	\$18,617	0.83
AC	Area 3A	direct expansion	efficient chiller	Rt	185	Elect	Elect	202	27.4	202	27.4	\$4,927	0.85
AC	Area 3A	direct expansion	efficient chiller	Rt	186	Elect	Elect	223	30.1	223	30.1	\$4,297	0.88
AC	Area 3A	direct expansion	efficient chiller	Rt	187	Elect	Elect	243	32.9	243	32.9	\$9,286	0.80
AC	Area 3A	direct expansion	efficient chiller	Rt	188	Elect	Elect	322	103.8	322	103.8	\$5,431	0.90
AC	Area 3A	direct expansion	efficient chiller	Rt	189	Elect	Elect	402	129.8	402	129.8	\$6,114	0.91
AC	Area 3A	heat pump	efficient chiller	Rt	190	Elect	Elect	27	3.8	27	3.8	-\$2,379	0.66
AC	Area 3A	heat pump	efficient chiller	Rt	191	Elect	Elect	27	3.8	27	3.8	\$1,932	0.69
AC	Area 3A	heat pump	efficient chiller	Rt	192	Elect	Elect	55	7.6	55	7.6	\$3,864	0.69
AC	Area 3A	heat pump	efficient chiller	Rt	193	Elect	Elect	18	2.5	18	2.5	\$1,321	0.69
AC	Area 1N	chilled water	efficient chiller	Rt	194	Elect	Elect	104	5.9	104	5.9	\$12,448	0.61
AC	Area 1N	chilled water	efficient chiller	Rt	195	Elect	Elect	302	97.3	302	97.3	\$564	0.99
AC	Area 1N	chilled water	efficient chiller	Rt	196	Elect	Elect	1,733	331.0	1,733	331.0	\$63,482	0.83

Table 3.4
All EROs: Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW-mo)	Full Implement. Energy Savings (MBtu)	Full Implement. Demand Savings (kW-mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 1N	direct expansion	efficient chiller	RI	197	Elect	Elect.	10	1.5	10	1.5	-\$1,149	0.61
AC	Area 1N	direct expansion	efficient chiller	RI	198	Elect	Elect.	29	4.5	29	4.5	-\$3,447	0.61
AC	Area 1N	direct expansion	efficient chiller	RI	199	Elect	Elect.	19	3.0	19	3.0	-\$1,983	0.63
AC	Area 1N	direct expansion	efficient chiller	RI	200	Elect	Elect.	38	6.0	38	6.0	-\$2,486	0.69
AC	Area 1N	direct expansion	efficient chiller	RI	201	Elect	Elect.	48	7.4	48	7.4	-\$2,851	0.70
AC	Area 1N	direct expansion	efficient chiller	RI	202	Elect	Elect.	144	22.3	144	22.3	-\$7,111	0.72
AC	Area 1N	direct expansion	efficient chiller	RI	203	Elect	Elect.	324	43.8	324	43.8	-\$9,308	0.83
AC	Area 1N	direct expansion	efficient chiller	RI	204	Elect	Elect.	243	32.9	243	32.9	-\$5,804	0.85
AC	Other	direct expansion	efficient chiller	RI	205	Elect	Elect.	19	3.0	19	3.0	-\$2,298	0.61
AC	Other	direct expansion	efficient chiller	RI	206	Elect	Elect.	38	6.0	38	6.0	-\$2,486	0.69
AC	Other	direct expansion	efficient chiller	RI	207	Elect	Elect.	58	8.9	58	8.9	-\$3,132	0.71
AC	Area 4	chilled water	install TES	ROF	1	Elect	Elect.	0	0	75	256	\$23,347	2.89
AC	Area 5	chilled water	install TES	ROF	2	Elect	Elect.	0	0	75	256	\$23,347	2.89
AC	Area 6	chilled water	install TES	ROF	3	Elect	Elect.	0	0	75	256	\$23,347	2.89
AC	Area 7	chilled water	install TES	ROF	4	Elect	Elect.	0	0	75	256	\$23,174	2.88
AC	Area 3A	chilled water	install TES	ROF	5	Elect	Elect.	0	0	75	256	\$23,347	2.89
AC	Area 6	chilled water	install TES	ROF	6	Elect	Elect.	0	0	-90	307	\$24,614	2.66
AC	Area 3A	chilled water	install TES	ROF	7	Elect	Elect.	0	0	-359	1,226	-\$186,794	0.21
AC	Area 5	chilled water	install TES	ROF	8	Elect	Elect.	0	0	-105	358	\$25,590	2.48
AC	Area 6	chilled water	install TES	ROF	9	Elect	Elect.	0	0	-120	409	\$28,923	2.46
AC	Area 1W	chilled water	install TES	ROF	10	Elect	Elect.	0	0	-120	409	\$28,923	2.46
AC	Area 3A	chilled water	install TES	ROF	11	Elect	Elect.	0	0	-164	562	\$35,849	2.32
AC	Area 6	chilled water	install TES	ROF	12	Elect	Elect.	0	0	-179	613	\$37,850	2.28
AC	Area 8	chilled water	install TES	ROF	13	Elect	Elect.	0	0	-179	613	\$37,850	2.28
AC	Area 1W	chilled water	install TES	ROF	14	Elect	Elect.	0	0	-179	613	\$37,850	2.28
AC	Area 3A	chilled water	install TES	ROF	15	Elect	Elect.	0	0	-717	2,453	-\$419,099	0.12
AC	Area 3	chilled water	install TES	ROF	16	Elect	Elect.	0	0	-209	715	\$45,542	2.32
AC	Area 3A	chilled water	install TES	ROF	17	Elect	Elect.	0	0	-209	715	\$45,542	2.32
AC	Area 7	chilled water	install TES	ROF	18	Elect	Elect.	0	0	-226	1,335	-\$22,342	0.85
AC	Area 1N	chilled water	install TES	ROF	19	Elect	Elect.	0	0	-113	668	\$48,256	2.30
AC	Area 3A	chilled water	install TES	ROF	20	Elect	Elect.	0	0	-121	712	\$50,496	2.28
AC	Area 3A	chilled water	install TES	ROF	21	Elect	Elect.	0	0	-128	757	\$52,736	2.26
AC	Area 6	chilled water	install TES	ROF	22	Elect	Elect.	0	0	-136	801	\$54,976	2.24
AC	Area 5	chilled water	install TES	ROF	23	Elect	Elect.	0	0	-302	1,780	-\$38,126	0.81
AC	Area 3A	chilled water	install TES	ROF	24	Elect	Elect.	0	0	-302	1,780	-\$38,126	0.81
AC	Area 7	chilled water	install TES	ROF	25	Elect	Elect.	0	0	-158	935	\$62,874	2.21
AC	Area 3A	chilled water	install TES	ROF	26	Elect	Elect.	0	0	-166	979	\$65,575	2.21
AC	Area 3A	chilled water	install TES	ROF	27	Elect	Elect.	0	0	-347	2,047	-\$46,715	0.79
AC	Area 2	chilled water	install TES	ROF	28	Elect	Elect.	0	0	-181	1,068	\$87,720	2.48
AC	Area 1W	chilled water	install TES	ROF	29	Elect	Elect.	0	0	-181	1,068	\$69,953	2.18
AC	Area 3A	chilled water	install TES	ROF	30	Elect	Elect.	0	0	-377	2,225	-\$52,014	0.79
AC	Area 3	chilled water	install TES	ROF	31	Elect	Elect.	0	0	-211	1,246	\$82,295	2.19
AC	Area 1W	chilled water	install TES	ROF	32	Elect	Elect.	0	0	-211	1,246	\$82,295	2.19
AC	Area 3A	chilled water	install TES	ROF	33	Elect	Elect.	0	0	-241	1,424	\$91,562	2.16
AC	Area 1W	chilled water	install TES	ROF	34	Elect	Elect.	0	0	-272	1,602	\$113,847	2.28
AC	Area 3A	chilled water	install TES	ROF	35	Elect	Elect.	0	0	-265	1,022	\$111,099	2.27
AC	Area 7	chilled water	install TES	ROF	36	Elect	Elect.	0	0	-278	1,073	\$116,654	2.27
AC	Area 3A	chilled water	install TES	ROF	37	Elect	Elect.	0	0	-298	1,150	\$124,987	2.27
AC	Area 3A	chilled water	install TES	ROF	38	Elect	Elect.	0	0	-318	1,226	\$133,319	2.27

Table 3.4
All EROs: Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW mo)	Full Implement Energy Savings (MBtu)	Full Implement Demand Savings (kW mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 1W	chilled water	install TES	ROF	39	Elect	Elect	0	0	-331	1,278	\$129,699	2.18
AC	Area 1W	chilled water	install TES	ROF	40	Elect	Elect	0	0	-364	1,405	\$138,999	2.15
AC	Area 1N	chilled water	install TES	ROF	41	Elect	Elect	0	0	-1,093	4,216	\$18,949	0.98
AC	Area 5	chilled water	install TES	ROF	42	Elect	Elect	0	0	398	1,533	\$148,272	2.13
AC	Area 1W	chilled water	install TES	ROF	43	Elect	Elect	0	0	398	1,533	\$148,272	2.13
AC	Area 5	chilled water	install TES	ROF	44	Elect	Elect	0	0	-424	1,635	\$155,706	2.11
AC	Area 3A	chilled water	install TES	ROF	45	Elect	Elect	0	0	-424	1,635	\$155,706	2.11
AC	Area 6	chilled water	install TES	ROF	46	Elect	Elect	0	0	-477	1,840	\$159,107	2.01
AC	Area 3A	chilled water	install TES	ROF	47	Elect	Elect	0	0	-496	1,911	\$178,154	2.08
AC	Area 3A	chilled water	install TES	ROF	48	Elect	Elect	0	0	651	3,000	\$267,509	2.22
AC	Area 3A	chilled water	install TES	ROF	49	Elect	Elect	0	0	677	3,120	\$278,209	2.22
AC	Area 8	chilled water	install TES	ROF	50	Elect	Elect	0	0	1,666	7,679	\$741,638	2.32
AC	Area 3	direct expansion	install TES	ROF	51	Elect	Elect	0	0	149	511	\$19,581	1.40
AC	Area 5	direct expansion	install TES	ROF	52	Elect	Elect	0	0	75	256	\$25,103	3.03
AC	Area 6	direct expansion	install TES	ROF	53	Elect	Elect	0	0	149	511	\$19,581	1.40
AC	Area 7	direct expansion	install TES	ROF	54	Elect	Elect	0	0	149	511	\$19,581	1.40
AC	Area 8	direct expansion	install TES	ROF	55	Elect	Elect	0	0	75	256	\$25,103	3.03
AC	Area 3A	direct expansion	install TES	ROF	56	Elect	Elect	0	0	-448	1,533	\$308,750	0.31
AC	Area 4	direct expansion	install TES	ROF	57	Elect	Elect	0	0	-269	920	\$26,694	0.80
AC	Area 5	direct expansion	install TES	ROF	58	Elect	Elect	0	0	90	307	\$27,852	2.88
AC	Area 7	direct expansion	install TES	ROF	59	Elect	Elect	0	0	179	613	\$18,954	1.32
AC	Area 8	direct expansion	install TES	ROF	60	Elect	Elect	0	0	179	613	\$18,954	1.32
AC	Area 1W	direct expansion	install TES	ROF	61	Elect	Elect	0	0	179	613	\$18,954	1.32
AC	Area 3A	direct expansion	install TES	ROF	62	Elect	Elect	0	0	807	2,760	\$1,072,317	0.11
AC	Area 7	direct expansion	install TES	ROF	63	Elect	Elect	0	0	-209	715	\$19,390	1.28
AC	Area 3A	direct expansion	install TES	ROF	64	Elect	Elect	0	0	105	358	\$31,132	2.80
AC	Area 5	direct expansion	install TES	ROF	65	Elect	Elect	0	0	120	409	\$34,413	2.74
AC	Area 3A	direct expansion	install TES	ROF	66	Elect	Elect	0	0	478	1,635	\$156,345	0.51
AC	Area 1N	direct expansion	install TES	ROF	67	Elect	Elect	0	0	239	818	\$19,826	1.25
AC	Area 1	direct expansion	install TES	ROF	68	Elect	Elect	0	0	149	511	\$41,588	2.68
AC	Area 6	direct expansion	install TES	ROF	69	Elect	Elect	0	0	149	511	\$41,588	2.68
AC	Area 7	direct expansion	install TES	ROF	70	Elect	Elect	0	0	299	1,022	\$21,927	1.22
AC	Area 1W	direct expansion	install TES	ROF	71	Elect	Elect	0	0	448	1,533	\$58,982	0.73
AC	Area 3A	direct expansion	install TES	ROF	72	Elect	Elect	0	0	149	511	\$41,588	2.68
AC	Area 3A	direct expansion	install TES	ROF	73	Elect	Elect	0	0	164	562	\$43,947	2.62
AC	Area 1W	direct expansion	install TES	ROF	74	Elect	Elect	0	0	359	1,226	\$37,128	1.31
AC	Area 3A	direct expansion	install TES	ROF	75	Elect	Elect	0	0	179	613	\$55,314	2.87
AC	Area 1N	direct expansion	install TES	ROF	76	Elect	Elect	0	0	179	613	\$49,733	2.68
AC	Area 5	direct expansion	install TES	ROF	77	Elect	Elect	0	0	241	1,424	\$35,129	1.22
AC	Area 3A	direct expansion	install TES	ROF	78	Elect	Elect	0	0	121	712	\$66,564	2.68
AC	Area 2	direct expansion	install TES	ROF	79	Elect	Elect	0	0	151	890	\$82,123	2.66
AC	Area 4	direct expansion	install TES	ROF	80	Elect	Elect	0	0	151	890	\$82,123	2.66
AC	Area 1W	direct expansion	install TES	ROF	81	Elect	Elect	0	0	151	890	\$82,123	2.66
AC	Area 3A	direct expansion	install TES	ROF	82	Elect	Elect	0	0	151	890	\$82,123	2.66
AC	Area 3	direct expansion	install TES	ROF	83	Elect	Elect	0	0	190	1,122	\$100,101	2.61
AC	Area 1W	heat pump	install TES	ROF	84	Elect	Elect	0	0	334	1,150	\$121,527	3.46
AC	Area 4	chilled water	install TES	RI	1	Elect	Elect	75	256	75	256	\$6,787	1.42
AC	Area 5	chilled water	install TES	RI	2	Elect	Elect	75	256	75	256	\$6,787	1.42
AC	Area 6	chilled water	install TES	RI	3	Elect	Elect	75	256	75	256	\$6,787	1.42

Table 3.4
All EROs: Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW mo)	Full Implement Energy Savings (MBtu)	Full Implement Demand Savings (kW mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 7	chilled water	install TES	RI	4	Elect	Elect	-75	256	-75	256	\$6,614	1.41
AC	Area 3A	chilled water	install TES	RI	5	Elect	Elect	-75	256	-75	256	\$6,787	1.42
AC	Area 6	chilled water	install TES	RI	6	Elect	Elect	-90	307	-90	307	\$3,616	1.19
AC	Area 3A	chilled water	install TES	RI	7	Elect	Elect	-359	1,226	-359	1,226	-\$468,511	-0.50
AC	Area 5	chilled water	install TES	RI	8	Elect	Elect	-105	358	-105	358	\$1,092	1.05
AC	Area 6	chilled water	install TES	RI	9	Elect	Elect	-120	409	-120	409	\$926	1.04
AC	Area 1W	chilled water	install TES	RI	10	Elect	Elect	-120	409	-120	409	\$926	1.04
AC	Area 3A	chilled water	install TES	RI	11	Elect	Elect	-164	562	-164	562	-\$2,648	0.93
AC	Area 6	chilled water	install TES	RI	12	Elect	Elect	-179	613	-179	613	-\$4,146	0.89
AC	Area 8	chilled water	install TES	RI	13	Elect	Elect	-179	613	-179	613	-\$4,146	0.89
AC	Area 1W	chilled water	install TES	RI	14	Elect	Elect	-179	613	-179	613	-\$4,146	0.89
AC	Area 3A	chilled water	install TES	RI	15	Elect	Elect	-717	2,453	-717	2,453	-\$982,534	-0.57
AC	Area 3	chilled water	install TES	RI	16	Elect	Elect	-209	715	-209	715	-\$3,454	0.92
AC	Area 3A	chilled water	install TES	RI	17	Elect	Elect	-209	715	-209	715	-\$3,454	0.92
AC	Area 7	chilled water	install TES	RI	18	Elect	Elect	-226	1,335	-226	1,335	-\$197,304	-0.01
AC	Area 1N	chilled water	install TES	RI	19	Elect	Elect	-113	668	-113	668	\$1,968	1.04
AC	Area 3A	chilled water	install TES	RI	20	Elect	Elect	-121	712	-121	712	\$1,122	1.02
AC	Area 3A	chilled water	install TES	RI	21	Elect	Elect	-128	757	-128	757	\$276	1.00
AC	Area 6	chilled water	install TES	RI	22	Elect	Elect	-136	801	-136	801	-\$570	0.99
AC	Area 5	chilled water	install TES	RI	23	Elect	Elect	-302	1,780	-302	1,780	-\$271,409	-0.04
AC	Area 3A	chilled water	install TES	RI	24	Elect	Elect	-302	1,780	-302	1,780	-\$271,409	-0.04
AC	Area 7	chilled water	install TES	RI	25	Elect	Elect	-158	935	-158	935	-\$1,930	0.97
AC	Area 3A	chilled water	install TES	RI	26	Elect	Elect	-166	979	-166	979	-\$2,314	0.97
AC	Area 3A	chilled water	install TES	RI	27	Elect	Elect	-347	2,047	-347	2,047	-\$314,990	-0.05
AC	Area 2	chilled water	install TES	RI	28	Elect	Elect	-181	1,068	-181	1,068	\$13,658	1.18
AC	Area 1W	chilled water	install TES	RI	29	Elect	Elect	-181	1,068	-181	1,068	-\$4,109	0.95
AC	Area 3A	chilled water	install TES	RI	30	Elect	Elect	-377	2,225	-377	2,225	-\$343,617	-0.06
AC	Area 3	chilled water	install TES	RI	31	Elect	Elect	-211	1,246	-211	1,246	-\$4,110	0.95
AC	Area 1W	chilled water	install TES	RI	32	Elect	Elect	-211	1,246	-211	1,246	-\$4,110	0.95
AC	Area 3A	chilled water	install TES	RI	33	Elect	Elect	-241	1,424	-241	1,424	-\$7,187	0.93
AC	Area 1W	chilled water	install TES	RI	34	Elect	Elect	-272	1,602	-272	1,602	\$2,755	1.02
AC	Area 3A	chilled water	install TES	RI	35	Elect	Elect	-265	1,022	-265	1,022	-\$26,432	0.80
AC	Area 7	chilled water	install TES	RI	36	Elect	Elect	-278	1,073	-278	1,073	-\$27,754	0.80
AC	Area 3A	chilled water	install TES	RI	37	Elect	Elect	-298	1,150	-298	1,150	-\$29,736	0.80
AC	Area 3A	chilled water	install TES	RI	38	Elect	Elect	-318	1,226	-318	1,226	\$31,719	0.80
AC	Area 1W	chilled water	install TES	RI	39	Elect	Elect	-331	1,278	-331	1,278	-\$42,215	0.74
AC	Area 1W	chilled water	install TES	RI	40	Elect	Elect	-364	1,405	-364	1,405	\$50,106	0.72
AC	Area 1N	chilled water	install TES	RI	41	Elect	Elect	-1093	4,216	-1,093	4,216	-\$1,574,306	-0.02
AC	Area 5	chilled water	install TES	RI	42	Elect	Elect	-398	1,533	-398	1,533	\$58,025	0.70
AC	Area 1W	chilled water	install TES	RI	43	Elect	Elect	-398	1,533	-398	1,533	\$58,025	0.70
AC	Area 5	chilled water	install TES	RI	44	Elect	Elect	-424	1,635	-424	1,635	-\$64,344	0.69
AC	Area 3A	chilled water	install TES	RI	45	Elect	Elect	-424	1,635	-424	1,635	-\$64,344	0.69
AC	Area 6	chilled water	install TES	RI	46	Elect	Elect	-477	1,840	-477	1,840	-\$88,449	0.62
AC	Area 3A	chilled water	install TES	RI	47	Elect	Elect	-496	1,911	-496	1,911	\$79,030	0.67
AC	Area 3A	chilled water	install TES	RI	48	Elect	Elect	-651	3,000	-651	3,000	-\$74,079	0.77
AC	Area 3A	chilled water	install TES	RI	49	Elect	Elect	-677	3,120	-677	3,120	-\$77,043	0.77
AC	Area 8	chilled water	install TES	RI	50	Elect	Elect	-1666	7,679	-1,666	7,679	-\$132,827	0.84
AC	Area 3	direct expansion	install TES	RI	51	Elect	Elect	-149	511	-149	511	\$39,122	0.40
AC	Area 5	direct expansion	install TES	RI	52	Elect	Elect	-75	256	-75	256	\$8,543	1.53

Table 3.4
All EROs: Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW mo)	Full Implement. Energy Savings (MBtu)	Full Implement. Demand Savings (kW mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 6	direct expansion	install TES	RI	53	Elect.	Elect.	-149	511	-149	511	-\$39,122	0.40
AC	Area 7	direct expansion	install TES	RI	54	Elect.	Elect.	-149	511	-149	511	-\$39,122	0.40
AC	Area 8	direct expansion	install TES	RI	55	Elect.	Elect.	-75	256	-75	256	\$8,543	1.53
AC	Area 3A	direct expansion	install TES	RI	56	Elect.	Elect.	-448	1,533	-448	1,533	-\$791,873	-0.35
AC	Area 4	direct expansion	install TES	RI	57	Elect.	Elect.	-269	920	-269	920	-\$178,412	-0.02
AC	Area 5	direct expansion	install TES	RI	58	Elect.	Elect.	-90	307	-90	307	\$7,980	1.41
AC	Area 7	direct expansion	install TES	RI	59	Elect.	Elect.	-179	613	-179	613	-\$51,491	0.34
AC	Area 8	direct expansion	install TES	RI	60	Elect.	Elect.	-179	613	-179	613	-\$51,491	0.34
AC	Area 1W	direct expansion	install TES	RI	61	Elect.	Elect.	-179	613	-179	613	-\$51,491	0.34
AC	Area 3A	direct expansion	install TES	RI	62	Elect.	Elect.	-807	2,760	-807	2,760	-\$2,356,403	-0.49
AC	Area 7	direct expansion	install TES	RI	63	Elect.	Elect.	-209	715	-209	715	-\$62,795	0.31
AC	Area 3A	direct expansion	install TES	RI	64	Elect.	Elect.	-105	358	-105	358	\$7,949	1.35
AC	Area 5	direct expansion	install TES	RI	65	Elect.	Elect.	-120	409	-120	409	\$7,917	1.30
AC	Area 3A	direct expansion	install TES	RI	66	Elect.	Elect.	-478	1,635	-478	1,635	-\$507,936	-0.22
AC	Area 1N	direct expansion	install TES	RI	67	Elect.	Elect.	-239	818	-239	818	-\$74,100	0.29
AC	Area 1	direct expansion	install TES	RI	68	Elect.	Elect.	-149	511	-149	511	\$8,469	1.26
AC	Area 6	direct expansion	install TES	RI	69	Elect.	Elect.	-149	511	-149	511	\$8,469	1.26
AC	Area 7	direct expansion	install TES	RI	70	Elect.	Elect.	-299	1,022	-299	1,022	-\$95,480	0.27
AC	Area 1W	direct expansion	install TES	RI	71	Elect.	Elect.	-448	1,533	-448	1,533	-\$311,846	-0.07
AC	Area 3A	direct expansion	install TES	RI	72	Elect.	Elect.	-149	511	-149	511	\$8,469	1.26
AC	Area 3A	direct expansion	install TES	RI	73	Elect.	Elect.	-164	562	-164	562	\$7,516	1.21
AC	Area 1W	direct expansion	install TES	RI	74	Elect.	Elect.	-359	1,226	-359	1,226	-\$103,760	0.33
AC	Area 3A	direct expansion	install TES	RI	75	Elect.	Elect.	-179	613	-179	613	\$15,570	1.40
AC	Area 1N	direct expansion	install TES	RI	76	Elect.	Elect.	-179	613	-179	613	\$9,990	1.26
AC	Area 5	direct expansion	install TES	RI	77	Elect.	Elect.	-241	1,424	-241	1,424	-\$139,481	0.33
AC	Area 3A	direct expansion	install TES	RI	78	Elect.	Elect.	-121	712	-121	712	\$20,194	1.39
AC	Area 2	direct expansion	install TES	RI	79	Elect.	Elect.	-151	890	-151	890	\$24,161	1.37
AC	Area 4	direct expansion	install TES	RI	80	Elect.	Elect.	-151	890	-151	890	\$24,161	1.37
AC	Area 1W	direct expansion	install TES	RI	81	Elect.	Elect.	-151	890	-151	890	\$24,161	1.37
AC	Area 3A	direct expansion	install TES	RI	82	Elect.	Elect.	-151	890	-151	890	\$24,161	1.37
AC	Area 3	direct expansion	install TES	RI	83	Elect.	Elect.	-190	1,122	-190	1,122	\$27,068	1.33
AC	Area 1W	heat pump	install TES	RI	84	Elect.	Elect.	-334	1,150	-334	1,150	\$53,536	1.82
AC	Area 1	Window AC	install efficient window units	ROF	1	Elect.	Elect.	0	0	0	0	\$709	2.23
AC	Area 1	Window AC	install efficient window units	ROF	2	Elect.	Elect.	0	0	0	0	\$1,418	2.49
AC	Area 1W	Window AC	install efficient window units	ROF	3	Elect.	Elect.	0	0	0	0	\$1,418	2.23
AC	Area 1W	Window AC	install efficient window units	ROF	4	Elect.	Elect.	0	0	47	5	\$7,089	2.49
AC	Area 1W	Window AC	install efficient window units	ROF	5	Elect.	Elect.	0	0	14	1	\$2,127	2.58
AC	Area 2	Window AC	install efficient window units	ROF	6	Elect.	Elect.	0	0	9	1	\$1,418	2.23
AC	Area 2	Window AC	install efficient window units	ROF	7	Elect.	Elect.	0	0	19	2	\$2,835	2.49
AC	Area 2	Window AC	install efficient window units	ROF	8	Elect.	Elect.	0	0	28	3	\$4,253	2.58
AC	Area 3	Window AC	install efficient window units	ROF	9	Elect.	Elect.	0	0	37	4	\$5,671	2.23
AC	Area 3	Window AC	install efficient window units	ROF	10	Elect.	Elect.	0	0	914	98	\$138,938	2.49
AC	Area 3	Window AC	install efficient window units	ROF	11	Elect.	Elect.	0	0	42	4	\$6,380	2.58
AC	Area 4	Window AC	install efficient window units	ROF	12	Elect.	Elect.	0	0	75	8	\$11,342	2.23
AC	Area 4	Window AC	install efficient window units	ROF	13	Elect.	Elect.	0	0	149	16	\$22,684	2.49
AC	Area 5	Window AC	install efficient window units	ROF	14	Elect.	Elect.	0	0	23	2	\$3,544	2.23
AC	Area 5	Window AC	install efficient window units	ROF	15	Elect.	Elect.	0	0	289	31	\$43,950	2.49
AC	Area 6	Window AC	install efficient window units	ROF	16	Elect.	Elect.	0	0	23	2	\$3,544	2.23
AC	Area 6	Window AC	install efficient window units	ROF	17	Elect.	Elect.	0	0	103	11	\$15,595	2.49

Table 3.4
All EROs: Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW-mo)	Full Implement Energy Savings (MBtu)	Full Implement Demand Savings (kW-mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 7	Window AC	install efficient window units	ROF	18	Elect.	Elect.	0	0	89	9	\$13,468	2.23
AC	Area 7	Window AC	install efficient window units	ROF	19	Elect.	Elect.	0	0	65	7	\$9,924	2.49
AC	Area 8	Window AC	install efficient window units	ROF	20	Elect.	Elect.	0	0	98	10	\$14,886	2.23
AC	Area 8	Window AC	install efficient window units	ROF	21	Elect.	Elect.	0	0	280	30	\$42,532	2.49
AC	Area IN	Window AC	install efficient window units	ROF	22	Elect.	Elect.	0	0	9	1	\$1,418	2.23
AC	Area IN	Window AC	install efficient window units	ROF	23	Elect.	Elect.	0	0	28	3	\$4,253	2.49
AC	Other	Window AC	install efficient window units	ROF	24	Elect.	Elect.	0	0	9	1	\$1,418	2.49
Cooling	1641	Envelope	Reflective Film	RI	1	na	na	81	8.8	81	8.8	\$7,057	3.00
Cooling	1645	Envelope	Reflective Film	RI	2	na	na	90	9.9	90	9.9	\$6,567	2.42
Cooling	1704	Envelope	Reflective Film	RI	3	na	na	76	8.3	76	8.3	\$4,390	1.99
Cooling	1722	Envelope	Reflective Film	RI	4	na	na	38	4.1	38	4.1	\$3,288	3.00
Cooling	1724	Envelope	Reflective Film	RI	5	na	na	41	4.4	41	4.4	\$2,954	2.42
Cooling	1748	Envelope	Reflective Film	RI	6	na	na	47	5.2	47	5.2	\$3,449	2.42
Cooling	49635	Envelope	Reflective Film	RI	7	na	na	42	4.6	42	4.6	\$2,447	1.99
Cooling	49750	Envelope	Reflective Film	RI	8	na	na	35	3.8	35	3.8	\$3,032	3.00
Cooling	54915	Envelope	Reflective Film	RI	9	na	na	69	7.6	69	7.6	\$5,038	2.42
Cooling	55005	Envelope	Reflective Film	RI	10	na	na	53	5.8	53	5.8	\$3,852	2.42
Cooling	60600	Envelope	Reflective Film	RI	11	na	na	38	4.2	38	4.2	\$2,769	2.42
Cooling	60740	Envelope	Reflective Film	RI	12	na	na	28	3.1	28	3.1	\$2,470	3.00
Cooling	1641	Envelope	Double Paned Window	RI	13	na	na	255	25.9	255	25.9	\$27,408	2.70
Cooling	1645	Envelope	Double Paned Window	RI	14	na	na	285	28.9	285	28.9	\$27,512	2.30
Cooling	1704	Envelope	Double Paned Window	RI	15	na	na	239	24.2	239	24.2	\$20,408	2.01
Cooling	1722	Envelope	Double Paned Window	RI	16	na	na	119	12.1	119	12.1	\$12,769	2.70
Cooling	1724	Envelope	Double Paned Window	RI	17	na	na	128	13.0	128	13.0	\$12,376	2.30
Cooling	1748	Envelope	Double Paned Window	RI	18	na	na	150	15.2	150	15.2	\$14,448	2.30
Cooling	49635	Envelope	Double Paned Window	RI	19	na	na	133	13.5	133	13.5	\$11,375	2.01
Cooling	49750	Envelope	Double Paned Window	RI	20	na	na	110	11.1	110	11.1	\$11,775	2.70
Cooling	54915	Envelope	Double Paned Window	RI	21	na	na	219	22.2	219	22.2	\$21,104	2.30
Cooling	55005	Envelope	Double Paned Window	RI	22	na	na	167	17.0	167	17.0	\$16,137	2.30
Cooling	60600	Envelope	Double Paned Window	RI	23	na	na	120	12.2	120	12.2	\$11,601	2.30
Cooling	60740	Envelope	Double Paned Window	RI	24	na	na	89	9.1	89	9.1	\$9,595	2.70
Cooling	1641	Envelope	ceiling insulation	RI	25	na	na	4	3.7	4	3.7	\$5,810	0.14
Cooling	1645	Envelope	ceiling insulation	RI	26	na	na	5	5.4	5	5.4	\$10,245	0.12
Cooling	1704	Envelope	ceiling insulation	RI	27	na	na	4	4.4	4	4.4	\$9,623	0.10
Cooling	1722	Envelope	ceiling insulation	RI	28	na	na	1	0.8	1	0.8	\$1,261	0.14
Cooling	1724	Envelope	ceiling insulation	RI	29	na	na	1	1.1	1	1.1	\$2,073	0.12
Cooling	1748	Envelope	ceiling insulation	RI	30	na	na	1	1.5	1	1.5	\$2,826	0.12
Cooling	49635	Envelope	ceiling insulation	RI	31	na	na	1	1.4	1	1.4	\$2,990	0.10
Cooling	49750	Envelope	ceiling insulation	RI	32	na	na	1	0.7	1	0.7	\$1,072	0.14
Cooling	54915	Envelope	ceiling insulation	RI	33	na	na	3	3.2	3	3.2	\$6,028	0.12
Cooling	55005	Envelope	ceiling insulation	RI	34	na	na	2	1.9	2	1.9	\$3,524	0.12
Cooling	60600	Envelope	ceiling insulation	RI	35	na	na	1	1.0	1	1.0	\$1,822	0.12
Cooling	60740	Envelope	ceiling insulation	RI	36	na	na	0	0.5	0	0.5	\$712	0.14
Cooling	Other	Envelope	Weatherization Package	RI	37	na	na	263	270.9	263	270.9	\$57,896	6.15
Int light.	ADMIN	FL 2X4 2-34 STD	FL 2X4 2F40T12ES ELC2	RI	1	Elect.	Elect.	1,906	1,217	1,906	1,217	\$213,423	1.82
Int light.	ADMIN	INC 60 CEIL	CFL 13 + BLST UNIT	RI	2	Elect.	Elect.	7,385	4,714	7,385	4,714	\$969,574	3.76
Int light.	BRK/ADM	FL 2X4 2-34 STD	FL 2X4 2F40T12ES ELC2	RI	3	Elect.	Elect.	5	3	5	3	\$177	0.88
Int light.	BRK/ADM	INC 60 CEIL	CFL 18 GLOBE UNIT	RI	4	Elect.	Elect.	16	10	16	10	\$1,734	3.55
Int light.	COMCATN	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	5	Elect.	Elect.	3,049	2,206	3,049	2,206	\$515,588	2.91

Table 3.4
All EROs: Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW-mo)	Full Implement. Energy Savings (MBtu)	Full Implement. Demand Savings (kW-mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
Int light.	COMCATN	INC 60 CEIL	CFL 13 + BLST UNIT	RI	6	Elect.	Elect.	4,518	3,269	4,518	3,269	\$610,917	3.51
Int light.	DET-RR	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	7	Elect.	Elect.	2	2	2	2	\$373	2.60
Int light.	DET-RR	INC 60 CEIL	CFL 13 + BLST UNIT	RI	8	Elect.	Elect.	18	16	18	16	\$2,509	3.15
Int light.	FUELDSP	FL 2X4 4-40 STD	FL 2X4 3F32T8 ELC3 REF	RI	9	Elect.	Elect.	39	16	39	16	\$5,908	4.36
Int light.	FUELDSP	INC 60 CEIL	CFL 13 + BLST UNIT	RI	10	Elect.	Elect.	35	14	35	14	\$4,244	5.04
Int light.	HANGAR	FL 2X4 4-40 STD	FL 2X4 3F32T8 ELC3 REF	RI	11	Elect.	Elect.	1,059	425	1,059	425	\$161,498	4.36
Int light.	HANGAR	HPS 150 PEND	LPS 90 PEND	RI	12	Elect.	Elect.	133	53	133	53	-\$6,793	0.69
Int light.	HANGAR	INC 60 CEIL	CFL 13 + BLST UNIT	RI	13	Elect.	Elect.	595	239	595	239	\$71,847	5.04
Int light.	LAB-MED	FL 2X4 4-40 STD	FL 2X4 3F32T8 ELC3 REF	RI	14	Elect.	Elect.	500	262	500	262	\$77,372	3.62
Int light.	LAB-MED	HPS 150 PEND	LPS 90 PEND	RI	15	Elect.	Elect.	32	17	32	17	-\$2,574	0.62
Int light.	LAB-MED	INC 60 CEIL	CFL 13 + BLST UNIT	RI	16	Elect.	Elect.	137	72	137	72	\$17,369	4.26
Int light.	MTRPOOL	FL 2X4 3-60 STD	MH 175 PEND	RI	17	Elect.	Elect.	153	61	153	61	\$52,179	2.37
Int light.	MTRPOOL	HPS 150 PEND	LPS 90 PEND	RI	18	Elect.	Elect.	97	39	97	39	-\$4,933	0.69
Int light.	MTRPOOL	INC 60 CEIL	CFL 13 + BLST UNIT	RI	19	Elect.	Elect.	1,013	407	1,013	407	\$122,321	5.04
Int light.	MWR	FL 2X4 3-60 STD	MH 175 PEND	RI	20	Elect.	Elect.	44	18	44	18	\$15,069	2.37
Int light.	MWR	INC 60 CEIL	CFL 13 + BLST UNIT	RI	21	Elect.	Elect.	201	81	201	81	\$24,252	5.04
Int light.	NASLEAS	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	22	Elect.	Elect.	4,607	2,941	4,607	2,941	\$771,257	3.15
Int light.	NASLEAS	INC 60 CEIL	CFL 13 + BLST UNIT	RI	23	Elect.	Elect.	6,827	4,358	6,827	4,358	\$896,387	3.76
Int light.	NASOWN	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	24	Elect.	Elect.	4,690	2,994	4,690	2,994	\$785,101	3.15
Int light.	NASOWN	INC 60 CEIL	CFL 13 + BLST UNIT	RI	25	Elect.	Elect.	6,949	4,436	6,949	4,436	\$912,351	3.76
Int light.	OTHER	FL 2X4 3-60 STD	MH 175 PEND	RI	26	Elect.	Elect.	44	32	44	32	\$6,712	1.34
Int light.	OTHER	INC 60 CEIL	CFL 13 + BLST UNIT	RI	27	Elect.	Elect.	203	147	203	147	\$27,405	3.51
Int light.	PLT-BLD general	FL 2X4 3-60 STD	MH 175 PEND	RI	28	Elect.	Elect.	221	133	221	133	\$10,158	1.09
Int light.	PLT-BLD control boards	FL 2X4 3-60 STD	MH 175 PEND	RI	29	Elect.	Elect.	29	18	29	18	\$1,338	1.09
Int light.	PLT-BLD	INC 60 CEIL	CFL 13 + BLST UNIT	RI	30	Elect.	Elect.	1,015	611	1,015	611	\$117,971	2.81
Int light.	PLT-EQU	FL 2X4 3-60 STD	MH 175 PEND	RI	31	Elect.	Elect.	258	156	258	156	\$11,863	1.09
Int light.	PLT-EQU	INC 60 CEIL	CFL 13 + BLST UNIT	RI	32	Elect.	Elect.	1,186	714	1,186	714	\$137,780	2.81
Int light.	R&D	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	33	Elect.	Elect.	4,382	3,171	4,382	3,171	\$741,055	2.91
Int light.	R&D	INC 60 CEIL	CFL 13 + BLST UNIT	RI	34	Elect.	Elect.	4,869	3,524	4,869	3,524	\$658,476	3.51
Int light.	RESTRNT cashier	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	35	Elect.	Elect.	12	6	12	6	\$1,971	3.54
Int light.	RESTRNT cleaning	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	36	Elect.	Elect.	12	6	12	6	\$1,971	3.54
Int light.	RESTRNT dining	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	37	Elect.	Elect.	21	11	21	11	\$3,549	3.54
Int light.	RESTRNT cashier	INC 60 CEIL	CFL 13 + BLST UNIT	RI	38	Elect.	Elect.	18	10	18	10	\$2,283	4.20
Int light.	RESTRNT cleaning	INC 60 CEIL	CFL 13 + BLST UNIT	RI	39	Elect.	Elect.	18	10	18	10	\$2,283	4.20
Int light.	RESTRNT dining	INC 60 CEIL	CFL 13 + BLST UNIT	RI	40	Elect.	Elect.	32	17	32	17	\$4,086	4.20
Int light.	SECURITY records	FL 2X4 4-34 STD	FL 2X4 3F32T8 ELC3 REF	RI	41	Elect.	Elect.	1,241	498	1,241	498	\$160,967	2.85
Int light.	SECURITY other	FL 2X4 4-34 STD	FL 2X4 3F32T8 ELC3 REF	RI	42	Elect.	Elect.	123	50	123	50	\$16,015	2.85
Int light.	SECURITY record	INC 60 CEIL	CFL 13 + BLST UNIT	RI	43	Elect.	Elect.	1,391	558	1,391	558	\$167,946	5.04
Int light.	SECURITY other	INC 60 CEIL	CFL 13 + BLST UNIT	RI	44	Elect.	Elect.	139	56	139	56	\$16,825	5.04
Int light.	SHOP	FL 2X4 3-60 STD	MH 175 PEND	RI	45	Elect.	Elect.	489	196	489	196	\$167,108	2.37
Int light.	SHOP	HPS 150 PEND	LPS 90 PEND	RI	46	Elect.	Elect.	309	124	309	124	-\$15,771	0.69
Int light.	SHOP	INC 60 CEIL	CFL 13 + BLST UNIT	RI	47	Elect.	Elect.	3,248	1,304	3,248	1,304	\$392,126	5.04
Int light.	SHOP-ELEC	FL 2X4 3-60 STD	MH 175 PEND	RI	48	Elect.	Elect.	860	345	860	345	\$294,183	2.37
Int light.	SHOP-ELEC	HPS 150 PEND	LPS 90 PEND	RI	49	Elect.	Elect.	545	219	545	219	-\$27,821	0.69
Int light.	SHOP-ELEC	INC 60 CEIL	CFL 13 + BLST UNIT	RI	50	Elect.	Elect.	5,716	2,295	5,716	2,295	\$690,123	5.04
Int light.	SHOP-WPN	FL 2X4 3-60 STD	MH 175 PEND	RI	51	Elect.	Elect.	29	12	29	12	\$9,896	2.37
Int light.	SHOP-WPN	HPS 150 PEND	LPS 90 PEND	RI	52	Elect.	Elect.	17	7	17	7	-\$890	0.69
Int light.	SHOP-WPN	INC 60 CEIL	CFL 13 + BLST UNIT	RI	53	Elect.	Elect.	191	77	191	77	\$23,039	5.04
Int light.	STOR-UH	FL 2X4 3-60 STD	MH 175 PEND	RI	54	Elect.	Elect.	174	70	174	70	\$59,376	2.37

Table 3.4
All EROs: Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW-mo)	Full Implement. Energy Savings (MBtu)	Full Implement. Demand Savings (kW mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
Int light.	STOR UH	HPS 150 PEND	LPS 90 PEND	RI	55	Elect.	Elect.	109	44	109	44	-\$5,580	0.69
Int light.	STOR UH	INC 60 CEIL	CFL 13 + BLST UNIT	RI	56	Elect.	Elect.	1,152	463	1,152	463	\$139,146	5.04
Int light.	TRAINING	FL 2X4 3-60 STD	MH 175 PEND	RI	57	Elect.	Elect.	50	36	50	36	\$7,544	1.34
Int light.	TRAINING	INC 60 CEIL	CFL 13 + BLST UNIT	RI	58	Elect.	Elect.	228	165	228	165	\$30,795	3.51
Int light.	WHS	FL 2X4 3 60 STD	MH 175 PEND	RI	59	Elect.	Elect.	181	175	181	175	\$1,390	1.01
Int light.	WHS	HPS 150 PEND	LPS 90 PEND	RI	60	Elect.	Elect.	115	111	115	111	-\$22,724	0.50
Int light.	WHS	INC 60 CEIL	CFL 13 + BLST UNIT	RI	61	Elect.	Elect.	1,204	1,160	1,204	1,160	\$173,654	3.01
Int light.	Exit Lights	INC 2-20 W	EXIT - LED	RI	62	Elect.	Elect.	9,604	3,856	9,604	3,856	\$1,738,921	2.32
Boilers	USAF	Boiler	High Eff Boiler	RI	1	Fuel Oil	Fuel Oil	4,889	0	4,889	0	\$556,206	2.47
Boilers	USAF	Boiler	High Eff Boiler	ROF	1	Fuel Oil	Fuel Oil	0	0	4,889	0	\$336,089	2.31
Boilers	NASA	Boiler	High Eff Boiler	RI	2	Fuel Oil	Fuel Oil	2,116	0	2,116	0	\$250,568	2.66
Boilers	NASA	Boiler	High Eff Boiler	ROF	2	Fuel Oil	Fuel Oil	0	0	2,116	0	\$150,891	2.48
Boilers	Navy	Boiler	High Eff Boiler	RI	3	Fuel Oil	Fuel Oil	567	0	567	0	\$64,854	2.52
Boilers	Navy	Boiler	High Eff Boiler	ROF	3	Fuel Oil	Fuel Oil	0	0	567	0	\$38,907	2.35
Boilers	USAF	Boiler	High Eff Boiler	RI	4	Fuel Oil	Fuel Oil	133	0	133	0	\$10,452	1.67
Boilers	USAF	Boiler	High Eff Boiler	ROF	4	Fuel Oil	Fuel Oil	0	0	133	0	\$6,196	1.59
Boilers	NASA	Boiler	High Eff Boiler	RI	5	Fuel Oil	Fuel Oil	60	0	60	0	\$5,177	1.74
Boilers	NASA	Boiler	High Eff Boiler	ROF	5	Fuel Oil	Fuel Oil	0	0	60	0	\$3,268	1.69
Boilers	USAF	Boiler	Replace electric w/ f.o. boiler	RI	6a	Electric	Fuel Oil	-5,427	8,398	-5,427	8,398	\$757,520	6.04
Boilers	USAF	Boiler	Replace electric w/ f.o. boiler	ROF	6a	Electric	Fuel Oil	0	0	-5,427	8,398	\$31,283	1.31
Boilers	USAF	Boiler	Replace electric w/ high eff. f.o. bo	RI	6b	Electric	Fuel Oil	-3,820	8,398	-3,820	8,398	\$998,880	7.17
Boilers	USAF	Boiler	Replace electric w/ high eff. f.o. bo	ROF	6b	Electric	Fuel Oil	0	0	-3,820	8,398	\$163,666	2.50
Boilers	NASA	Boiler	Replace electric w/ f.o. boiler	RI	7a	Electric	Fuel Oil	-2,430	3,761	-2,430	3,761	\$363,981	11.12
Boilers	NASA	Boiler	Replace electric w/ f.o. boiler	ROF	7a	Electric	Fuel Oil	0	0	-2,430	3,761	\$28,576	2.18
Boilers	NASA	Boiler	Replace electric w/ high eff. f.o. bo	RI	7b	Electric	Fuel Oil	-1,710	3,761	-1,710	3,761	\$472,886	12.79
Boilers	NASA	Boiler	Replace electric w/ high eff. f.o. bo	ROF	7b	Electric	Fuel Oil	0	0	-1,710	3,761	\$88,318	4.26
Boilers	Navy	Boiler	Replace electric w/ f.o. boiler	RI	8a	Electric	Fuel Oil	-318	492	-318	492	\$26,892	1.93
Boilers	Navy	Boiler	Replace electric w/ f.o. boiler	ROF	8a	Electric	Fuel Oil	0	0	-318	492	\$9,095	0.54
Boilers	Navy	Boiler	Replace electric w/ high eff. f.o. bo	RI	8b	Electric	Fuel Oil	-224	492	-224	492	\$40,028	2.30
Boilers	Navy	Boiler	Replace electric w/ high eff. f.o. bo	ROF	8b	Electric	Fuel Oil	0	0	-224	492	-\$2,019	0.90
Boilers	USAF	Boiler	Replace electric w/ f.o. boiler	RI	9a	Electric	Fuel Oil	-5,017	7,764	-5,017	7,764	\$756,202	10.58
Boilers	USAF	Boiler	Replace electric w/ f.o. boiler	ROF	9a	Electric	Fuel Oil	0	0	-5,017	7,764	\$65,315	2.23
Boilers	USAF	Boiler	Replace electric w/ high eff. f.o. bo	RI	9b	Electric	Fuel Oil	-3,531	7,764	-3,531	7,764	\$971,969	11.01
Boilers	USAF	Boiler	Replace electric w/ high eff. f.o. bo	ROF	9b	Electric	Fuel Oil	0	0	-3,531	7,764	\$182,724	3.79
Boilers	All	Boiler	High Eff Boiler	RI	10	Fuel Oil	Fuel Oil	7,764	0	7,764	0	\$887,278	2.49
Boilers	All	Boiler	High Eff Boiler	ROF	10	Fuel Oil	Fuel Oil	0	0	7,764	0	\$535,362	2.33
Boilers	All	Boiler	Replace electric w/ f.o. boiler	RI	11a	Electric	Fuel Oil	-13,192	20,414	-13,192	20,414	\$1,904,518	7.48
Boilers	All	Boiler	Replace electric w/ f.o. boiler	ROF	11a	Electric	Fuel Oil	0	0	-13,192	20,414	\$116,051	1.58
Boilers	All	Boiler	Replace electric w/ high eff. f.o. bo	RI	11b	Electric	Fuel Oil	-9,286	20,414	-9,286	20,414	\$2,483,952	8.53
Boilers	All	Boiler	Replace electric w/ high eff. f.o. bo	ROF	11b	Electric	Fuel Oil	0	0	-9,286	20,414	\$432,938	2.94
Motors	ADMIN	Fan Motors	Install Energy Efficient Motor	RI	1	Elec.	Elec.	350.80	164.67	350.80	164.67	\$40,104	1.92
Motors	BRK/ADM	Fan Motors	Install Energy Efficient Motor	RI	2	Elec.	Elec.	2.05	0.72	2.05	0.72	\$211	1.83
Motors	COMCATN	Fan Motors	Install Energy Efficient Motor	RI	3	Elec.	Elec.	243.30	114.21	243.30	114.21	\$27,815	1.92
Motors	DET RR	Fan Motors	Install Energy Efficient Motor	RI	4	Elec.	Elec.	1.75	0.82	1.75	0.82	\$201	1.92
Motors	FUEL DSP	Fan Motors	Install Energy Efficient Motor	RI	5	Elec.	Elec.	2.66	1.25	2.66	1.25	\$304	1.92
Motors	HANGAR	Fan Motors	Install Energy Efficient Motor	RI	6	Elec.	Elec.	44.85	21.06	44.85	21.06	\$5,128	1.92
Motors	LAB MFD	Fan Motors	Install Energy Efficient Motor	RI	7	Elec.	Elec.	13.35	6.27	13.35	6.27	\$1,527	1.92
Motors	MIRPOOL	Fan Motors	Install Energy Efficient Motor	RI	8	Elec.	Elec.	75.65	35.51	75.65	35.51	\$8,648	1.92
Motors	MWR	Fan Motors	Install Energy Efficient Motor	RI	9	Elec.	Elec.	15.04	7.06	15.04	7.06	\$1,719	1.92

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ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW-mo)	Full Implement. Energy Savings (MBtu)	Full Implement. Demand Savings (kW-mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
Motors	NASLEAS	Fan Motors	Install Energy Efficient Motor	RI	10	Elec	Elec	810.79	380.60	810.79	380.60	\$92,690	1.92
Motors	NASOWN	Fan Motors	Install Energy Efficient Motor	RI	11	Elec	Elec	825.24	387.39	825.24	387.39	\$94,343	1.92
Motors	OTHER	Fan Motors	Install Energy Efficient Motor	RI	12	Elec	Elec	10.61	4.98	10.61	4.98	\$1,212	1.92
Motors	PLT-BLD	Fan Motors	Install Energy Efficient Motor	RI	13	Elec	Elec	38.69	18.16	38.69	18.16	\$4,423	1.92
Motors	PLT-EQU	Fan Motors	Install Energy Efficient Motor	RI	14	Elec	Elec	75.91	35.63	75.91	35.63	\$8,678	1.92
Motors	R&D	Fan Motors	Install Energy Efficient Motor	RI	15	Elec	Elec	1,369.26	642.76	1,369.26	642.76	\$156,536	1.92
Motors	RESTRNT	Fan Motors	Install Energy Efficient Motor	RI	16	Elec	Elec	18.20	8.54	18.20	8.54	\$2,081	1.92
Motors	SECURITY	Fan Motors	Install Energy Efficient Motor	RI	17	Elec	Elec	41.56	19.51	41.56	19.51	\$4,751	1.92
Motors	SHOP	Fan Motors	Install Energy Efficient Motor	RI	18	Elec	Elec	242.54	113.86	242.54	113.86	\$27,728	1.92
Motors	SHOP-ELEC	Fan Motors	Install Energy Efficient Motor	RI	19	Elec	Elec	85.39	40.08	85.39	40.08	\$9,761	1.92
Motors	SHOP-WPN	Fan Motors	Install Energy Efficient Motor	RI	20	Elec	Elec	5.70	2.68	5.70	2.68	\$652	1.92
Motors	STOR-UH	Fan Motors	Install Energy Efficient Motor	RI	21	Elec	Elec	172.20	80.83	172.20	80.83	\$19,686	1.92
Motors	TRAING	Fan Motors	Install Energy Efficient Motor	RI	22	Elec	Elec	6.14	2.88	6.14	2.88	\$702	1.92
Motors	WHIS	Fan Motors	Install Energy Efficient Motor	RI	23	Elec	Elec	431.51	202.56	431.51	202.56	\$49,331	1.92
Motors	Area 2	Chilled Water Pump Mot	Install Energy Efficient Motor	RI	1C	Elec	Elec	10.26	0.00	10.26	0.00	\$639	1.47
Motors	Area 3	Chilled Water Pump Mot	Install Energy Efficient Motor	RI	2C	Elec	Elec	17.96	0.00	17.96	0.00	\$1,118	1.47
Motors	Area 4	Chilled Water Pump Mot	Install Energy Efficient Motor	RI	3C	Elec	Elec	2.14	-0.00	2.14	-0.00	\$133	1.47
Motors	Area 5	Chilled Water Pump Mot	Install Energy Efficient Motor	RI	4C	Elec	Elec	75.26	0.00	75.26	0.00	\$4,687	1.47
Motors	Area 6	Chilled Water Pump Mot	Install Energy Efficient Motor	RI	5C	Elec	Elec	53.45	0.00	53.45	0.00	\$3,329	1.47
Motors	Area 7	Chilled Water Pump Mot	Install Energy Efficient Motor	RI	6C	Elec	Elec	41.91	-0.00	41.91	-0.00	\$2,610	1.47
Motors	Area 8	Chilled Water Pump Mot	Install Energy Efficient Motor	RI	7C	Elec	Elec	114.61	-0.00	114.61	-0.00	\$7,136	1.47
Motors	Area 1W	Chilled Water Pump Mot	Install Energy Efficient Motor	RI	8C	Elec	Elec	116.74	0.00	116.74	0.00	\$7,270	1.47
Motors	Area 3A	Chilled Water Pump Mot	Install Energy Efficient Motor	RI	9C	Elec	Elec	345.36	0.00	345.36	0.00	\$21,505	1.47
Motors	Area 1N	Chilled Water Pump Mot	Install Energy Efficient Motor	RI	10C	Elec	Elec	79.03	-0.00	79.03	-0.00	\$4,921	1.47
Motors	ADMIN	Fan Motors	Install Energy Efficient Motor	ROF	1	Elec	Elec	0.00	0.00	350.80	164.67	\$36,581	2.11
Motors	BRK/ADM	Fan Motors	Install Energy Efficient Motor	ROF	2	Elec	Elec	0.00	0.00	2.05	0.72	\$199	2.03
Motors	COMCATN	Fan Motors	Install Energy Efficient Motor	ROF	3	Elec	Elec	0.00	0.00	243.30	114.21	\$25,372	2.11
Motors	DET-RR	Fan Motors	Install Energy Efficient Motor	ROF	4	Elec	Elec	0.00	0.00	1.75	0.82	\$183	2.11
Motors	FUEL DSP	Fan Motors	Install Energy Efficient Motor	ROF	5	Elec	Elec	0.00	0.00	2.66	1.25	\$277	2.11
Motors	HANGAR	Fan Motors	Install Energy Efficient Motor	ROF	6	Elec	Elec	0.00	0.00	44.85	21.06	\$4,677	2.11
Motors	LAB-MED	Fan Motors	Install Energy Efficient Motor	ROF	7	Elec	Elec	0.00	0.00	13.35	6.27	\$1,393	2.11
Motors	MTRPOOL	Fan Motors	Install Energy Efficient Motor	ROF	8	Elec	Elec	0.00	0.00	75.65	35.51	\$7,889	2.11
Motors	MWR	Fan Motors	Install Energy Efficient Motor	ROF	9	Elec	Elec	0.00	0.00	15.04	7.06	\$1,568	2.11
Motors	NASLEAS	Fan Motors	Install Energy Efficient Motor	ROF	10	Elec	Elec	0.00	0.00	810.79	380.60	\$84,550	2.11
Motors	NASOWN	Fan Motors	Install Energy Efficient Motor	ROF	11	Elec	Elec	0.00	0.00	825.24	387.39	\$86,057	2.11
Motors	OTHER	Fan Motors	Install Energy Efficient Motor	ROF	12	Elec	Elec	0.00	0.00	10.61	4.98	\$1,106	2.11
Motors	PLT-BLD	Fan Motors	Install Energy Efficient Motor	ROF	13	Elec	Elec	0.00	0.00	38.69	18.16	\$4,035	2.11
Motors	PLT-EQU	Fan Motors	Install Energy Efficient Motor	ROF	14	Elec	Elec	0.00	0.00	75.91	35.63	\$7,916	2.11
Motors	R&D	Fan Motors	Install Energy Efficient Motor	ROF	15	Elec	Elec	0.00	0.00	1,369.26	642.76	\$142,787	2.11
Motors	RESTRNT	Fan Motors	Install Energy Efficient Motor	ROF	16	Elec	Elec	0.00	0.00	18.20	8.54	\$1,898	2.11
Motors	SECURITY	Fan Motors	Install Energy Efficient Motor	ROF	17	Elec	Elec	0.00	0.00	41.56	19.51	\$4,334	2.11
Motors	SHOP	Fan Motors	Install Energy Efficient Motor	ROF	18	Elec	Elec	0.00	0.00	242.54	113.86	\$25,293	2.11
Motors	SHOP-ELEC	Fan Motors	Install Energy Efficient Motor	ROF	19	Elec	Elec	0.00	0.00	85.39	40.08	\$8,904	2.11
Motors	SHOP-WPN	Fan Motors	Install Energy Efficient Motor	ROF	20	Elec	Elec	0.00	0.00	5.70	2.68	\$595	2.11
Motors	STOR-UH	Fan Motors	Install Energy Efficient Motor	ROF	21	Elec	Elec	0.00	0.00	172.20	80.83	\$17,957	2.11
Motors	TRAING	Fan Motors	Install Energy Efficient Motor	ROF	22	Elec	Elec	0.00	0.00	6.14	2.88	\$640	2.11
Motors	WHIS	Fan Motors	Install Energy Efficient Motor	ROF	23	Elec	Elec	0.00	0.00	431.51	202.56	\$44,998	2.11
Motors	Area 2	Chilled Water Pump Mot	Install Energy Efficient Motor	ROF	1C	Elec	Elec	0.00	0.00	10.26	0.00	\$757	1.74
Motors	Area 3	Chilled Water Pump Mot	Install Energy Efficient Motor	ROF	2C	Elec	Elec	0.00	0.00	17.96	0.00	\$1,325	1.74

Table 3.4
All EROs: Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW-mo)	Full Implement. Energy Savings (MBtu)	Full Implement. Demand Savings (kW-mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
Motors	Area 4	Chilled Water Pump Mot	Install Energy Efficient Motor	ROF	3C	Elec.	Elec.	0.00	0.00	2.14	-0.00	\$158	1.74
Motors	Area 5	Chilled Water Pump Mot	Install Energy Efficient Motor	ROF	4C	Elec.	Elec.	0.00	0.00	75.26	0.00	\$5,551	1.74
Motors	Area 6	Chilled Water Pump Mot	Install Energy Efficient Motor	ROF	5C	Elec.	Elec.	0.00	0.00	53.45	0.00	\$3,942	1.74
Motors	Area 7	Chilled Water Pump Mot	Install Energy Efficient Motor	ROF	6C	Elec.	Elec.	0.00	0.00	41.91	-0.00	\$3,091	1.74
Motors	Area 8	Chilled Water Pump Mot	Install Energy Efficient Motor	ROF	7C	Elec.	Elec.	0.00	0.00	114.61	-0.00	\$8,452	1.74
Motors	Area 1W	Chilled Water Pump Mot	Install Energy Efficient Motor	ROF	8C	Elec.	Elec.	0.00	0.00	116.74	0.00	\$8,610	1.74
Motors	Area 3A	Chilled Water Pump Mot	Install Energy Efficient Motor	ROF	9C	Elec.	Elec.	0.00	0.00	345.36	0.00	\$25,470	1.74
Motors	Area 1N	Chilled Water Pump Mot	Install Energy Efficient Motor	ROF	10C	Elec.	Elec.	0.00	0.00	79.03	-0.00	\$5,828	1.74
Heatpipes	OPTICS LAB	AC/Boilers	Install Heatpipes	RI	1	Fuel Oil	Fuel Oil	1,006	na	1,006	na	\$99,243	2.66
Heatpipes	RCC MECH BLD	AC/Boilers	Install Heatpipes	RI	2	Fuel Oil	Fuel Oil	3,888	na	3,888	na	\$483,731	4.72
Heatpipes	HANGER R&D	AC/Boilers	Install Heatpipes	RI	3	Elec.	Elec.	835	na	835	na	\$72,986	1.79
Heatpipes	PSL	AC/Boilers	Install Heatpipes	RI	4	Fuel Oil	Fuel Oil	1,167	na	1,167	na	\$115,174	2.66
Heatpipes	HANGER S	AC/Boilers	Install Heatpipes	RI	5	Fuel Oil	Fuel Oil	4,303	na	4,303	na	\$539,471	4.85
Heatpipes	HANGER N	AC/Boilers	Install Heatpipes	RI	6	Fuel Oil	Fuel Oil	2,612	na	2,612	na	\$338,184	5.51
Heatpipes	HANGER L	AC/Boilers	Install Heatpipes	RI	7	Elec.	Elec.	921	na	921	na	\$117,651	5.20
Heatpipes	CX 41 AC SHR	AC/Boilers	Install Heatpipes	RI	8	Elec.	Elec.	8,680	na	8,680	na	\$1,323,149	3.92
Heatpipes	CX 41	AC/Boilers	Install Heatpipes	RI	9	Fuel Oil	Fuel Oil	959	na	959	na	\$123,096	5.32
Heatpipes	TGSF	AC/Boilers	Install Heatpipes	RI	10	Fuel Oil	Fuel Oil	1,901	na	1,901	na	\$244,118	5.32
Heatpipes	CTL COMP-COM	AC/Boilers	Install Heatpipes	RI	11	Fuel Oil	Fuel Oil	2,465	na	2,465	na	\$314,414	5.18
Heatpipes	RCT STOR BLD	AC/Boilers	Install Heatpipes	RI	12	Fuel Oil	Fuel Oil	451	na	451	na	\$58,401	5.53
Heatpipes	S&A LAB	AC/Boilers	Install Heatpipes	RI	13	Elec.	Elec.	2,624	na	2,624	na	\$461,078	7.99
Heatpipes	M ANNEX	AC/Boilers	Install Heatpipes	RI	14	Fuel Oil	Fuel Oil	1,615	na	1,615	na	\$207,319	5.32
Heatpipes	M/ASMB BD-AC	AC/Boilers	Install Heatpipes	RI	15	Fuel Oil	Fuel Oil	5,882	na	5,882	na	\$749,662	5.16
Heatpipes	GPS PROP FAC	AC/Boilers	Install Heatpipes	RI	16	Fuel Oil	Fuel Oil	711	na	711	na	\$70,200	2.66
Heatpipes	CX 30 BLKISE	AC/Boilers	Install Heatpipes	RI	17	Fuel Oil	Fuel Oil	1,307	na	1,307	na	\$166,592	5.16
Heatpipes	HANGER AO-AM	AC/Boilers	Install Heatpipes	RI	18	Fuel Oil	Fuel Oil	3,927	na	3,927	na	\$489,881	4.77
Heatpipes	HANGER AE	AC/Boilers	Install Heatpipes	RI	19	Fuel Oil	Fuel Oil	5,271	na	5,271	na	\$671,780	5.16
Heatpipes	MIS CK BD AK	AC/Boilers	Install Heatpipes	RI	20	Fuel Oil	Fuel Oil	1,755	na	1,755	na	\$169,949	2.58
Heatpipes	HANGER AF	AC/Boilers	Install Heatpipes	RI	21	Fuel Oil	Fuel Oil	2,733	na	2,733	na	\$264,735	2.58
Heatpipes	MK VI CK BLD	AC/Boilers	Install Heatpipes	RI	22	Fuel Oil	Fuel Oil	421	na	421	na	\$53,989	5.32
Heatpipes	DELTA SPN BD	AC/Boilers	Install Heatpipes	RI	23	Fuel Oil	Fuel Oil	706	na	706	na	\$69,702	2.66
Heatpipes	CTL BD SP TS	AC/Boilers	Install Heatpipes	RI	24	Fuel Oil	Fuel Oil	341	na	341	na	\$33,689	2.66
Heatpipes	SMAB WEST	AC/Boilers	Install Heatpipes	RI	25	Fuel Oil	Fuel Oil	5,843	na	5,843	na	\$744,664	5.16
Heatpipes	VIB	AC/Boilers	Install Heatpipes	RI	26	Fuel Oil	Fuel Oil	5,539	na	5,539	na	\$690,179	4.75
Heatpipes	COMM CTL FAC	AC/Boilers	Install Heatpipes	RI	27	HW	Fuel Oil	1,050	na	1,050	na	\$134,757	5.32
Generator	N Substation	Generator	1-200 kW unit	RI	1	na	NG	-259	2,400	-259	2,400	-\$242,396	0.47
Generator	N Substation	Generator	2-200 kW units	RI	2	na	NG	-1,030	4,800	-1,030	4,800	-\$466,848	0.46
Generator	N Substation	Generator	3-200 kW units	RI	3	na	NG	-2,075	7,200	-2,075	7,200	-\$713,911	0.43
Generator	N Substation	Generator	4-200 kW units	RI	4	na	NG	-3,209	9,600	-3,209	9,600	-\$968,231	0.42
Generator	N Substation	Generator	5-200 kW units	RI	5	na	NG	-4,365	12,000	-4,365	12,000	-\$1,224,419	0.41
Generator	N Substation	Generator	5-200, 1-500 kW	RI	6	na	NG	-7,559	18,000	-7,559	18,000	-\$1,740,175	0.40
Generator	N Substation	Generator	5-200, 2-500	RI	7	na	NG	-11,123	24,000	-11,123	24,000	-\$2,286,431	0.39
Generator	N Substation	Generator	5-200, 3-500	RI	8	na	NG	-15,134	30,000	-15,134	30,000	-\$2,869,626	0.38
Generator	N Substation	Generator	5-200, 4-500	RI	9	na	NG	-20,086	36,000	-20,086	36,000	-\$3,530,446	0.35
Generator	N Substation	Generator	5-200, 5-500	RI	10	na	NG	-27,483	42,000	-27,483	42,000	-\$4,392,720	0.30
Generator	N Substation	Generator	5-200, 6-500	RI	11	na	NG	-35,790	48,000	-35,790	48,000	-\$5,330,151	0.26
Generator	N Substation	Generator	5-200, 6-500, 1-1000	RI	12	na	NG	-52,670	60,000	-52,670	60,000	-\$7,224,879	0.18
Generator	N Substation	Generator	5-200, 6-500, 2-1000	RI	13	na	NG	-69,437	72,000	-69,437	72,000	-\$9,109,749	0.14
Generator	N Substation	Generator	5-200, 6-500, 2-1000, 1-3000	RI	14	na	NG	-119,329	108,000	-119,329	108,000	-\$14,128,339	0.06

Table 3.4
All EROs: Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW-mo)	Full Implement. Energy Savings (MBtu)	Full Implement. Demand Savings (kW-mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
Generator	N Substation	Generator	5-200,6-500,2-1000,2-3000	RI	15	na	NG	-168,522	144,000	-168,522	144,000	\$19,085,452	0.02
Generator	N Substation	Generator	2-400 kW units	RI	4a	na	NG	-2,737	9,600	-2,737	9,600	-\$686,792	0.52
Generator	N Substation	Generator	2-500 kW units	RI	5a	na	NG	-4,534	12,000	-4,534	12,000	-\$879,253	0.48
Generator	N Substation	Generator	3-500 kW units	RI	6a	na	NG	-7,801	18,000	-7,801	18,000	-\$1,401,447	0.45
Generator	N Substation	Generator	2-1000 kW units	RI	7a	na	NG	-10,576	24,000	-10,576	24,000	-\$1,878,359	0.45
Generator	N Substation	Generator	2-1000, 1-500 kW	RI	8a	na	NG	-14,725	30,000	-14,725	30,000	-\$2,473,715	0.42
Generator	N Substation	Generator	3-1000 kW units	RI	9a	na	NG	-18,983	36,000	-18,983	36,000	-\$3,073,507	0.40
Generator	N Substation	Generator	3-1000, 1-500 kW	RI	10a	na	NG	-26,440	42,000	-26,440	42,000	-\$3,941,090	0.34
Generator	N Substation	Generator	4-1000 kW units	RI	11a	na	NG	-33,695	48,000	-33,695	48,000	-\$4,786,051	0.30
Generator	N Substation	Generator	5-1000 kW units	RI	12a	na	NG	-49,830	60,000	-49,830	60,000	-\$6,615,313	0.22
Generator	N Substation	Generator	2-3000 kW units	RI	13a	na	NG	-60,836	72,000	-60,836	72,000	-\$6,793,897	0.25
Generator	N Substation	Generator	3-3000 kW units	RI	14a	na	NG	-105,481	108,000	-105,481	108,000	-\$11,351,401	0.16
Generator	N Substation	Generator	4-3000 kW units	RI	15a	na	NG	-150,127	144,000	-150,127	144,000	-\$15,908,906	0.12
Generator	S Substation	Generator	1-200 kW unit	RI	1	na	NG	-560	2,400	-560	2,400	-\$267,146	0.42
Generator	S Substation	Generator	2-200 kW units	RI	2	na	NG	-1,650	4,800	-1,650	4,800	-\$517,846	0.40
Generator	S Substation	Generator	3-200 kW units	RI	3	na	NG	-2,963	7,200	-2,963	7,200	-\$786,995	0.38
Generator	S Substation	Generator	4-200 kW units	RI	4	na	NG	-4,528	9,600	-4,528	9,600	-\$1,076,825	0.35
Generator	S Substation	Generator	5-200 kW units	RI	5	na	NG	-6,441	12,000	-6,441	12,000	-\$1,395,288	0.32
Generator	S Substation	Generator	5-200, 1-500 kW	RI	6	na	NG	-14,405	18,000	-14,405	18,000	-\$2,303,703	0.21
Generator	S Substation	Generator	5-200, 2-500	RI	7	na	NG	-22,957	24,000	-22,957	24,000	-\$3,260,901	0.13
Generator	S Substation	Generator	5-200, 3-500	RI	8	na	NG	-31,550	30,000	-31,550	30,000	-\$4,221,744	0.08
Generator	S Substation	Generator	5-200, 4-500	RI	9	na	NG	-40,171	36,000	-40,171	36,000	-\$5,185,018	0.05
Generator	S Substation	Generator	5-200, 5-500	RI	10	na	NG	-48,811	42,000	-48,811	42,000	-\$6,149,994	0.03
Generator	S Substation	Generator	5-200, 6-500	RI	11	na	NG	-57,465	48,000	-57,465	48,000	-\$7,116,207	0.01
Generator	S Substation	Generator	5-200, 6-500, 1-1000	RI	12	na	NG	-74,241	60,000	-74,241	60,000	-\$9,001,858	-0.02
Generator	S Substation	Generator	5-200, 6-500, 2-1000	RI	13	na	NG	-90,919	72,000	-90,919	72,000	-\$10,878,865	-0.03
Generator	S Substation	Generator	2-400 kW units	RI	4a	na	NG	-3,863	9,600	-3,863	9,600	-\$778,342	0.45
Generator	S Substation	Generator	2-500 kW units	RI	5a	na	NG	-6,691	12,000	-6,691	12,000	-\$1,057,180	0.38
Generator	S Substation	Generator	3-500 kW units	RI	6a	na	NG	-14,866	18,000	-14,866	18,000	-\$1,984,239	0.22
Generator	S Substation	Generator	2-1000 kW units	RI	7a	na	NG	-21,827	24,000	-21,827	24,000	-\$2,801,685	0.18
Generator	S Substation	Generator	2-1000, 1-500 kW	RI	8a	na	NG	-30,698	30,000	-30,698	30,000	-\$3,786,879	0.11
Generator	S Substation	Generator	3-1000 kW units	RI	9a	na	NG	-37,964	36,000	-37,964	36,000	-\$4,631,149	0.09
Generator	S Substation	Generator	3-1000, 1-500 kW	RI	10a	na	NG	-46,959	42,000	-46,959	42,000	-\$5,627,252	0.05
Generator	S Substation	Generator	4-1000 kW units	RI	11a	na	NG	-54,101	48,000	-54,101	48,000	-\$6,460,613	0.05
Generator	S Substation	Generator	5-1000 kW units	RI	12a	na	NG	-70,238	60,000	-70,238	60,000	-\$8,290,077	0.02
Generator	S Substation	Generator	2-3000 kW units	RI	13a	na	NG	-79,657	72,000	-79,657	72,000	-\$8,329,167	0.07
Generator	Titan Substation	Generator	1-200 kW unit	RI	1	na	NG	-714	2,400	-714	2,400	-\$279,837	0.39
Generator	Titan Substation	Generator	2-200 kW units	RI	2	na	NG	-2,287	4,800	-2,287	4,800	-\$570,328	0.34
Generator	Titan Substation	Generator	3-200 kW units	RI	3	na	NG	-4,214	7,200	-4,214	7,200	-\$889,881	0.29
Generator	Titan Substation	Generator	4-200 kW units	RI	4	na	NG	-6,496	9,600	-6,496	9,600	-\$1,278,720	0.25
Generator	Titan Substation	Generator	5-200 kW units	RI	5	na	NG	-9,419	12,000	-9,419	12,000	-\$1,640,315	0.20
Generator	Titan Substation	Generator	5-200, 1-500 kW	RI	6	na	NG	-17,762	18,000	-17,762	18,000	-\$2,580,059	0.11
Generator	Titan Substation	Generator	5-200, 2-500	RI	7	na	NG	-26,329	24,000	-26,329	24,000	-\$3,538,606	0.06
Generator	Titan Substation	Generator	5-200, 3-500	RI	8	na	NG	-34,934	30,000	-34,934	30,000	-\$4,500,462	0.02
Generator	Titan Substation	Generator	5-200, 4-500	RI	9	na	NG	-43,563	36,000	-43,563	36,000	-\$5,464,523	0.00
Generator	Titan Substation	Generator	5-200, 5-500	RI	10	na	NG	-52,211	42,000	-52,211	42,000	-\$6,430,128	0.02
Generator	Titan Substation	Generator	5-200, 6-500	RI	11	na	NG	-60,871	48,000	-60,871	48,000	-\$7,396,857	0.03
Generator	Titan Substation	Generator	5-200, 6-500, 1-1000	RI	12	na	NG	-77,631	60,000	-77,631	60,000	-\$9,281,048	0.05
Generator	Titan Substation	Generator	2-400 kW units	RI	4a	na	NG	-5,541	9,600	-5,541	9,600	-\$914,827	0.36

Table 3.4
All EROs: Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW-mo)	Full Implement. Energy Savings (MBtu)	Full Implement. Demand Savings (kW-mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
Generator	Titan Substation	Generator	2 500 kW units	RI	5a	na	NG	-9,783	12,000	-9,783	12,000	-\$1,312,327	0.23
Generator	Titan Substation	Generator	3 500 kW units	RI	6a	na	NG	-18,331	18,000	-18,331	18,000	-\$2,270,041	0.11
Generator	Titan Substation	Generator	2 1000 kW units	RI	7a	na	NG	-25,034	24,000	-25,034	24,000	-\$3,064,816	0.10
Generator	Titan Substation	Generator	2 1000, 1-500 kW	RI	8a	na	NG	-33,990	30,000	-33,990	30,000	-\$4,057,566	0.05
Generator	Titan Substation	Generator	3 1000 kW units	RI	9a	na	NG	-41,171	36,000	-41,171	36,000	-\$4,894,279	0.04
Generator	Titan Substation	Generator	3 1000, 1-500 kW	RI	10a	na	NG	-50,230	42,000	-50,230	42,000	-\$5,896,050	0.01
Generator	Titan Substation	Generator	4 1000 kW units	RI	11a	na	NG	-57,308	48,000	-57,308	48,000	-\$6,723,743	0.01
Generator	Titan Substation	Generator	5 1000 kW units	RI	12a	na	NG	-73,445	60,000	-73,445	60,000	-\$8,553,207	-0.01
Generator	N Substation	Generator	DGEN-1	RI	1	na	Diesel	-248	2,400	-248	2,400	\$187,851	8.25
Generator	N Substation	Generator	DGEN-2	RI	2	na	Diesel	-985	4,800	-985	4,800	\$326,108	8.33
Generator	N Substation	Generator	DGEN-3	RI	3	na	Diesel	-1,986	7,200	-1,986	7,200	\$417,503	7.09
Generator	N Substation	Generator	DGEN-4	RI	4	na	Diesel	-3,070	9,600	-3,070	9,600	\$480,029	5.99
Generator	N Substation	Generator	DGEN-5	RI	5	na	Diesel	-4,176	12,000	-4,176	12,000	\$520,067	5.08
Generator	N Substation	Generator	DGEN-6	RI	6	na	Diesel	-7,186	18,000	-7,186	18,000	\$688,602	5.03
Generator	N Substation	Generator	DGEN-7	RI	7	na	Diesel	-10,526	24,000	-10,526	24,000	\$766,485	4.41
Generator	N Substation	Generator	DGEN-8	RI	8	na	Diesel	-14,273	30,000	-14,273	30,000	\$732,564	3.52
Generator	N Substation	Generator	DGEN-9	RI	9	na	Diesel	-18,894	36,000	-18,894	36,000	\$508,333	2.38
Generator	N Substation	Generator	DGEN-10	RI	10	na	Diesel	-25,797	42,000	-25,797	42,000	\$157,785	0.68
Generator	N Substation	Generator	DGEN-11	RI	11	na	Diesel	-33,537	48,000	-33,537	48,000	-\$1,070,275	-0.72
Generator	N Substation	Generator	DGEN-12	RI	12	na	Diesel	-49,595	60,000	-49,595	60,000	-\$2,584,026	-2.10
Generator	N Substation	Generator	DGEN-13	RI	13	na	Diesel	-65,656	72,000	-65,656	72,000	-\$4,297,971	-2.97
Generator	N Substation	Generator	DGEN-14	RI	14	na	Diesel	-113,839	108,000	-113,839	108,000	-\$7,576,234	-3.81
Generator	N Substation	Generator	DGEN-15	RI	15	na	Diesel	-162,022	144,000	-162,022	144,000	\$11,399,759	-4.22
Generator	S Substation	Generator	DGEN-1	RI	1	na	Diesel	-536	2,400	-536	2,400	\$158,634	7.12
Generator	S Substation	Generator	DGEN-2	RI	2	na	Diesel	-1,578	4,800	-1,578	4,800	\$260,761	6.76
Generator	S Substation	Generator	DGEN-3	RI	3	na	Diesel	-2,835	7,200	-2,835	7,200	\$315,879	5.43
Generator	S Substation	Generator	DGEN-4	RI	4	na	Diesel	-4,333	9,600	-4,333	9,600	\$318,008	4.11
Generator	S Substation	Generator	DGEN-5	RI	5	na	Diesel	-6,163	12,000	-6,163	12,000	\$248,927	2.80
Generator	S Substation	Generator	DGEN-6	RI	6	na	Diesel	-13,694	18,000	-13,694	18,000	\$185,726	0.08
Generator	S Substation	Generator	DGEN-7	RI	7	na	Diesel	-21,725	24,000	-21,725	24,000	\$779,559	-1.75
Generator	S Substation	Generator	DGEN-8	RI	8	na	Diesel	-29,755	30,000	-29,755	30,000	\$1,493,354	-2.87
Generator	S Substation	Generator	DGEN-9	RI	9	na	Diesel	-37,786	36,000	-37,786	36,000	-\$2,336,063	-3.60
Generator	S Substation	Generator	DGEN-10	RI	10	na	Diesel	-45,816	42,000	-45,816	42,000	\$3,331,439	3.98
Generator	S Substation	Generator	DGEN-11	RI	11	na	Diesel	-53,847	48,000	-53,847	48,000	\$4,460,410	4.26
Generator	S Substation	Generator	DGEN-12	RI	12	na	Diesel	-69,908	60,000	-69,908	60,000	-\$6,014,260	-4.47
Generator	S Substation	Generator	DGEN-13	RI	13	na	Diesel	-85,969	72,000	-85,969	72,000	\$7,818,240	-4.63
Generator	Titan Substation	Generator	DGEN-1	RI	1	na	Diesel	-684	2,400	-684	2,400	\$143,652	6.55
Generator	Titan Substation	Generator	DGEN-2	RI	2	na	Diesel	-2,189	4,800	-2,189	4,800	\$193,513	5.20
Generator	Titan Substation	Generator	DGEN-3	RI	3	na	Diesel	-4,032	7,200	-4,032	7,200	\$172,814	3.29
Generator	Titan Substation	Generator	DGEN-4	RI	4	na	Diesel	-6,215	9,600	-6,215	9,600	\$76,604	1.69
Generator	Titan Substation	Generator	DGEN-5	RI	5	na	Diesel	-9,012	12,000	-9,012	12,000	-\$139,989	-0.09
Generator	Titan Substation	Generator	DGEN-6	RI	6	na	Diesel	-16,886	18,000	-16,886	18,000	\$622,416	-1.78
Generator	Titan Substation	Generator	DGEN-7	RI	7	na	Diesel	-24,916	24,000	-24,916	24,000	\$1,232,473	2.94
Generator	Titan Substation	Generator	DGEN-8	RI	8	na	Diesel	-32,947	30,000	-32,947	30,000	\$1,967,987	-3.67
Generator	Titan Substation	Generator	DGEN-9	RI	9	na	Diesel	-40,977	36,000	-40,977	36,000	\$2,835,162	-4.16
Generator	Titan Substation	Generator	DGEN-10	RI	10	na	Diesel	-49,008	42,000	-49,008	42,000	\$3,856,575	-4.38
Generator	Titan Substation	Generator	DGEN-11	RI	11	na	Diesel	-57,038	48,000	-57,038	48,000	\$5,012,563	-4.55
Generator	Titan Substation	Generator	DGEN-12	RI	12	na	Diesel	-73,099	60,000	-73,099	60,000	\$6,572,651	-4.66

Table 3.5
All EROs: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 1	direct expansion	efficient chiller	RI	1	Elect	Elect	\$33 500	\$12 135	\$1 023	\$0	\$15 416	\$28 573	-\$4 927	0.85
AC	Area 2	chilled water	efficient chiller	RI	2	Elect	Elect	\$76 333	\$28 960	\$5 810	\$0	\$35 126	\$69 886	-\$6 437	0.92
AC	Area 2	direct expansion	efficient chiller	RI	3	Elect	Elect	\$2 950	\$429	\$41	\$0	\$1 331	\$1 801	-\$1 149	0.61
AC	Area 2	direct expansion	efficient chiller	RI	4	Elect	Elect	\$8 850	\$1 286	\$124	\$0	\$3 993	\$5 403	-\$3 447	0.61
AC	Area 2	direct expansion	efficient chiller	RI	5	Elect	Elect	\$27 875	\$5 360	\$515	\$0	\$12 575	\$18 450	-\$9 425	0.66
AC	Area 2	direct expansion	efficient chiller	RI	6	Elect	Elect	\$18 950	\$4 288	\$412	\$0	\$8 549	\$13 249	-\$5 701	0.70
AC	Area 2	direct expansion	efficient chiller	RI	7	Elect	Elect	\$12 900	\$3 216	\$309	\$0	\$5 820	\$9 345	-\$3 555	0.72
AC	Area 2	direct expansion	efficient chiller	RI	8	Elect	Elect	\$65 000	\$24 133	\$4 842	\$0	\$29 911	\$58 886	-\$6 114	0.91
AC	Area 3	chilled water	efficient chiller	RI	9	Elect	Elect	\$39 500	\$16 989	\$1 432	\$0	\$18 177	\$36 597	-\$2 903	0.93
AC	Area 3	chilled water	efficient chiller	RI	10	Elect	Elect	\$69 500	\$33 787	\$6 778	\$0	\$31 982	\$72 547	-\$3 047	1.04
AC	Area 3	direct expansion	efficient chiller	RI	11	Elect	Elect	\$29 500	\$4 288	\$412	\$0	\$13 308	\$18 008	-\$11 492	0.61
AC	Area 3	direct expansion	efficient chiller	RI	12	Elect	Elect	\$35 400	\$5 145	\$495	\$0	\$15 970	\$21 610	-\$13 790	0.61
AC	Area 3	direct expansion	efficient chiller	RI	13	Elect	Elect	\$31 950	\$5 145	\$495	\$0	\$14 414	\$20 054	-\$11 896	0.63
AC	Area 3	direct expansion	efficient chiller	RI	14	Elect	Elect	\$16 725	\$3 216	\$309	\$0	\$7 545	\$11 070	-\$5 655	0.66
AC	Area 3	direct expansion	efficient chiller	RI	15	Elect	Elect	\$6 375	\$1 286	\$124	\$0	\$2 876	\$4 286	-\$2 089	0.67
AC	Area 3	direct expansion	efficient chiller	RI	16	Elect	Elect	\$7 175	\$1 501	\$144	\$0	\$3 237	\$4 882	-\$2 293	0.68
AC	Area 3	direct expansion	efficient chiller	RI	17	Elect	Elect	\$31 820	\$6 860	\$660	\$0	\$14 355	\$21 875	-\$9 945	0.69
AC	Area 3	direct expansion	efficient chiller	RI	18	Elect	Elect	\$37 900	\$8 575	\$825	\$0	\$17 098	\$26 498	-\$11 402	0.70
AC	Area 3	direct expansion	efficient chiller	RI	19	Elect	Elect	\$32 535	\$7 718	\$742	\$0	\$14 678	\$23 138	-\$9 397	0.71
AC	Area 3	direct expansion	efficient chiller	RI	20	Elect	Elect	\$25 800	\$6 431	\$618	\$0	\$11 639	\$18 689	-\$7 111	0.72
AC	Area 3	direct expansion	efficient chiller	RI	21	Elect	Elect	\$116 220	\$29 124	\$2 454	\$0	\$53 481	\$85 058	-\$31 462	0.73
AC	Area 3	direct expansion	efficient chiller	RI	22	Elect	Elect	\$43 460	\$12 135	\$1 023	\$0	\$19 999	\$33 156	-\$10 304	0.76
AC	Area 4	chilled water	efficient chiller	RI	23	Elect	Elect	\$78 000	\$30 408	\$6 100	\$0	\$35 893	\$72 402	-\$5 598	0.93
AC	Area 4	direct expansion	efficient chiller	RI	24	Elect	Elect	\$19 700	\$6 067	\$511	\$0	\$9 065	\$15 644	-\$4 056	0.79
AC	Area 4	direct expansion	efficient chiller	RI	25	Elect	Elect	\$23 600	\$3 430	\$330	\$0	\$10 647	\$14 407	-\$9 193	0.61
AC	Area 4	direct expansion	efficient chiller	RI	26	Elect	Elect	\$13 275	\$1 929	\$186	\$0	\$5 989	\$8 104	-\$5 171	0.61
AC	Area 4	direct expansion	efficient chiller	RI	27	Elect	Elect	\$21 300	\$3 430	\$330	\$0	\$9 609	\$13 369	-\$7 931	0.63
AC	Area 4	direct expansion	efficient chiller	RI	28	Elect	Elect	\$61 325	\$11 791	\$1 134	\$0	\$27 666	\$40 591	-\$20 734	0.66
AC	Area 4	direct expansion	efficient chiller	RI	29	Elect	Elect	\$6 375	\$1 286	\$124	\$0	\$2 876	\$4 286	-\$2 089	0.67
AC	Area 4	direct expansion	efficient chiller	RI	30	Elect	Elect	\$39 775	\$8 575	\$825	\$0	\$17 944	\$27 344	-\$12 431	0.69
AC	Area 4	direct expansion	efficient chiller	RI	31	Elect	Elect	\$56 850	\$12 863	\$1 237	\$0	\$25 647	\$39 747	-\$17 103	0.70
AC	Area 4	direct expansion	efficient chiller	RI	32	Elect	Elect	\$38 700	\$9 647	\$928	\$0	\$17 459	\$28 034	-\$10 666	0.72
AC	Area 4	direct expansion	efficient chiller	RI	33	Elect	Elect	\$96 850	\$24 270	\$2 045	\$0	\$44 567	\$70 882	-\$25 968	0.73
AC	Area 4	direct expansion	efficient chiller	RI	34	Elect	Elect	\$70 350	\$21 843	\$1 841	\$0	\$32 373	\$56 056	-\$14 294	0.80
AC	Area 4	direct expansion	efficient chiller	RI	35	Elect	Elect	\$65 000	\$24 133	\$4 842	\$0	\$29 911	\$58 886	-\$6 114	0.91
AC	Area 5	chilled water	efficient chiller	RI	36	Elect	Elect	\$19 700	\$6 067	\$511	\$0	\$9 065	\$15 644	-\$4 056	0.79
AC	Area 5	chilled water	efficient chiller	RI	37	Elect	Elect	\$22 500	\$8 494	\$716	\$0	\$10 354	\$19 564	-\$2 936	0.87
AC	Area 5	chilled water	efficient chiller	RI	38	Elect	Elect	\$102 000	\$48 267	\$9 683	\$0	\$46 937	\$104 887	-\$2 887	1.03
AC	Area 5	chilled water	efficient chiller	RI	39	Elect	Elect	\$128 750	\$51 236	\$6 087	\$0	\$51 910	\$109 233	-\$19 517	0.85
AC	Area 5	chilled water	efficient chiller	RI	40	Elect	Elect	\$132 900	\$54 652	\$6 493	\$0	\$53 583	\$114 728	-\$18 172	0.86
AC	Area 5	direct expansion	efficient chiller	RI	41	Elect	Elect	\$1 475	\$214	\$21	\$0	\$665	\$900	-\$575	0.61
AC	Area 5	direct expansion	efficient chiller	RI	42	Elect	Elect	\$8 850	\$1 286	\$124	\$0	\$3 993	\$5 403	-\$3 447	0.61
AC	Area 5	direct expansion	efficient chiller	RI	43	Elect	Elect	\$35 400	\$5 145	\$495	\$0	\$15 970	\$21 610	-\$13 790	0.61
AC	Area 5	direct expansion	efficient chiller	RI	44	Elect	Elect	\$26 625	\$4 288	\$412	\$0	\$12 011	\$16 711	-\$9 914	0.63
AC	Area 5	direct expansion	efficient chiller	RI	45	Elect	Elect	\$50 175	\$9 647	\$928	\$0	\$22 635	\$33 230	-\$16 965	0.66
AC	Area 5	direct expansion	efficient chiller	RI	46	Elect	Elect	\$23 865	\$5 145	\$495	\$0	\$10 766	\$16 406	-\$7 459	0.69
AC	Area 5	direct expansion	efficient chiller	RI	47	Elect	Elect	\$66 325	\$15 007	\$1 443	\$0	\$29 921	\$46 371	-\$19 954	0.70
AC	Area 5	direct expansion	efficient chiller	RI	48	Elect	Elect	\$10 845	\$2 573	\$247	\$0	\$4 893	\$7 713	-\$3 132	0.71
AC	Area 5	direct expansion	efficient chiller	RI	49	Elect	Elect	\$38 700	\$9 647	\$928	\$0	\$17 459	\$28 034	-\$10 666	0.72
AC	Area 5	direct expansion	efficient chiller	RI	50	Elect	Elect	\$116 220	\$29 124	\$2 454	\$0	\$53 481	\$85 058	-\$31 462	0.73
AC	Area 5	direct expansion	efficient chiller	RI	51	Elect	Elect	\$21 700	\$6 067	\$511	\$0	\$9 999	\$16 578	-\$5 152	0.76
AC	Area 5	direct expansion	efficient chiller	RI	52	Elect	Elect	\$23 400	\$7 281	\$614	\$0	\$10 731	\$18 685	-\$4 765	0.80
AC	Area 5	direct expansion	efficient chiller	RI	53	Elect	Elect	\$28 100	\$9 708	\$816	\$0	\$12 940	\$23 466	-\$4 654	0.83
AC	Area 5	direct expansion	efficient chiller	RI	54	Elect	Elect	\$16 000	\$6 614	\$7 747	\$0	\$48 778	\$95 138	-\$10 862	0.90
AC	Area 5	heat pump	efficient chiller	RI	55	Elect	Elect	\$2 300	\$478	\$41	\$0	\$1 037	\$1 557	-\$793	0.66
AC	Area 5	heat pump	efficient chiller	RI	56	Elect	Elect	\$25 000	\$5 740	\$496	\$0	\$11 036	\$17 272	-\$7 728	0.69
AC	Area 5	heat pump	efficient chiller	RI	57	Elect	Elect	\$16 900	\$3 827	\$331	\$0	\$7 400	\$11 618	-\$5 282	0.69
AC	Area 6	chilled water	efficient chiller	RI	58	Elect	Elect	\$17 500	\$4 854	\$400	\$0	\$8 053	\$13 316	-\$4 184	0.76
AC	Area 6	chilled water	efficient chiller	RI	59	Elect	Elect	\$19 700	\$6 067	\$511	\$0	\$9 065	\$15 644	-\$4 056	0.79
AC	Area 6	chilled water	efficient chiller	RI	60	Elect	Elect	\$21 900	\$7 281	\$614	\$0	\$10 078	\$17 972	-\$5 928	0.82
AC	Area 6	chilled water	efficient chiller	RI	61	Elect	Elect	\$25 400	\$9 708	\$816	\$0	\$11 088	\$22 214	-\$3 186	0.87

Table 3.5
All EROs: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	Rt or ROF	ID	Existing Fuel	Resulting Fuel	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 6	chilled water	efficient chiller	Rt	62	Elect	Elect	\$32,700	\$14,562	\$1,227	\$0	\$15,048	\$30,836	-\$1,864	0.94
AC	Area 6	chilled water	efficient chiller	Rt	63	Elect	Elect	\$46,710	\$21,720	\$4,357	\$0	\$21,490	\$47,567	\$867	1.02
AC	Area 6	chilled water	efficient chiller	Rt	64	Elect	Elect	\$120,450	\$61,483	\$7,304	\$0	\$48,564	\$117,351	-\$3,099	0.97
AC	Area 6	direct expansion	efficient chiller	Rt	65	Elect	Elect	\$1,475	\$214	\$21	\$0	\$665	\$900	\$525	0.61
AC	Area 6	direct expansion	efficient chiller	Rt	66	Elect	Elect	\$2,950	\$429	\$41	\$0	\$1,331	\$1,801	\$1,149	0.61
AC	Area 6	direct expansion	efficient chiller	Rt	67	Elect	Elect	\$8,850	\$1,286	\$124	\$0	\$3,993	\$5,403	\$3,417	0.61
AC	Area 6	direct expansion	efficient chiller	Rt	68	Elect	Elect	\$30,975	\$4,502	\$433	\$0	\$13,974	\$18,909	\$12,066	0.61
AC	Area 6	direct expansion	efficient chiller	Rt	69	Elect	Elect	\$31,950	\$5,145	\$495	\$0	\$14,414	\$20,054	\$11,896	0.63
AC	Area 6	direct expansion	efficient chiller	Rt	70	Elect	Elect	\$22,300	\$4,288	\$412	\$0	\$10,060	\$14,760	\$7,540	0.66
AC	Area 6	direct expansion	efficient chiller	Rt	71	Elect	Elect	\$6,375	\$1,286	\$124	\$0	\$2,876	\$4,286	\$2,089	0.67
AC	Area 6	direct expansion	efficient chiller	Rt	72	Elect	Elect	\$31,820	\$6,860	\$660	\$0	\$14,355	\$21,875	\$9,945	0.69
AC	Area 6	direct expansion	efficient chiller	Rt	73	Elect	Elect	\$56,850	\$12,863	\$1,237	\$0	\$25,647	\$39,747	\$17,103	0.70
AC	Area 6	direct expansion	efficient chiller	Rt	74	Elect	Elect	\$25,800	\$6,431	\$618	\$0	\$11,639	\$18,689	\$7,111	0.72
AC	Area 6	direct expansion	efficient chiller	Rt	75	Elect	Elect	\$38,740	\$9,708	\$818	\$0	\$17,827	\$28,353	\$10,387	0.73
AC	Area 6	direct expansion	efficient chiller	Rt	76	Elect	Elect	\$43,460	\$12,135	\$1,023	\$0	\$19,999	\$33,156	\$10,304	0.76
AC	Area 6	direct expansion	efficient chiller	Rt	77	Elect	Elect	\$33,500	\$12,135	\$1,023	\$0	\$15,416	\$28,573	\$4,927	0.85
AC	Area 6	heat pump	efficient chiller	Rt	78	Elect	Elect	\$18,750	\$4,305	\$372	\$0	\$8,277	\$12,954	\$5,796	0.69
AC	Area 7	chilled water	efficient chiller	Rt	79	Elect	Elect	\$19,500	\$6,067	\$511	\$0	\$8,973	\$15,552	-\$3,948	0.80
AC	Area 7	chilled water	efficient chiller	Rt	80	Elect	Elect	\$82,600	\$36,200	\$7,262	\$0	\$38,010	\$81,473	\$1,127	0.99
AC	Area 7	chilled water	efficient chiller	Rt	81	Elect	Elect	\$53,250	\$25,340	\$5,084	\$0	\$24,504	\$54,928	\$1,678	1.03
AC	Area 7	chilled water	efficient chiller	Rt	82	Elect	Elect	\$113,400	\$35,885	\$4,261	\$0	\$45,721	\$85,847	-\$27,563	0.76
AC	Area 7	direct expansion	efficient chiller	Rt	83	Elect	Elect	\$26,550	\$3,859	\$371	\$0	\$11,978	\$16,208	\$10,342	0.61
AC	Area 7	direct expansion	efficient chiller	Rt	84	Elect	Elect	\$4,425	\$643	\$62	\$0	\$1,996	\$2,701	\$1,724	0.61
AC	Area 7	direct expansion	efficient chiller	Rt	85	Elect	Elect	\$44,600	\$8,575	\$825	\$0	\$20,120	\$29,520	\$15,080	0.66
AC	Area 7	direct expansion	efficient chiller	Rt	86	Elect	Elect	\$39,775	\$8,575	\$825	\$0	\$17,944	\$27,344	\$12,431	0.69
AC	Area 7	direct expansion	efficient chiller	Rt	87	Elect	Elect	\$66,325	\$15,007	\$1,443	\$0	\$29,921	\$46,371	-\$19,854	0.70
AC	Area 7	direct expansion	efficient chiller	Rt	88	Elect	Elect	\$10,845	\$2,573	\$247	\$0	\$4,893	\$7,713	\$3,132	0.71
AC	Area 7	direct expansion	efficient chiller	Rt	89	Elect	Elect	\$23,060	\$5,574	\$536	\$0	\$10,403	\$16,513	\$6,547	0.72
AC	Area 7	direct expansion	efficient chiller	Rt	90	Elect	Elect	\$12,215	\$3,001	\$289	\$0	\$5,511	\$8,891	\$3,414	0.72
AC	Area 7	direct expansion	efficient chiller	Rt	91	Elect	Elect	\$90,300	\$22,510	\$2,165	\$0	\$40,737	\$65,412	-\$24,888	0.72
AC	Area 7	direct expansion	efficient chiller	Rt	92	Elect	Elect	\$174,330	\$43,685	\$3,681	\$0	\$80,221	\$127,588	-\$46,742	0.73
AC	Area 7	direct expansion	efficient chiller	Rt	93	Elect	Elect	\$43,460	\$12,135	\$1,023	\$0	\$19,999	\$33,156	-\$10,304	0.76
AC	Area 7	direct expansion	efficient chiller	Rt	94	Elect	Elect	\$46,910	\$14,562	\$1,227	\$0	\$21,582	\$37,371	-\$9,529	0.80
AC	Area 7	direct expansion	efficient chiller	Rt	95	Elect	Elect	\$51,570	\$16,989	\$1,432	\$0	\$23,731	\$42,151	-\$9,419	0.82
AC	Area 7	direct expansion	efficient chiller	Rt	96	Elect	Elect	\$67,000	\$24,270	\$2,045	\$0	\$30,831	\$57,146	-\$9,854	0.85
AC	Area 8	chilled water	efficient chiller	Rt	97	Elect	Elect	\$32,710	\$14,562	\$1,227	\$0	\$15,048	\$30,836	-\$1,864	0.94
AC	Area 8	chilled water	efficient chiller	Rt	98	Elect	Elect	\$531,600	\$268,606	\$42,819	\$0	\$214,334	\$525,848	\$5,752	0.99
AC	Area 8	direct expansion	efficient chiller	Rt	99	Elect	Elect	\$1,475	\$214	\$21	\$0	\$665	\$900	\$525	0.61
AC	Area 8	direct expansion	efficient chiller	Rt	100	Elect	Elect	\$5,910	\$858	\$82	\$0	\$2,662	\$3,602	\$2,298	0.61
AC	Area 8	direct expansion	efficient chiller	Rt	101	Elect	Elect	\$13,275	\$1,929	\$186	\$0	\$5,989	\$8,104	\$5,171	0.61
AC	Area 8	direct expansion	efficient chiller	Rt	102	Elect	Elect	\$10,650	\$1,715	\$165	\$0	\$4,805	\$6,685	\$3,965	0.63
AC	Area 8	direct expansion	efficient chiller	Rt	103	Elect	Elect	\$13,450	\$6,431	\$618	\$0	\$15,090	\$22,140	\$11,310	0.66
AC	Area 8	direct expansion	efficient chiller	Rt	104	Elect	Elect	\$6,375	\$1,286	\$124	\$0	\$2,876	\$4,286	\$2,089	0.67
AC	Area 8	direct expansion	efficient chiller	Rt	105	Elect	Elect	\$8,700	\$1,929	\$186	\$0	\$3,925	\$6,040	\$2,660	0.69
AC	Area 8	direct expansion	efficient chiller	Rt	106	Elect	Elect	\$56,850	\$12,863	\$1,237	\$0	\$25,647	\$39,747	\$17,103	0.70
AC	Area 8	direct expansion	efficient chiller	Rt	107	Elect	Elect	\$64,510	\$16,079	\$1,546	\$0	\$29,098	\$46,723	\$17,777	0.72
AC	Area 8	direct expansion	efficient chiller	Rt	108	Elect	Elect	\$14,040	\$3,859	\$371	\$0	\$6,334	\$10,564	\$3,476	0.75
AC	Area 8	direct expansion	efficient chiller	Rt	109	Elect	Elect	\$38,740	\$9,708	\$818	\$0	\$17,827	\$28,353	\$10,387	0.73
AC	Area 8	direct expansion	efficient chiller	Rt	110	Elect	Elect	\$21,730	\$6,067	\$511	\$0	\$9,999	\$16,578	\$5,152	0.76
AC	Area 8	direct expansion	efficient chiller	Rt	111	Elect	Elect	\$46,910	\$14,562	\$1,227	\$0	\$21,582	\$37,371	-\$9,529	0.80
AC	Area 8	heat pump	efficient chiller	Rt	112	Elect	Elect	\$2,150	\$239	\$21	\$0	\$949	\$1,209	\$941	0.56
AC	Area 8	heat pump	efficient chiller	Rt	113	Elect	Elect	\$7,050	\$1,435	\$124	\$0	\$3,112	\$4,671	\$2,379	0.66
AC	Area 8	heat pump	efficient chiller	Rt	114	Elect	Elect	\$4,700	\$957	\$83	\$0	\$2,075	\$3,114	-\$1,506	0.66
AC	Area 8	heat pump	efficient chiller	Rt	115	Elect	Elect	\$15,625	\$3,588	\$310	\$0	\$6,897	\$10,795	\$4,830	0.69
AC	Area 8	heat pump	efficient chiller	Rt	116	Elect	Elect	\$4,225	\$957	\$81	\$0	\$1,965	\$2,904	\$1,321	0.69
AC	Area 1W	chilled water	efficient chiller	Rt	117	Elect	Elect	\$25,400	\$9,708	\$818	\$0	\$11,688	\$22,214	\$3,186	0.87
AC	Area 1W	chilled water	efficient chiller	Rt	118	Elect	Elect	\$12,700	\$14,562	\$1,227	\$0	\$15,048	\$30,836	-\$1,864	0.94
AC	Area 1W	chilled water	efficient chiller	Rt	119	Elect	Elect	\$69,110	\$28,960	\$5,811	\$0	\$27,150	\$61,920	\$2,920	1.05
AC	Area 1W	chilled water	efficient chiller	Rt	120	Elect	Elect	\$69,510	\$33,787	\$6,778	\$0	\$31,982	\$72,547	\$3,047	1.04
AC	Area 1W	chilled water	efficient chiller	Rt	121	Elect	Elect	\$97,210	\$43,440	\$8,715	\$0	\$44,728	\$56,884	-\$316	1.01
AC	Area 1W	chilled water	efficient chiller	Rt	122	Elect	Elect	\$118,410	\$42,697	\$5,072	\$0	\$47,737	\$55,516	\$22,894	0.81

Table 3.5
All EROs: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	Rt or ROF	ID	Existing Fuel	Resulting Fuel	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 1W	chilled water	efficient chiller	Rt	123	Elect	Elect	\$123,600	\$46,986	\$6,580	\$0	\$49,834	\$102,380	\$21,220	0.83
AC	Area 1W	chilled water	efficient chiller	Rt	124	Elect	Elect	\$128,750	\$51,236	\$6,087	\$0	\$51,910	\$109,233	\$19,517	0.85
AC	Area 1W	direct expansion	efficient chiller	Rt	125	Elect	Elect	\$4,425	\$643	\$62	\$0	\$1,996	\$2,701	\$1,724	0.61
AC	Area 1W	direct expansion	efficient chiller	Rt	126	Elect	Elect	\$26,550	\$3,859	\$371	\$0	\$11,978	\$16,208	\$10,342	0.61
AC	Area 1W	direct expansion	efficient chiller	Rt	127	Elect	Elect	\$44,250	\$6,431	\$618	\$0	\$19,963	\$27,013	\$17,237	0.61
AC	Area 1W	direct expansion	efficient chiller	Rt	128	Elect	Elect	\$21,300	\$3,430	\$339	\$0	\$9,609	\$13,369	\$7,931	0.63
AC	Area 1W	direct expansion	efficient chiller	Rt	129	Elect	Elect	\$55,750	\$10,719	\$1,031	\$0	\$25,151	\$36,900	\$18,850	0.66
AC	Area 1W	direct expansion	efficient chiller	Rt	130	Elect	Elect	\$12,750	\$2,573	\$247	\$0	\$5,752	\$8,572	\$4,178	0.67
AC	Area 1W	direct expansion	efficient chiller	Rt	131	Elect	Elect	\$14,350	\$3,001	\$289	\$0	\$6,474	\$9,764	\$4,586	0.68
AC	Area 1W	direct expansion	efficient chiller	Rt	132	Elect	Elect	\$7,955	\$1,715	\$165	\$0	\$3,589	\$5,469	\$2,486	0.69
AC	Area 1W	direct expansion	efficient chiller	Rt	133	Elect	Elect	\$12,900	\$3,216	\$309	\$0	\$5,620	\$9,345	\$3,555	0.72
AC	Area 1W	direct expansion	efficient chiller	Rt	134	Elect	Elect	\$19,370	\$4,854	\$469	\$0	\$8,913	\$14,176	\$5,194	0.73
AC	Area 1W	direct expansion	efficient chiller	Rt	135	Elect	Elect	\$46,900	\$14,582	\$1,227	\$0	\$21,582	\$37,371	\$9,529	0.80
AC	Area 1W	direct expansion	efficient chiller	Rt	136	Elect	Elect	\$100,500	\$36,494	\$3,068	\$0	\$46,247	\$85,719	\$14,781	0.85
AC	Area 1W	direct expansion	efficient chiller	Rt	137	Elect	Elect	\$82,900	\$29,124	\$2,454	\$0	\$42,750	\$74,327	\$18,573	0.88
AC	Area 1W	direct expansion	efficient chiller	Rt	138	Elect	Elect	\$65,000	\$24,133	\$4,842	\$0	\$29,911	\$58,886	\$6,114	0.91
AC	Area 1W	heat pump	efficient chiller	Rt	139	Elect	Elect	\$4,225	\$957	\$83	\$0	\$1,865	\$2,904	\$1,321	0.69
AC	Area 1W	heat pump	efficient chiller	Rt	140	Elect	Elect	\$100,000	\$23,917	\$2,067	\$0	\$44,144	\$70,128	\$29,872	0.70
AC	Area 3A	chilled water	efficient chiller	Rt	141	Elect	Elect	\$6,750	\$282	\$7	\$0	\$3,045	\$3,254	\$3,486	0.48
AC	Area 3A	chilled water	efficient chiller	Rt	142	Elect	Elect	\$6,750	\$1,008	\$34	\$0	\$3,045	\$4,088	\$2,662	0.61
AC	Area 3A	chilled water	efficient chiller	Rt	143	Elect	Elect	\$10,600	\$1,815	\$54	\$0	\$4,782	\$6,451	\$4,149	0.61
AC	Area 3A	chilled water	efficient chiller	Rt	144	Elect	Elect	\$17,500	\$4,854	\$409	\$0	\$8,053	\$13,316	\$4,184	0.76
AC	Area 3A	chilled water	efficient chiller	Rt	145	Elect	Elect	\$19,700	\$6,067	\$511	\$0	\$9,065	\$15,644	\$4,056	0.79
AC	Area 3A	chilled water	efficient chiller	Rt	146	Elect	Elect	\$87,600	\$29,124	\$2,454	\$0	\$40,311	\$71,888	\$15,712	0.82
AC	Area 3A	chilled water	efficient chiller	Rt	147	Elect	Elect	\$31,100	\$13,348	\$1,125	\$0	\$14,311	\$28,784	\$2,316	0.83
AC	Area 3A	chilled water	efficient chiller	Rt	148	Elect	Elect	\$130,800	\$58,247	\$4,908	\$0	\$60,190	\$123,345	\$7,455	0.84
AC	Area 3A	chilled water	efficient chiller	Rt	149	Elect	Elect	\$39,500	\$16,989	\$1,432	\$0	\$18,177	\$36,587	\$2,903	0.93
AC	Area 3A	chilled water	efficient chiller	Rt	150	Elect	Elect	\$43,100	\$19,307	\$3,873	\$0	\$19,833	\$43,013	\$87	1.00
AC	Area 3A	chilled water	efficient chiller	Rt	151	Elect	Elect	\$44,900	\$20,513	\$4,115	\$0	\$20,662	\$45,290	\$380	1.01
AC	Area 3A	chilled water	efficient chiller	Rt	152	Elect	Elect	\$102,000	\$48,287	\$9,683	\$0	\$46,937	\$104,887	\$2,887	1.03
AC	Area 3A	chilled water	efficient chiller	Rt	153	Elect	Elect	\$55,500	\$26,547	\$5,326	\$0	\$25,539	\$57,412	\$1,912	1.03
AC	Area 3A	chilled water	efficient chiller	Rt	154	Elect	Elect	\$114,500	\$55,507	\$11,136	\$0	\$52,689	\$119,332	\$4,832	1.04
AC	Area 3A	chilled water	efficient chiller	Rt	155	Elect	Elect	\$123,250	\$60,334	\$12,104	\$0	\$56,716	\$129,153	\$5,903	1.05
AC	Area 3A	chilled water	efficient chiller	Rt	156	Elect	Elect	\$77,000	\$38,614	\$7,747	\$0	\$35,433	\$81,793	\$4,793	1.06
AC	Area 3A	chilled water	efficient chiller	Rt	157	Elect	Elect	\$108,000	\$34,157	\$4,058	\$0	\$43,544	\$81,759	\$26,241	0.76
AC	Area 3A	chilled water	efficient chiller	Rt	158	Elect	Elect	\$121,500	\$38,427	\$4,565	\$0	\$48,987	\$91,979	\$29,521	0.76
AC	Area 3A	chilled water	efficient chiller	Rt	159	Elect	Elect	\$129,600	\$40,989	\$4,869	\$0	\$52,253	\$98,111	\$31,489	0.76
AC	Area 3A	chilled water	efficient chiller	Rt	160	Elect	Elect	\$132,900	\$54,652	\$6,493	\$0	\$53,583	\$114,728	\$18,172	0.86
AC	Area 3A	chilled water	efficient chiller	Rt	161	Elect	Elect	\$148,400	\$63,874	\$7,588	\$0	\$59,833	\$131,295	\$17,105	0.88
AC	Area 3A	chilled water	efficient chiller	Rt	162	Elect	Elect	\$167,500	\$104,959	\$16,720	\$0	\$67,534	\$189,219	\$21,719	1.13
AC	Area 3A	chilled water	efficient chiller	Rt	163	Elect	Elect	\$174,200	\$109,158	\$17,395	\$0	\$70,235	\$196,788	\$22,588	1.13
AC	Area 3A	direct expansion	efficient chiller	Rt	164	Elect	Elect	\$13,275	\$1,929	\$186	\$0	\$5,989	\$8,104	\$5,171	0.61
AC	Area 3A	direct expansion	efficient chiller	Rt	165	Elect	Elect	\$2,950	\$429	\$41	\$0	\$1,331	\$1,801	\$1,149	0.61
AC	Area 3A	direct expansion	efficient chiller	Rt	166	Elect	Elect	\$4,425	\$643	\$62	\$0	\$1,996	\$2,701	\$1,724	0.61
AC	Area 3A	direct expansion	efficient chiller	Rt	167	Elect	Elect	\$79,650	\$11,577	\$1,113	\$0	\$35,933	\$48,623	\$31,027	0.61
AC	Area 3A	direct expansion	efficient chiller	Rt	168	Elect	Elect	\$8,850	\$1,286	\$124	\$0	\$3,993	\$5,403	\$3,447	0.61
AC	Area 3A	direct expansion	efficient chiller	Rt	169	Elect	Elect	\$194,700	\$28,298	\$2,721	\$0	\$87,835	\$118,855	\$75,845	0.61
AC	Area 3A	direct expansion	efficient chiller	Rt	170	Elect	Elect	\$31,950	\$5,145	\$495	\$0	\$14,414	\$20,054	\$11,856	0.63
AC	Area 3A	direct expansion	efficient chiller	Rt	171	Elect	Elect	\$178,400	\$34,301	\$3,299	\$0	\$80,482	\$118,082	\$60,318	0.66
AC	Area 3A	direct expansion	efficient chiller	Rt	172	Elect	Elect	\$6,375	\$1,286	\$124	\$0	\$2,876	\$4,286	\$2,089	0.67
AC	Area 3A	direct expansion	efficient chiller	Rt	173	Elect	Elect	\$7,175	\$1,501	\$144	\$0	\$3,237	\$4,882	\$2,293	0.68
AC	Area 3A	direct expansion	efficient chiller	Rt	174	Elect	Elect	\$127,280	\$27,441	\$2,639	\$0	\$57,420	\$87,500	\$39,780	0.69
AC	Area 3A	direct expansion	efficient chiller	Rt	175	Elect	Elect	\$492,700	\$111,479	\$10,721	\$0	\$222,272	\$344,472	\$148,228	0.70
AC	Area 3A	direct expansion	efficient chiller	Rt	176	Elect	Elect	\$86,760	\$20,581	\$1,979	\$0	\$39,140	\$61,700	\$25,060	0.71
AC	Area 3A	direct expansion	efficient chiller	Rt	177	Elect	Elect	\$283,800	\$70,746	\$6,893	\$0	\$128,031	\$205,581	\$78,219	0.72
AC	Area 3A	direct expansion	efficient chiller	Rt	178	Elect	Elect	\$13,280	\$3,430	\$339	\$0	\$5,991	\$9,751	\$3,529	0.73
AC	Area 3A	direct expansion	efficient chiller	Rt	179	Elect	Elect	\$14,040	\$3,859	\$371	\$0	\$6,314	\$10,564	\$3,476	0.75
AC	Area 3A	direct expansion	efficient chiller	Rt	180	Elect	Elect	\$193,700	\$48,539	\$4,090	\$0	\$89,115	\$141,764	\$51,936	0.73
AC	Area 3A	direct expansion	efficient chiller	Rt	181	Elect	Elect	\$130,380	\$36,404	\$3,068	\$0	\$59,997	\$99,469	\$39,511	0.76
AC	Area 3A	direct expansion	efficient chiller	Rt	182	Elect	Elect	\$211,050	\$65,528	\$5,732	\$0	\$97,119	\$168,168	\$42,882	0.80
AC	Area 3A	direct expansion	efficient chiller	Rt	183	Elect	Elect	\$25,785	\$8,494	\$716	\$0	\$11,805	\$21,076	\$4,799	0.82

Table 3.5
All EROs: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	Rt or ROF	ID	Existing Fuel	Resulting Fuel	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 3A	direct expansion	efficient chiller	Rt	184	Elect	Elect	\$112 480	\$38 831	\$3 272	\$0	\$51 760	\$93 863	\$18 617	0.83
AC	Area 3A	direct expansion	efficient chiller	Rt	185	Elect	Elect	\$33 500	\$12 135	\$1 023	\$0	\$15 416	\$28 573	\$4 927	0.85
AC	Area 3A	direct expansion	efficient chiller	Rt	186	Elect	Elect	\$34 770	\$13 348	\$1 125	\$0	\$16 000	\$30 473	\$4 297	0.88
AC	Area 3A	direct expansion	efficient chiller	Rt	187	Elect	Elect	\$46 450	\$14 562	\$1 227	\$0	\$21 375	\$37 164	\$9 286	0.80
AC	Area 3A	direct expansion	efficient chiller	Rt	188	Elect	Elect	\$53 000	\$19 307	\$3 873	\$0	\$24 389	\$47 569	\$5 431	0.90
AC	Area 3A	direct expansion	efficient chiller	Rt	189	Elect	Elect	\$65 000	\$24 133	\$4 842	\$0	\$29 911	\$58 086	\$6 114	0.91
AC	Area 3A	heat pump	efficient chiller	Rt	190	Elect	Elect	\$7 050	\$1 435	\$124	\$0	\$3 112	\$4 671	\$2 379	0.66
AC	Area 3A	heat pump	efficient chiller	Rt	191	Elect	Elect	\$6 250	\$1 435	\$124	\$0	\$2 759	\$4 318	\$1 932	0.69
AC	Area 3A	heat pump	efficient chiller	Rt	192	Elect	Elect	\$12 500	\$2 870	\$248	\$0	\$5 518	\$8 636	\$3 864	0.69
AC	Area 3A	heat pump	efficient chiller	Rt	193	Elect	Elect	\$4 225	\$857	\$83	\$0	\$1 865	\$2 804	\$1 321	0.69
AC	Area IN	chilled water	efficient chiller	Rt	194	Elect	Elect	\$31 800	\$4 844	\$162	\$0	\$14 346	\$19 352	\$12 448	0.61
AC	Area IN	chilled water	efficient chiller	Rt	195	Elect	Elect	\$41 300	\$18 100	\$3 631	\$0	\$19 005	\$40 736	\$564	0.99
AC	Area IN	chilled water	efficient chiller	Rt	196	Elect	Elect	\$370 500	\$140 888	\$16 739	\$0	\$149 380	\$307 018	\$63 482	0.83
AC	Area IN	direct expansion	efficient chiller	Rt	197	Elect	Elect	\$2 950	\$429	\$41	\$0	\$1 331	\$1 801	\$1 149	0.61
AC	Area IN	direct expansion	efficient chiller	Rt	198	Elect	Elect	\$8 850	\$1 286	\$124	\$0	\$3 993	\$5 403	\$3 447	0.61
AC	Area IN	direct expansion	efficient chiller	Rt	199	Elect	Elect	\$5 325	\$858	\$82	\$0	\$2 402	\$3 342	\$1 983	0.63
AC	Area IN	direct expansion	efficient chiller	Rt	200	Elect	Elect	\$7 955	\$1 715	\$165	\$0	\$3 589	\$5 469	\$2 486	0.69
AC	Area IN	direct expansion	efficient chiller	Rt	201	Elect	Elect	\$9 475	\$2 144	\$206	\$0	\$4 274	\$6 624	\$2 851	0.70
AC	Area IN	direct expansion	efficient chiller	Rt	202	Elect	Elect	\$25 800	\$6 431	\$618	\$0	\$11 639	\$18 689	\$7 111	0.72
AC	Area IN	direct expansion	efficient chiller	Rt	203	Elect	Elect	\$56 240	\$19 416	\$1 636	\$0	\$25 880	\$46 932	\$9 308	0.83
AC	Area IN	direct expansion	efficient chiller	Rt	204	Elect	Elect	\$40 000	\$14 562	\$1 227	\$0	\$18 407	\$34 196	\$5 804	0.85
AC	Other	direct expansion	efficient chiller	Rt	205	Elect	Elect	\$5 900	\$858	\$82	\$0	\$2 662	\$3 602	\$2 298	0.61
AC	Other	direct expansion	efficient chiller	Rt	206	Elect	Elect	\$7 955	\$1 715	\$165	\$0	\$3 589	\$5 469	\$2 486	0.69
AC	Other	direct expansion	efficient chiller	Rt	207	Elect	Elect	\$10 845	\$2 573	\$247	\$0	\$4 893	\$7 713	\$3 132	0.71
AC	Area 4	chilled water	install TES	ROF	1	Elect	Elect	\$12 349	\$6 286	\$25 439	\$2 460	\$14 382	\$35 695	\$23 347	2.89
AC	Area 5	chilled water	install TES	ROF	2	Elect	Elect	\$12 349	\$6 286	\$25 439	\$2 460	\$14 082	\$35 695	\$23 347	2.89
AC	Area 6	chilled water	install TES	ROF	3	Elect	Elect	\$12 349	\$6 286	\$25 439	\$2 460	\$14 082	\$35 695	\$23 347	2.89
AC	Area 7	chilled water	install TES	ROF	4	Elect	Elect	\$12 349	\$6 286	\$25 439	\$2 460	\$13 908	\$35 522	\$23 174	2.88
AC	Area 3A	chilled water	install TES	ROF	5	Elect	Elect	\$12 349	\$6 286	\$25 439	\$2 460	\$14 082	\$35 695	\$23 347	2.89
AC	Area 6	chilled water	install TES	ROF	6	Elect	Elect	\$14 818	\$7 543	\$30 527	\$2 953	\$13 496	\$39 432	\$24 614	2.66
AC	Area 3A	chilled water	install TES	ROF	7	Elect	Elect	\$237 094	\$30 170	\$122 106	\$11 810	\$53 445	\$50 301	\$186 794	0.21
AC	Area 5	chilled water	install TES	ROF	8	Elect	Elect	\$17 288	\$8 800	\$35 614	\$3 445	\$12 619	\$42 878	\$25 580	2.48
AC	Area 6	chilled water	install TES	ROF	9	Elect	Elect	\$19 758	\$10 057	\$40 702	\$3 937	\$14 099	\$48 681	\$28 923	2.46
AC	Area 1W	chilled water	install TES	ROF	10	Elect	Elect	\$19 758	\$10 057	\$40 702	\$3 937	\$14 099	\$48 681	\$28 923	2.46
AC	Area 3A	chilled water	install TES	ROF	11	Elect	Elect	\$27 167	\$13 828	\$55 965	\$5 413	\$15 466	\$63 016	\$35 849	2.32
AC	Area 6	chilled water	install TES	ROF	12	Elect	Elect	\$29 637	\$15 085	\$61 053	\$5 905	\$15 614	\$67 487	\$37 850	2.28
AC	Area 8	chilled water	install TES	ROF	13	Elect	Elect	\$29 637	\$15 085	\$61 053	\$5 905	\$15 614	\$67 487	\$37 850	2.28
AC	Area 1W	chilled water	install TES	ROF	14	Elect	Elect	\$29 637	\$15 085	\$61 053	\$5 905	\$15 614	\$67 487	\$37 850	2.28
AC	Area 3A	chilled water	install TES	ROF	15	Elect	Elect	\$474 189	\$60 341	\$244 212	\$23 621	\$152 402	\$55 090	\$419 089	0.12
AC	Area 3	chilled water	install TES	ROF	16	Elect	Elect	\$34 576	\$17 569	\$71 229	\$6 889	\$19 600	\$80 118	\$45 542	2.32
AC	Area 3A	chilled water	install TES	ROF	17	Elect	Elect	\$34 576	\$17 569	\$71 229	\$6 889	\$19 600	\$80 118	\$45 542	2.32
AC	Area 7	chilled water	install TES	ROF	18	Elect	Elect	\$148 184	\$17 003	\$132 938	\$14 763	\$4 856	\$125 842	\$22 342	0.85
AC	Area IN	chilled water	install TES	ROF	19	Elect	Elect	\$37 046	\$8 501	\$66 469	\$7 381	\$19 953	\$85 302	\$48 256	2.30
AC	Area 3A	chilled water	install TES	ROF	20	Elect	Elect	\$39 516	\$9 068	\$70 910	\$7 874	\$20 306	\$90 012	\$50 496	2.28
AC	Area 3A	chilled water	install TES	ROF	21	Elect	Elect	\$41 985	\$9 635	\$75 332	\$8 366	\$20 659	\$94 721	\$52 736	2.26
AC	Area 6	chilled water	install TES	ROF	22	Elect	Elect	\$44 455	\$10 202	\$79 763	\$8 858	\$21 012	\$99 431	\$54 976	2.24
AC	Area 5	chilled water	install TES	ROF	23	Elect	Elect	\$197 579	\$22 670	\$177 251	\$19 684	\$14 812	\$159 453	\$38 126	0.81
AC	Area 3A	chilled water	install TES	ROF	24	Elect	Elect	\$197 579	\$22 670	\$177 251	\$19 684	\$14 812	\$159 453	\$38 126	0.81
AC	Area 7	chilled water	install TES	ROF	25	Elect	Elect	\$51 864	\$11 902	\$93 057	\$10 334	\$23 250	\$114 739	\$62 874	2.21
AC	Area 3A	chilled water	install TES	ROF	26	Elect	Elect	\$54 334	\$12 469	\$97 488	\$10 826	\$24 064	\$119 909	\$65 575	2.21
AC	Area 3A	chilled water	install TES	ROF	27	Elect	Elect	\$227 215	\$26 071	\$203 818	\$22 636	\$19 903	\$180 501	\$46 715	0.79
AC	Area 2	chilled water	install TES	ROF	28	Elect	Elect	\$59 274	\$13 602	\$106 350	\$11 810	\$42 434	\$145 993	\$87 720	2.48
AC	Area 1W	chilled water	install TES	ROF	29	Elect	Elect	\$59 274	\$13 602	\$106 350	\$11 810	\$42 434	\$129 226	\$69 953	2.18
AC	Area 3A	chilled water	install TES	ROF	30	Elect	Elect	\$246 153	\$28 338	\$221 563	\$24 605	\$22 871	\$194 960	\$52 014	0.79
AC	Area 3	chilled water	install TES	ROF	31	Elect	Elect	\$69 153	\$15 869	\$124 076	\$13 779	\$29 462	\$151 447	\$82 295	2.19
AC	Area 1W	chilled water	install TES	ROF	32	Elect	Elect	\$69 153	\$15 869	\$124 076	\$13 779	\$29 462	\$151 447	\$82 295	2.19
AC	Area 3A	chilled water	install TES	ROF	33	Elect	Elect	\$79 031	\$18 136	\$141 891	\$15 747	\$31 182	\$170 593	\$91 562	2.16
AC	Area 1W	chilled water	install TES	ROF	34	Elect	Elect	\$88 910	\$20 403	\$159 526	\$17 715	\$45 919	\$202 757	\$113 847	2.28
AC	Area 3A	chilled water	install TES	ROF	35	Elect	Elect	\$87 823	\$17 208	\$101 755	\$19 684	\$94 691	\$198 922	\$111 099	2.27
AC	Area 7	chilled water	install TES	ROF	36	Elect	Elect	\$92 215	\$18 068	\$106 843	\$20 668	\$49 426	\$208 869	\$116 654	2.27
AC	Area 3A	chilled water	install TES	ROF	37	Elect	Elect	\$98 801	\$19 359	\$114 474	\$22 144	\$106 528	\$223 788	\$124 587	2.27

Table 3.5
All EROs: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF ID	Existing Fuel	Resulting Fuel	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio	
AC	Area 3A	chilled water	install	IES	ROF 38	Elect	Elect	\$105,388	\$20,649	\$122,106	\$23,621	\$113,630	\$238,707	\$133,319	2.27
AC	Area 1W	chilled water	install	IES	ROF 39	Elect	Elect	\$109,779	\$21,510	\$127,194	\$24,605	\$109,190	\$239,479	\$129,699	2.18
AC	Area 1W	chilled water	install	IES	ROF 40	Elect	Elect	\$120,757	\$23,661	\$139,913	\$27,065	\$116,439	\$259,757	\$138,999	2.15
AC	Area 1N	chilled water	install	IES	ROF 41	Elect	Elect	\$1,086,814	\$70,982	\$419,740	\$81,196	\$637,912	\$1,067,865	-\$18,949	0.98
AC	Area 5	chilled water	install	IES	ROF 42	Elect	Elect	\$131,735	\$25,812	\$152,633	\$29,526	\$123,660	\$280,007	\$148,272	2.13
AC	Area 1W	chilled water	install	IES	ROF 43	Elect	Elect	\$131,735	\$25,812	\$152,633	\$29,526	\$123,660	\$280,007	\$148,272	2.13
AC	Area 5	chilled water	install	IES	ROF 44	Elect	Elect	\$140,517	\$27,533	\$162,808	\$31,494	\$129,454	\$296,224	\$155,706	2.11
AC	Area 3A	chilled water	install	IES	ROF 45	Elect	Elect	\$140,517	\$27,533	\$162,808	\$31,494	\$129,454	\$296,224	\$155,706	2.11
AC	Area 6	chilled water	install	IES	ROF 46	Elect	Elect	\$158,082	\$30,974	\$183,159	\$35,431	\$129,573	\$317,189	\$158,107	2.01
AC	Area 3A	chilled water	install	IES	ROF 47	Elect	Elect	\$164,230	\$32,179	\$190,282	\$36,809	\$147,471	\$342,383	\$178,154	2.08
AC	Area 3A	chilled water	install	IES	ROF 48	Elect	Elect	\$219,558	\$40,850	\$268,629	\$49,210	\$180,078	\$487,067	\$267,509	2.22
AC	Area 3A	chilled water	install	IES	ROF 49	Elect	Elect	\$228,341	\$42,484	\$310,574	\$51,178	\$187,281	\$506,550	\$278,209	2.22
AC	Area 8	chilled water	install	IES	ROF 50	Elect	Elect	\$562,069	\$104,576	\$764,490	\$125,976	\$517,816	\$1,303,707	\$741,638	2.32
AC	Area 3	direct expansion	install	IES	ROF 51	Elect	Elect	\$49,395	\$12,571	\$50,878	\$4,921	\$25,749	\$68,976	\$19,581	1.40
AC	Area 5	direct expansion	install	IES	ROF 52	Elect	Elect	\$12,349	\$6,286	\$25,439	\$2,460	\$15,838	\$37,452	\$25,103	3.03
AC	Area 6	direct expansion	install	IES	ROF 53	Elect	Elect	\$49,395	\$12,571	\$50,878	\$4,921	\$25,749	\$68,976	\$19,581	1.40
AC	Area 7	direct expansion	install	IES	ROF 54	Elect	Elect	\$49,395	\$12,571	\$50,878	\$4,921	\$25,749	\$68,976	\$19,581	1.40
AC	Area 8	direct expansion	install	IES	ROF 55	Elect	Elect	\$12,349	\$6,286	\$25,439	\$2,460	\$15,838	\$37,452	\$25,103	3.03
AC	Area 3A	direct expansion	install	IES	ROF 56	Elect	Elect	\$444,552	\$37,713	\$152,633	\$14,763	\$6,119	\$135,802	-\$308,750	0.31
AC	Area 4	direct expansion	install	IES	ROF 57	Elect	Elect	\$133,366	\$22,626	\$91,580	\$8,858	\$28,862	\$106,672	-\$26,694	0.80
AC	Area 5	direct expansion	install	IES	ROF 58	Elect	Elect	\$14,818	\$7,543	\$30,527	\$2,953	\$16,733	\$42,670	\$27,852	2.88
AC	Area 7	direct expansion	install	IES	ROF 59	Elect	Elect	\$59,274	\$15,085	\$61,053	\$5,905	\$26,354	\$78,227	\$18,954	1.32
AC	Area 8	direct expansion	install	IES	ROF 60	Elect	Elect	\$59,274	\$15,085	\$61,053	\$5,905	\$26,354	\$78,227	\$18,954	1.32
AC	Area 1W	direct expansion	install	IES	ROF 61	Elect	Elect	\$59,274	\$15,085	\$61,053	\$5,905	\$26,354	\$78,227	\$18,954	1.32
AC	Area 3A	direct expansion	install	IES	ROF 62	Elect	Elect	\$1,200,290	\$67,883	\$274,739	\$26,573	-\$105,456	\$127,973	-\$1,072,317	0.11
AC	Area 7	direct expansion	install	IES	ROF 63	Elect	Elect	\$69,153	\$17,598	\$71,229	\$6,889	\$28,024	\$88,542	\$19,390	1.28
AC	Area 3A	direct expansion	install	IES	ROF 64	Elect	Elect	\$17,288	\$8,800	\$35,614	\$3,445	\$18,161	\$48,420	\$31,132	2.80
AC	Area 5	direct expansion	install	IES	ROF 65	Elect	Elect	\$19,758	\$10,057	\$40,702	\$3,937	\$19,589	\$54,171	\$34,413	2.74
AC	Area 3A	direct expansion	install	IES	ROF 66	Elect	Elect	\$316,126	\$40,227	\$162,808	\$15,747	\$21,453	\$159,781	-\$156,345	0.51
AC	Area 1N	direct expansion	install	IES	ROF 67	Elect	Elect	\$79,031	\$20,114	\$81,404	\$7,874	\$29,694	\$88,858	\$19,826	1.25
AC	Area 1	direct expansion	install	IES	ROF 68	Elect	Elect	\$24,697	\$12,571	\$50,878	\$4,921	\$23,058	\$66,286	\$41,588	2.68
AC	Area 6	direct expansion	install	IES	ROF 69	Elect	Elect	\$24,697	\$12,571	\$50,878	\$4,921	\$23,058	\$66,286	\$41,588	2.68
AC	Area 7	direct expansion	install	IES	ROF 70	Elect	Elect	\$98,789	\$25,142	\$101,755	\$9,842	\$34,262	\$120,717	\$21,927	1.22
AC	Area 1W	direct expansion	install	IES	ROF 71	Elect	Elect	\$222,276	\$37,713	\$152,633	\$14,763	\$33,611	\$163,293	-\$58,982	0.73
AC	Area 3A	direct expansion	install	IES	ROF 72	Elect	Elect	\$24,697	\$12,571	\$50,878	\$4,921	\$23,058	\$66,286	\$41,588	2.68
AC	Area 3A	direct expansion	install	IES	ROF 73	Elect	Elect	\$27,167	\$13,828	\$55,965	\$5,413	\$23,564	\$71,115	\$43,947	2.62
AC	Area 1W	direct expansion	install	IES	ROF 74	Elect	Elect	\$118,547	\$30,170	\$122,106	\$11,810	\$51,930	\$155,676	\$37,128	1.31
AC	Area 3A	direct expansion	install	IES	ROF 75	Elect	Elect	\$29,637	\$15,085	\$61,053	\$5,905	\$33,078	\$84,950	\$55,314	2.87
AC	Area 1N	direct expansion	install	IES	ROF 76	Elect	Elect	\$29,637	\$15,085	\$61,053	\$5,905	\$33,078	\$84,950	\$55,314	2.87
AC	Area 5	direct expansion	install	IES	ROF 77	Elect	Elect	\$158,063	\$18,136	\$141,801	\$15,747	\$53,781	\$193,192	\$35,129	1.22
AC	Area 3A	direct expansion	install	IES	ROF 78	Elect	Elect	\$39,516	\$9,068	\$70,900	\$7,874	\$36,374	\$106,080	\$66,564	2.68
AC	Area 2	direct expansion	install	IES	ROF 79	Elect	Elect	\$49,395	\$11,335	\$88,625	\$9,842	\$44,386	\$131,518	\$82,123	2.66
AC	Area 4	direct expansion	install	IES	ROF 80	Elect	Elect	\$49,395	\$11,335	\$88,625	\$9,842	\$44,386	\$131,518	\$82,123	2.66
AC	Area 1W	direct expansion	install	IES	ROF 81	Elect	Elect	\$49,395	\$11,335	\$88,625	\$9,842	\$44,386	\$131,518	\$82,123	2.66
AC	Area 3A	direct expansion	install	IES	ROF 82	Elect	Elect	\$49,395	\$11,335	\$88,625	\$9,842	\$44,386	\$131,518	\$82,123	2.66
AC	Area 3	direct expansion	install	IES	ROF 83	Elect	Elect	\$62,237	\$14,282	\$111,668	\$12,401	\$52,552	\$162,338	\$100,101	2.61
AC	Area 1W	heat pump	install	IES	ROF 84	Elect	Elect	\$49,395	\$28,064	\$114,474	\$9,842	\$74,669	\$170,921	\$121,527	3.46
AC	Area 4	chilled water	install	IES	RI 1	Elect	Elect	\$16,250	\$10,053	\$25,439	\$2,460	\$5,191	\$23,037	\$6,787	1.42
AC	Area 5	chilled water	install	IES	RI 2	Elect	Elect	\$16,250	\$10,053	\$25,439	\$2,460	\$5,191	\$23,037	\$6,787	1.42
AC	Area 6	chilled water	install	IES	RI 3	Elect	Elect	\$16,250	\$10,053	\$25,439	\$2,460	\$5,191	\$23,037	\$6,787	1.42
AC	Area 7	chilled water	install	IES	RI 4	Elect	Elect	\$16,250	\$10,053	\$25,439	\$2,460	\$5,191	\$22,864	\$6,614	1.41
AC	Area 3A	chilled water	install	IES	RI 5	Elect	Elect	\$16,250	\$10,053	\$25,439	\$2,460	\$5,191	\$23,037	\$6,787	1.42
AC	Area 6	chilled water	install	IES	RI 6	Elect	Elect	\$19,500	\$12,064	\$30,527	\$2,953	\$1,700	\$25,116	\$3,616	1.19
AC	Area 3A	chilled water	install	IES	RI 7	Elect	Elect	\$312,000	\$48,255	\$122,106	\$11,810	\$242,173	\$156,511	-\$468,511	0.50
AC	Area 5	chilled water	install	IES	RI 8	Elect	Elect	\$22,750	\$14,074	\$35,614	\$5,445	\$1,143	\$23,842	\$1,092	1.05
AC	Area 6	chilled water	install	IES	RI 9	Elect	Elect	\$26,000	\$16,085	\$40,702	\$5,937	\$1,628	\$26,926	\$926	1.04
AC	Area 1W	chilled water	install	IES	RI 10	Elect	Elect	\$26,000	\$16,085	\$40,702	\$5,937	\$1,628	\$26,926	\$926	1.04
AC	Area 3A	chilled water	install	IES	RI 11	Elect	Elect	\$35,750	\$22,117	\$55,965	\$5,413	\$6,159	\$33,102	\$2,648	0.93
AC	Area 6	chilled water	install	IES	RI 12	Elect	Elect	\$39,000	\$24,127	\$61,053	\$5,905	\$7,977	\$34,854	\$4,146	0.89
AC	Area 8	chilled water	install	IES	RI 13	Elect	Elect	\$39,000	\$24,127	\$61,053	\$5,905	\$7,977	\$34,854	\$4,146	0.89
AC	Area 1W	chilled water	install	IES	RI 14	Elect	Elect	\$39,000	\$24,127	\$61,053	\$5,905	\$7,977	\$34,854	\$4,146	0.89

Table 3.5
All EROs: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 3A	chilled water	install TES	RI	15	Elect	Elect	\$624,000	-\$96,510	\$244,212	\$23,621	-\$529,857	-\$358,534	-\$982,534	-0.57
AC	Area 3	chilled water	install TES	RI	16	Elect	Elect	\$45,500	-\$28,149	\$71,229	\$6,889	-\$7,923	\$42,046	-\$3,454	0.92
AC	Area 3A	chilled water	install TES	RI	17	Elect	Elect	\$45,500	-\$28,149	\$71,229	\$6,889	-\$7,923	\$42,046	-\$3,454	0.92
AC	Area 7	chilled water	install TES	RI	18	Elect	Elect	\$195,000	-\$27,194	\$132,938	\$14,763	-\$122,811	-\$2,304	-\$197,304	-0.01
AC	Area IN	chilled water	install TES	RI	19	Elect	Elect	\$48,750	-\$13,597	\$66,469	\$7,381	-\$9,536	\$50,718	\$1,968	1.04
AC	Area 3A	chilled water	install TES	RI	20	Elect	Elect	\$52,000	-\$14,503	\$70,900	\$7,874	-\$11,149	\$53,122	\$1,122	1.02
AC	Area 3A	chilled water	install TES	RI	21	Elect	Elect	\$55,250	-\$15,410	\$75,332	\$8,366	-\$12,762	\$55,526	\$276	1.00
AC	Area 6	chilled water	install TES	RI	22	Elect	Elect	\$58,500	-\$16,316	\$79,763	\$8,858	-\$14,374	\$57,930	-\$570	0.99
AC	Area 5	chilled water	install TES	RI	23	Elect	Elect	\$260,000	-\$36,250	\$177,251	\$19,684	-\$172,085	-\$11,409	-\$271,409	-0.04
AC	Area 3A	chilled water	install TES	RI	24	Elect	Elect	\$260,000	-\$36,250	\$177,251	\$19,684	-\$172,085	-\$11,409	-\$271,409	-0.04
AC	Area 7	chilled water	install TES	RI	25	Elect	Elect	\$68,250	-\$19,036	\$93,057	\$10,334	-\$18,034	\$66,320	-\$1,930	0.97
AC	Area 3A	chilled water	install TES	RI	26	Elect	Elect	\$71,500	-\$19,942	\$97,488	\$10,426	-\$19,186	\$69,186	-\$2,314	0.97
AC	Area 3A	chilled water	install TES	RI	27	Elect	Elect	\$299,000	-\$41,697	\$203,838	\$22,636	-\$200,767	-\$15,990	-\$314,390	-0.05
AC	Area 2	chilled water	install TES	RI	28	Elect	Elect	\$78,000	-\$21,755	\$106,350	\$11,810	-\$4,747	\$91,658	\$13,658	1.18
AC	Area 1W	chilled water	install TES	RI	29	Elect	Elect	\$78,000	-\$21,755	\$106,350	\$11,810	-\$22,514	\$73,891	\$4,309	0.95
AC	Area 3A	chilled water	install TES	RI	30	Elect	Elect	\$325,000	-\$45,323	\$221,563	\$24,605	-\$219,462	-\$18,617	-\$343,617	-0.06
AC	Area 3	chilled water	install TES	RI	31	Elect	Elect	\$91,000	-\$25,381	\$124,076	\$13,779	-\$25,583	\$86,890	-\$4,110	0.95
AC	Area 1W	chilled water	install TES	RI	32	Elect	Elect	\$91,000	-\$25,381	\$124,076	\$13,779	-\$25,583	\$86,890	-\$4,110	0.95
AC	Area 3A	chilled water	install TES	RI	33	Elect	Elect	\$104,000	-\$29,007	\$141,801	\$15,747	-\$31,728	\$95,813	-\$7,187	0.93
AC	Area 1W	chilled water	install TES	RI	34	Elect	Elect	\$117,000	-\$32,633	\$159,526	\$17,715	-\$24,854	\$119,755	\$2,755	1.02
AC	Area 3A	chilled water	install TES	RI	35	Elect	Elect	\$130,000	-\$34,977	\$191,755	\$19,684	-\$17,106	\$103,568	-\$26,432	0.80
AC	Area 7	chilled water	install TES	RI	36	Elect	Elect	\$136,500	-\$36,726	\$196,843	\$20,668	-\$19,961	\$108,746	-\$27,754	0.80
AC	Area 3A	chilled water	install TES	RI	37	Elect	Elect	\$146,250	-\$39,349	\$114,474	\$22,144	-\$19,244	\$116,514	-\$29,736	0.80
AC	Area 3A	chilled water	install TES	RI	38	Elect	Elect	\$156,000	-\$41,972	\$122,106	\$23,621	-\$20,527	\$124,281	-\$31,719	0.80
AC	Area 1W	chilled water	install TES	RI	39	Elect	Elect	\$162,500	-\$43,721	\$127,194	\$24,605	-\$12,207	\$120,285	-\$42,215	0.74
AC	Area 1W	chilled water	install TES	RI	40	Elect	Elect	\$178,750	-\$48,093	\$139,913	\$27,065	-\$9,758	\$128,644	-\$50,108	0.72
AC	Area IN	chilled water	install TES	RI	41	Elect	Elect	\$1,608,750	-\$144,279	\$419,740	\$81,196	-\$322,213	\$34,444	-\$1,574,306	0.02
AC	Area 5	chilled water	install TES	RI	42	Elect	Elect	\$195,000	-\$52,465	\$152,633	\$29,526	-\$7,282	\$136,975	-\$58,025	0.70
AC	Area 1W	chilled water	install TES	RI	43	Elect	Elect	\$195,000	-\$52,465	\$152,633	\$29,526	-\$7,282	\$136,975	-\$58,025	0.70
AC	Area 5	chilled water	install TES	RI	44	Elect	Elect	\$208,000	-\$55,963	\$162,808	\$31,494	-\$5,317	\$143,656	-\$64,344	0.69
AC	Area 3A	chilled water	install TES	RI	45	Elect	Elect	\$208,000	-\$55,963	\$162,808	\$31,494	-\$5,317	\$143,656	-\$64,344	0.69
AC	Area 6	chilled water	install TES	RI	46	Elect	Elect	\$234,000	-\$62,958	\$183,159	\$35,431	-\$10,081	\$145,551	-\$88,449	0.62
AC	Area 3A	chilled water	install TES	RI	47	Elect	Elect	\$243,100	-\$65,406	\$190,282	\$36,819	-\$2,386	\$164,070	-\$79,030	0.67
AC	Area 3A	chilled water	install TES	RI	48	Elect	Elect	\$325,000	-\$83,032	\$298,629	\$49,210	-\$13,886	\$250,921	-\$74,079	0.77
AC	Area 3A	chilled water	install TES	RI	49	Elect	Elect	\$338,000	-\$86,383	\$310,574	\$51,178	-\$14,442	\$260,957	-\$77,043	0.77
AC	Area 8	chilled water	install TES	RI	50	Elect	Elect	\$852,000	-\$212,561	\$764,490	\$125,976	-\$21,267	\$699,173	-\$132,827	0.84
AC	Area 3	direct expansion	install TES	RI	51	Elect	Elect	\$65,000	-\$20,106	\$50,878	\$4,921	-\$9,815	\$25,878	-\$39,122	0.40
AC	Area 5	direct expansion	install TES	RI	52	Elect	Elect	\$16,250	-\$10,053	\$25,439	\$2,460	-\$6,947	\$24,793	-\$8,543	1.53
AC	Area 6	direct expansion	install TES	RI	53	Elect	Elect	\$65,000	-\$20,106	\$50,878	\$4,921	-\$9,815	\$25,878	-\$39,122	0.40
AC	Area 7	direct expansion	install TES	RI	54	Elect	Elect	\$65,000	-\$20,106	\$50,878	\$4,921	-\$9,815	\$25,878	-\$39,122	0.40
AC	Area 8	direct expansion	install TES	RI	55	Elect	Elect	\$16,250	-\$10,053	\$25,439	\$2,460	-\$6,947	\$24,793	-\$8,543	1.53
AC	Area 3A	direct expansion	install TES	RI	56	Elect	Elect	\$585,000	-\$60,318	\$152,633	\$14,763	-\$313,950	\$206,873	-\$791,873	-0.35
AC	Area 4	direct expansion	install TES	RI	57	Elect	Elect	\$175,500	-\$36,191	\$91,580	\$8,858	-\$67,158	-\$2,912	-\$178,412	-0.02
AC	Area 5	direct expansion	install TES	RI	58	Elect	Elect	\$19,500	-\$12,064	\$30,527	\$2,953	-\$6,064	\$27,480	-\$7,980	1.41
AC	Area 7	direct expansion	install TES	RI	59	Elect	Elect	\$78,000	-\$24,127	\$61,053	\$5,905	-\$16,322	\$26,509	-\$51,491	0.34
AC	Area 8	direct expansion	install TES	RI	60	Elect	Elect	\$78,000	-\$24,127	\$61,053	\$5,905	-\$16,322	\$26,509	-\$51,491	0.34
AC	Area 1W	direct expansion	install TES	RI	61	Elect	Elect	\$78,000	-\$24,127	\$61,053	\$5,905	-\$16,322	\$26,509	-\$51,491	0.34
AC	Area 3A	direct expansion	install TES	RI	62	Elect	Elect	\$1,579,500	-\$108,573	\$274,739	\$26,573	-\$969,642	-\$776,903	\$2,356,403	0.49
AC	Area 7	direct expansion	install TES	RI	63	Elect	Elect	\$91,000	-\$28,149	\$71,229	\$6,889	-\$7,923	\$26,205	-\$62,795	0.31
AC	Area 3A	direct expansion	install TES	RI	64	Elect	Elect	\$22,750	-\$14,074	\$35,614	\$3,445	-\$5,714	\$30,699	-\$7,949	1.35
AC	Area 5	direct expansion	install TES	RI	65	Elect	Elect	\$26,000	-\$16,085	\$40,712	\$3,937	-\$5,363	\$33,917	-\$7,917	1.30
AC	Area 3A	direct expansion	install TES	RI	66	Elect	Elect	\$416,000	-\$64,340	\$162,808	\$15,747	-\$206,151	\$91,936	-\$507,936	-0.22
AC	Area IN	direct expansion	install TES	RI	67	Elect	Elect	\$104,000	-\$32,170	\$81,414	\$7,874	-\$27,207	\$29,900	\$74,100	0.29
AC	Area 1	direct expansion	install TES	RI	68	Elect	Elect	\$32,500	-\$20,106	\$50,878	\$4,921	-\$5,277	\$40,969	-\$8,469	1.26
AC	Area 6	direct expansion	install TES	RI	69	Elect	Elect	\$32,500	-\$20,106	\$50,878	\$4,921	-\$5,277	\$40,969	-\$8,469	1.26
AC	Area 7	direct expansion	install TES	RI	70	Elect	Elect	\$130,000	-\$40,212	\$101,755	\$9,842	-\$36,865	\$34,520	-\$95,480	0.27
AC	Area 1W	direct expansion	install TES	RI	71	Elect	Elect	\$292,500	-\$60,318	\$152,633	\$14,763	-\$126,423	\$19,346	-\$311,846	0.07
AC	Area 3A	direct expansion	install TES	RI	72	Elect	Elect	\$32,500	-\$20,106	\$50,878	\$4,921	-\$5,277	\$40,969	-\$8,469	1.26
AC	Area 3A	direct expansion	install TES	RI	73	Elect	Elect	\$35,750	-\$22,117	\$55,965	\$5,413	-\$4,005	\$43,266	-\$7,516	1.21
AC	Area 1W	direct expansion	install TES	RI	74	Elect	Elect	\$156,000	-\$48,255	\$122,106	\$11,810	-\$15,422	\$52,240	-\$103,760	0.33
AC	Area 3A	direct expansion	install TES	RI	75	Elect	Elect	\$39,000	-\$24,127	\$61,053	\$5,905	-\$11,740	\$54,570	-\$15,570	1.40

Table 3 5
All EROs: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area IN	direct expansion	install TES	RI	76	Elect	Elect	\$39 000	-\$24 127	\$61 053	\$5 905	\$6 159	\$48 990	\$9 990	1.26
AC	Area 5	direct expansion	install TES	RI	77	Elect	Elect	\$208 000	-\$29 007	\$141 801	\$15 747	-\$60 022	\$68 519	-\$139 481	0.33
AC	Area 3A	direct expansion	install TES	RI	78	Elect	Elect	\$52 000	-\$14 503	\$70 900	\$7 874	\$7 923	\$72 194	\$20 194	1.39
AC	Area 2	direct expansion	install TES	RI	79	Elect	Elect	\$65 000	-\$18 129	\$88 625	\$9 842	\$8 823	\$89 161	\$24 161	1.37
AC	Area 4	direct expansion	install TES	RI	80	Elect	Elect	\$65 000	-\$18 129	\$88 625	\$9 842	\$8 823	\$89 161	\$24 161	1.37
AC	Area 1W	direct expansion	install TES	RI	81	Elect	Elect	\$65 000	-\$18 129	\$88 625	\$9 842	\$8 823	\$89 161	\$24 161	1.37
AC	Area 3A	direct expansion	install TES	RI	82	Elect	Elect	\$65 000	-\$18 129	\$88 625	\$9 842	\$8 823	\$89 161	\$24 161	1.37
AC	Area 3	direct expansion	install TES	RI	83	Elect	Elect	\$81 900	-\$22 843	\$111 668	\$12 401	\$7 742	\$108 968	\$27 068	1.33
AC	Area 1W	heat pump	install TES	RI	84	Elect	Elect	\$65 000	-\$44 886	\$114 474	\$9 842	\$39 106	\$118 536	\$53 536	1.82
AC	Area 1	Window AC	install efficient window units	ROF	1	Elect	Elect	\$578	\$658	\$44	\$7	\$1 287	\$709	2.23	
AC	Area 1	Window AC	install efficient window units	ROF	2	Elect	Elect	\$954	\$1 316	\$88	\$14	\$954	\$2 372	\$1 418	2.49
AC	Area 1W	Window AC	install efficient window units	ROF	3	Elect	Elect	\$1 156	\$1 316	\$88	\$14	\$1 156	\$2 573	\$1 418	2.23
AC	Area 1W	Window AC	install efficient window units	ROF	4	Elect	Elect	\$4 771	\$6 579	\$439	\$71	\$4 771	\$11 859	\$7 089	2.49
AC	Area 1W	Window AC	install efficient window units	ROF	5	Elect	Elect	\$1 350	\$1 974	\$132	\$21	\$1 350	\$3 476	\$2 127	2.58
AC	Area 2	Window AC	install efficient window units	ROF	6	Elect	Elect	\$1 156	\$1 316	\$88	\$14	\$1 156	\$2 573	\$1 418	2.23
AC	Area 2	Window AC	install efficient window units	ROF	7	Elect	Elect	\$1 908	\$2 631	\$176	\$28	\$1 908	\$4 744	\$2 835	2.49
AC	Area 2	Window AC	install efficient window units	ROF	8	Elect	Elect	\$2 700	\$3 947	\$263	\$43	\$2 700	\$6 953	\$4 253	2.58
AC	Area 3	Window AC	install efficient window units	ROF	9	Elect	Elect	\$4 623	\$5 263	\$351	\$57	\$4 623	\$10 294	\$5 671	2.23
AC	Area 3	Window AC	install efficient window units	ROF	10	Elect	Elect	\$93 506	\$128 943	\$8 600	\$1 394	\$93 506	\$232 444	\$138 938	2.49
AC	Area 3	Window AC	install efficient window units	ROF	11	Elect	Elect	\$4 050	\$5 821	\$395	\$64	\$4 050	\$10 429	\$6 380	2.58
AC	Area 4	Window AC	install efficient window units	ROF	12	Elect	Elect	\$9 246	\$10 526	\$702	\$114	\$9 246	\$20 587	\$11 342	2.23
AC	Area 4	Window AC	install efficient window units	ROF	13	Elect	Elect	\$15 266	\$21 052	\$1 404	\$228	\$15 266	\$37 950	\$22 684	2.49
AC	Area 5	Window AC	install efficient window units	ROF	14	Elect	Elect	\$2 889	\$3 289	\$219	\$36	\$2 889	\$6 434	\$3 544	2.23
AC	Area 5	Window AC	install efficient window units	ROF	15	Elect	Elect	\$29 578	\$40 788	\$2 720	\$441	\$29 578	\$73 528	\$43 950	2.49
AC	Area 6	Window AC	install efficient window units	ROF	16	Elect	Elect	\$2 889	\$3 289	\$219	\$36	\$2 889	\$6 434	\$3 544	2.23
AC	Area 6	Window AC	install efficient window units	ROF	17	Elect	Elect	\$10 496	\$14 473	\$965	\$157	\$10 496	\$26 091	\$15 595	2.49
AC	Area 7	Window AC	install efficient window units	ROF	18	Elect	Elect	\$10 979	\$12 500	\$834	\$135	\$10 979	\$24 448	\$13 468	2.23
AC	Area 7	Window AC	install efficient window units	ROF	19	Elect	Elect	\$6 679	\$9 210	\$614	\$100	\$6 679	\$16 603	\$9 924	2.49
AC	Area 8	Window AC	install efficient window units	ROF	20	Elect	Elect	\$12 135	\$13 815	\$921	\$149	\$12 135	\$27 021	\$14 886	2.23
AC	Area 8	Window AC	install efficient window units	ROF	21	Elect	Elect	\$28 624	\$39 472	\$2 633	\$427	\$28 624	\$71 156	\$42 532	2.49
AC	Area IN	Window AC	install efficient window units	ROF	22	Elect	Elect	\$1 156	\$1 316	\$88	\$14	\$1 156	\$2 573	\$1 418	2.23
AC	Area IN	Window AC	install efficient window units	ROF	23	Elect	Elect	\$2 862	\$3 947	\$263	\$43	\$2 862	\$7 116	\$4 253	2.49
AC	Other	Window AC	install efficient window units	ROF	24	Elect	Elect	\$954	\$1 316	\$88	\$14	\$954	\$2 372	\$1 418	2.49
Cooling	1641	Envelope	Reflective Film	RI	1	na	na	\$3 528	\$12 973	\$879	\$0	-\$3 267	\$10 585	\$7 057	3.00
Cooling	1645	Envelope	Reflective Film	RI	2	na	na	\$4 629	\$14 501	\$982	\$0	-\$4 287	\$11 197	\$6 567	2.42
Cooling	1704	Envelope	Reflective Film	RI	3	na	na	\$4 448	\$12 136	\$822	\$0	-\$4 119	\$8 838	\$4 390	1.99
Cooling	1722	Envelope	Reflective Film	RI	4	na	na	\$1 644	\$6 044	\$409	\$0	-\$1 522	\$4 931	\$3 288	3.00
Cooling	1724	Envelope	Reflective Film	RI	5	na	na	\$2 082	\$6 523	\$442	\$0	-\$1 929	\$5 037	\$2 954	2.42
Cooling	1748	Envelope	Reflective Film	RI	6	na	na	\$2 431	\$7 616	\$516	\$0	\$2 251	\$5 880	\$3 449	2.42
Cooling	49635	Envelope	Reflective Film	RI	7	na	na	\$2 479	\$6 764	\$458	\$0	-\$2 296	\$4 926	\$2 447	1.99
Cooling	49750	Envelope	Reflective Film	RI	8	na	na	\$1 516	\$5 573	\$378	\$0	-\$1 404	\$4 547	\$3 032	3.00
Cooling	54915	Envelope	Reflective Film	RI	9	na	na	\$3 551	\$11 124	\$754	\$0	\$3 289	\$8 589	\$5 038	2.42
Cooling	55005	Envelope	Reflective Film	RI	10	na	na	\$2 715	\$8 506	\$576	\$0	-\$2 515	\$6 567	\$3 852	2.42
Cooling	60600	Envelope	Reflective Film	RI	11	na	na	\$1 952	\$6 115	\$414	\$0	\$1 808	\$4 721	\$2 769	2.42
Cooling	60740	Envelope	Reflective Film	RI	12	na	na	\$1 235	\$4 541	\$308	\$0	-\$1 144	\$3 705	\$2 470	3.00
Cooling	1641	Envelope	Double Paned Window	RI	13	na	na	\$16 077	\$40 907	\$2 578	\$0	\$0	\$43 485	\$27 468	2.70
Cooling	1645	Envelope	Double Paned Window	RI	14	na	na	\$21 096	\$45 726	\$2 882	\$0	\$0	\$48 608	\$27 512	2.30
Cooling	1704	Envelope	Double Paned Window	RI	15	na	na	\$20 270	\$38 266	\$2 411	\$0	\$0	\$40 678	\$20 408	2.01
Cooling	1722	Envelope	Double Paned Window	RI	16	na	na	\$7 490	\$19 058	\$1 201	\$0	\$0	\$20 259	\$12 769	2.70
Cooling	1724	Envelope	Double Paned Window	RI	17	na	na	\$9 490	\$20 569	\$1 296	\$0	\$0	\$21 866	\$12 376	2.30
Cooling	1748	Envelope	Double Paned Window	RI	18	na	na	\$11 079	\$24 014	\$1 513	\$0	\$0	\$25 527	\$14 448	2.30
Cooling	49635	Envelope	Double Paned Window	RI	19	na	na	\$11 298	\$21 329	\$1 344	\$0	\$0	\$22 673	\$11 375	2.01
Cooling	49750	Envelope	Double Paned Window	RI	20	na	na	\$6 907	\$17 574	\$1 107	\$0	\$0	\$18 681	\$11 775	2.70
Cooling	54915	Envelope	Double Paned Window	RI	21	na	na	\$16 183	\$35 077	\$2 210	\$0	\$0	\$37 287	\$21 104	2.30
Cooling	55005	Envelope	Double Paned Window	RI	22	na	na	\$12 374	\$26 820	\$1 690	\$0	\$0	\$28 510	\$16 137	2.30
Cooling	60600	Envelope	Double Paned Window	RI	23	na	na	\$8 895	\$19 281	\$1 215	\$0	\$0	\$20 496	\$11 601	2.30
Cooling	60740	Envelope	Double Paned Window	RI	24	na	na	\$5 628	\$14 320	\$942	\$0	\$0	\$15 273	\$9 595	2.70
Cooling	1641	Envelope	ceiling insulation	RI	25	na	na	\$6 751	\$574	\$367	\$0	\$0	\$941	-\$5 810	0.14
Cooling	1645	Envelope	ceiling insulation	RI	26	na	na	\$11 626	\$842	\$539	\$0	\$0	\$1 381	\$10 245	0.12
Cooling	1704	Envelope	ceiling insulation	RI	27	na	na	\$10 733	\$677	\$433	\$0	\$0	\$1 110	-\$9 623	0.10
Cooling	1722	Envelope	ceiling insulation	RI	28	na	na	\$1 465	\$125	\$80	\$0	\$0	\$204	\$1 261	0.14

Table 3.5
All EROs: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	Rt or ROF	ID	Existing Fuel	Resulting Fuel	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio
Cooling	1724	Envelope	ceiling insulation	Rt	29	na	na	\$2,352	\$170	\$109	\$0	\$0	\$2,79	-\$2,073	0.12
Cooling	1748	Envelope	ceiling insulation	Rt	30	na	na	\$3,206	\$232	\$149	\$0	\$0	\$3,61	-\$2,826	0.12
Cooling	49635	Envelope	ceiling insulation	Rt	31	na	na	\$3,335	\$210	\$135	\$0	\$0	\$3,45	-\$2,990	0.10
Cooling	49750	Envelope	ceiling insulation	Rt	32	na	na	\$1,246	\$106	\$68	\$0	\$0	\$1,74	-\$1,072	0.14
Cooling	54915	Envelope	ceiling insulation	Rt	33	na	na	\$6,841	\$495	\$317	\$0	\$0	\$8,13	-\$6,028	0.12
Cooling	55905	Envelope	ceiling insulation	Rt	34	na	na	\$3,999	\$290	\$185	\$0	\$0	\$4,75	-\$3,524	0.12
Cooling	60600	Envelope	ceiling insulation	Rt	35	na	na	\$2,067	\$150	\$96	\$0	\$0	\$2,45	-\$1,822	0.12
Cooling	60740	Envelope	ceiling insulation	Rt	36	na	na	\$627	\$70	\$45	\$0	\$0	\$1,15	-\$712	0.14
Cooling	Other	Envelope	Weatherization Package	Rt	37	na	na	\$11,232	\$42,153	\$26,975	\$0	\$0	\$69,128	\$57,896	6.15
Int light	ADMIN	FL 2X4 2 34 STD	FL 2X4 2F40T12ES ELC2	Rt	1	Elect	Elect	\$259,703	\$301,988	\$121,123	\$50,016	na	\$473,126	\$213,423	1.82
Int light	ADMIN	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	2	Elect	Elect	\$351,299	\$1,170,092	\$469,308	\$318,527	na	\$1,320,873	\$969,574	3.76
Int light	BRK/ADM	FL 2X4 2 34 STD	FL 2X4 2F40T12ES ELC2	Rt	3	Elect	Elect	\$1,509	\$750	\$281	\$300	na	\$1,332	-\$177	0.88
Int light	BRK/ADM	INC 60 CEIL	CFL 18 GLOBE UNIT	Rt	4	Elect	Elect	\$679	\$2,592	\$972	\$1,151	na	\$2,413	\$1,734	3.55
Int light	COMCATN	FL 2X4 4 34 STD	FL 2X4 3F40T12 ELC3	Rt	5	Elect	Elect	\$269,437	\$483,541	\$219,653	\$81,831	na	\$785,025	\$515,588	2.91
Int light	COMCATN	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	6	Elect	Elect	\$243,652	\$716,549	\$325,500	\$187,480	na	\$854,569	\$610,917	3.51
Int light	DET-RR	FL 2X4 4 34 STD	FL 2X4 3F40T12 ELC3	Rt	7	Elect	Elect	\$233	\$344	\$190	\$72	na	\$606	\$373	2.60
Int light	DET-RR	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	8	Elect	Elect	\$1,164	\$2,815	\$1,555	\$697	na	\$3,673	\$2,509	3.15
Int light	FUELDSP	FL 2X4 4 40 STD	FL 2X4 3F32T8 ELC3 REF	Rt	9	Elect	Elect	\$1,758	\$6,120	\$1,548	\$2	na	\$7,666	\$5,908	4.36
Int light	FUELDSP	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	10	Elect	Elect	\$1,052	\$5,553	\$1,405	\$1,662	na	\$5,296	\$4,244	5.04
Int light	HANGAR	FL 2X4 4 40 STD	FL 2X4 3F32T8 ELC3 REF	Rt	11	Elect	Elect	\$48,042	\$167,271	\$42,321	\$51	na	\$209,540	\$161,498	4.36
Int light	HANGAR	HPS 150 PEND	LPS 90 PEND	Rt	12	Elect	Elect	\$21,770	\$21,022	\$5,319	\$11,564	na	\$14,977	-\$6,793	0.69
Int light	HANGAR	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	13	Elect	Elect	\$17,803	\$94,005	\$23,784	\$28,138	na	\$89,650	\$71,847	5.04
Int light	LAB MED	FL 2X4 4 40 STD	FL 2X4 3F32T8 ELC3 REF	Rt	14	Elect	Elect	\$29,587	\$79,538	\$26,063	\$1,357	na	\$106,959	\$77,372	3.62
Int light	LAB MED	HPS 150 PEND	LPS 90 PEND	Rt	15	Elect	Elect	\$6,738	\$5,024	\$1,646	\$2,506	na	\$4,164	-\$2,574	0.62
Int light	LAB-MED	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	16	Elect	Elect	\$5,334	\$21,744	\$7,125	\$6,167	na	\$22,702	\$17,369	4.26
Int light	MTRPOOL	FL 2X4 3 60 STD	MH 175 PEND	Rt	17	Elect	Elect	\$38,111	\$24,101	\$6,058	\$60,091	na	\$90,290	\$52,179	2.37
Int light	MTRPOOL	HPS 150 PEND	LPS 90 PEND	Rt	18	Elect	Elect	\$15,809	\$15,286	\$3,862	\$8,253	na	\$10,876	\$4,933	0.66
Int light	MTRPOOL	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	19	Elect	Elect	\$30,311	\$160,046	\$40,493	\$47,907	na	\$152,632	\$122,321	5.04
Int light	MWR	FL 2X4 3 60 STD	MH 175 PEND	Rt	20	Elect	Elect	\$11,006	\$6,960	\$1,761	\$17,354	na	\$26,075	\$15,069	2.37
Int light	MWR	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	21	Elect	Elect	\$6,010	\$31,732	\$8,028	\$9,498	na	\$30,262	\$24,252	5.04
Int light	NASLEAS	FL 2X4 4 34 STD	FL 2X4 3F40T12 ELC3	Rt	22	Elect	Elect	\$359,146	\$729,984	\$282,787	\$167,632	na	\$1,130,403	\$771,257	3.15
Int light	NASLEAS	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	23	Elect	Elect	\$324,781	\$1,081,769	\$433,883	\$294,483	na	\$1,221,168	\$896,387	3.76
Int light	NAS/OWN	FL 2X4 4 34 STD	FL 2X4 3F40T12 ELC3	Rt	24	Elect	Elect	\$365,593	\$743,087	\$298,042	\$169,564	na	\$1,150,694	\$785,101	3.15
Int light	NAS/OWN	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	25	Elect	Elect	\$330,566	\$1,101,035	\$441,610	\$299,728	na	\$1,242,917	\$912,351	3.76
Int light	OTHER	FL 2X4 3 60 STD	MH 175 PEND	Rt	26	Elect	Elect	\$19,877	\$7,001	\$3,180	\$16,408	na	\$26,589	\$6,712	1.34
Int light	OTHER	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	27	Elect	Elect	\$10,930	\$32,144	\$14,602	\$8,410	na	\$38,335	\$27,405	3.51
Int light	PLT-BLD general	FL 2X4 3 60 STD	MH 175 PEND	Rt	28	Elect	Elect	\$118,439	\$35,361	\$13,265	\$79,971	na	\$128,597	\$10,158	1.09
Int light	PLT-BLD control boards	FL 2X4 3 60 STD	MH 175 PEND	Rt	29	Elect	Elect	\$15,606	\$4,659	\$1,748	\$10,537	na	\$16,944	\$1,338	1.09
Int light	PLT-BLD	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	30	Elect	Elect	\$65,091	\$162,260	\$60,870	\$40,468	na	\$183,062	\$117,971	2.81
Int light	PLT-EQU	FL 2X4 3 60 STD	MH 175 PEND	Rt	31	Elect	Elect	\$138,315	\$41,295	\$15,491	\$93,592	na	\$150,178	\$11,863	1.09
Int light	PLT-EQU	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	32	Elect	Elect	\$76,021	\$189,506	\$71,091	\$46,786	na	\$213,801	\$137,780	2.81
Int light	R&D	FL 2X4 4 34 STD	FL 2X4 3F40T12 ELC3	Rt	33	Elect	Elect	\$387,263	\$694,994	\$315,708	\$117,616	na	\$1,128,318	\$741,655	2.91
Int light	R&D	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	34	Elect	Elect	\$262,620	\$772,331	\$350,839	\$262,075	na	\$921,095	\$658,476	3.51
Int light	RESTRNT cashier	FL 2X4 4 34 STD	FL 2X4 3F40T12 ELC3	Rt	35	Elect	Elect	\$777	\$1,892	\$633	\$223	na	\$2,748	\$1,971	3.54
Int light	RESTRNT clearing	FL 2X4 4 34 STD	FL 2X4 3F40T12 ELC3	Rt	36	Elect	Elect	\$777	\$1,892	\$633	\$223	na	\$2,748	\$1,971	3.54
Int light	RESTRNT (dinner)	FL 2X4 4 34 STD	FL 2X4 3F40T12 ELC3	Rt	37	Elect	Elect	\$1,398	\$3,405	\$1,140	\$402	na	\$4,947	\$3,549	3.54
Int light	RESTRNT cashier	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	38	Elect	Elect	\$714	\$2,848	\$953	\$54	na	\$2,997	\$2,283	4.20
Int light	RESTRNT clearing	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	39	Elect	Elect	\$714	\$2,848	\$953	\$54	na	\$2,997	\$2,283	4.20
Int light	RESTRNT (dinner)	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	40	Elect	Elect	\$1,277	\$5,097	\$1,746	\$1,439	na	\$5,363	\$4,086	4.20
Int light	SECURITY clear-ids	FL 2X4 4 34 STD	FL 2X4 3F32T8 ELC3 REF	Rt	41	Elect	Elect	\$86,857	\$196,008	\$49,562	\$2,223	na	\$247,823	\$160,967	2.85
Int light	SECURITY clear-ids	FL 2X4 4 34 STD	FL 2X4 3F32T8 ELC3 REF	Rt	42	Elect	Elect	\$8,642	\$19,502	\$4,934	\$221	na	\$24,657	\$16,015	2.85
Int light	SECURITY rec'd	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	43	Elect	Elect	\$41,616	\$219,741	\$55,596	\$65,175	na	\$269,562	\$167,946	5.04
Int light	SECURITY clear-ids	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	44	Elect	Elect	\$4,169	\$22,014	\$5,570	\$6,169	na	\$20,994	\$16,825	5.04
Int light	SHIP	FL 2X4 3 60 STD	MH 175 PEND	Rt	45	Elect	Elect	\$122,753	\$77,185	\$19,529	\$162,447	na	\$289,161	\$167,108	2.37
Int light	SHIP	HPS 150 PEND	LPS 90 PEND	Rt	46	Elect	Elect	\$50,538	\$48,801	\$12,347	\$34,768	na	\$134,768	\$15,771	0.69
Int light	SHIP	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	47	Elect	Elect	\$97,168	\$513,059	\$129,809	\$11,774	na	\$489,293	\$392,126	5.04
Int light	SHIP-ELEC	FL 2X4 3 60 STD	MH 175 PEND	Rt	48	Elect	Elect	\$214,665	\$135,879	\$34,183	\$16,784	na	\$599,484	\$294,183	2.37
Int light	SHIP-ELEC	HPS 150 PEND	LPS 90 PEND	Rt	49	Elect	Elect	\$89,154	\$86,091	\$21,762	\$46,139	na	\$61,334	\$27,821	0.69
Int light	SHIP-ELEC	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	50	Elect	Elect	\$171,011	\$602,960	\$228,457	\$26,154	na	\$861,133	\$690,123	5.04
Int light	SHIP-WHTR	FL 2X4 3 60 STD	MH 175 PEND	Rt	51	Elect	Elect	\$7,228	\$4,571	\$1,120	\$11,197	na	\$17,124	\$9,896	2.37
Int light	SHIP-WHTR	HPS 150 PEND	LPS 90 PEND	Rt	52	Elect	Elect	\$2,651	\$2,753	\$677	\$1,458	na	\$1,961	\$890	0.69

Table 3.5
All EROs: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio
Int light	SHOP-WPN	INC 60 CEIL	CFL 13 + BLST UNIT	RI	53	Elect	Elect	\$5,709	\$30,145	\$7,627	-\$9,023	na	\$28,749	\$23,039	5.04
Int light	STOR-UH	FL 2X4 3-60 STD	MH 175 PEND	RI	54	Elect	Elect	\$43,367	\$27,425	\$6,939	\$68,380	na	\$102,744	\$59,376	2.37
Int light	STOR-UH	HPS 150 PEND	LPS 90 PEND	RI	55	Elect	Elect	\$17,883	\$17,268	\$4,369	-\$9,335	na	\$12,302	-\$5,580	0.69
Int light	STOR-UH	INC 60 CEIL	CFL 13 + BLST UNIT	RI	56	Elect	Elect	\$34,480	\$182,060	\$46,063	-\$54,496	na	\$173,626	\$139,146	5.04
Int light	TRAINING	FL 2X4 3-60 STD	MH 175 PEND	RI	57	Elect	Elect	\$22,341	\$7,869	\$3,575	\$18,442	na	\$29,885	\$7,544	1.34
Int light	TRAINING	INC 60 CEIL	CFL 13 + BLST UNIT	RI	58	Elect	Elect	\$12,282	\$36,120	\$16,408	-\$9,451	na	\$43,078	\$30,795	3.51
Int light	WHS	FL 2X4 3-60 STD	MH 175 PEND	RI	59	Elect	Elect	\$108,582	\$28,577	\$17,373	\$64,022	na	\$109,973	\$1,390	1.01
Int light	WHS	HPS 150 PEND	LPS 90 PEND	RI	60	Elect	Elect	\$45,096	\$18,122	\$11,017	-\$6,768	na	\$22,372	-\$22,724	0.50
Int light	WHS	INC 60 CEIL	CFL 13 + BLST UNIT	RI	61	Elect	Elect	\$86,426	\$189,914	\$115,458	-\$45,292	na	\$260,080	\$173,654	3.01
Int light	Exit Lights	INC 2-20 W	EXIT - LED	RI	62	Elect	Elect	\$1,317,146	\$1,517,755	\$383,856	\$1,154,456	na	\$3,056,067	\$1,738,921	2.32
Boilers	USAF	Boiler	High Eff Boiler	RI	1	Fuel Oil	Fuel Oil	\$379,225	\$770,033	\$0	\$0	\$165,397	\$935,431	\$556,206	2.47
Boilers	USAF	Boiler	High Eff Boiler	ROF	1	Fuel Oil	Fuel Oil	\$256,191	\$426,883	\$0	\$0	\$165,397	\$592,280	\$336,089	2.31
Boilers	NASA	Boiler	High Eff Boiler	RI	2	Fuel Oil	Fuel Oil	\$150,575	\$333,301	\$0	\$0	\$67,842	\$401,143	\$250,568	2.66
Boilers	NASA	Boiler	High Eff Boiler	ROF	2	Fuel Oil	Fuel Oil	\$101,723	\$184,772	\$0	\$0	\$67,842	\$252,614	\$150,891	2.48
Boilers	Navy	Boiler	High Eff Boiler	RI	3	Fuel Oil	Fuel Oil	\$42,675	\$89,295	\$0	\$0	\$18,235	\$107,529	\$64,854	2.52
Boilers	Navy	Boiler	High Eff Boiler	ROF	3	Fuel Oil	Fuel Oil	\$28,830	\$49,502	\$0	\$0	\$18,235	\$67,737	\$38,907	2.35
Boilers	USAF	Boiler	High Eff Boiler	RI	4	Fuel Oil	Fuel Oil	\$15,600	\$20,907	\$0	\$0	\$5,145	\$26,052	\$10,452	1.67
Boilers	USAF	Boiler	High Eff Boiler	ROF	4	Fuel Oil	Fuel Oil	\$10,539	\$11,590	\$0	\$0	\$5,145	\$16,735	\$6,196	1.59
Boilers	NASA	Boiler	High Eff Boiler	RI	5	Fuel Oil	Fuel Oil	\$7,000	\$9,382	\$0	\$0	\$2,796	\$12,177	\$5,177	1.74
Boilers	NASA	Boiler	High Eff Boiler	ROF	5	Fuel Oil	Fuel Oil	\$4,729	\$5,201	\$0	\$0	\$2,796	\$7,997	\$3,268	1.69
Boilers	USAF	Boiler	Replace electric w/ f.o. boiler	RI	6a	Electric	Fuel Oil	\$150,265	\$38,556	\$836,088	-\$2,066	\$35,207	\$907,785	\$757,520	6.04
Boilers	USAF	Boiler	Replace electric w/ f.o. boiler	ROF	6a	Electric	Fuel Oil	\$101,514	-\$239,971	\$339,627	-\$2,066	\$35,207	\$132,797	\$31,283	1.31
Boilers	USAF	Boiler	Replace electric w/ high eff. f	RI	6b	Electric	Fuel Oil	\$161,975	\$291,625	\$836,088	-\$2,066	\$35,207	\$1,160,855	\$988,880	7.17
Boilers	USAF	Boiler	Replace electric w/ high eff. f	ROF	6b	Electric	Fuel Oil	\$109,425	-\$99,677	\$339,627	-\$2,066	\$35,207	\$273,091	\$163,666	2.50
Boilers	NASA	Boiler	Replace electric w/ f.o. boiler	RI	7a	Electric	Fuel Oil	\$35,950	\$17,289	\$374,438	-\$826	\$9,051	\$399,931	\$363,981	11.12
Boilers	NASA	Boiler	Replace electric w/ f.o. boiler	ROF	7a	Electric	Fuel Oil	\$24,287	-\$107,462	\$152,100	-\$826	\$9,051	\$52,863	\$28,576	2.18
Boilers	NASA	Boiler	Replace electric w/ high eff. f	RI	7b	Electric	Fuel Oil	\$40,100	\$130,612	\$374,438	-\$826	\$8,763	\$512,986	\$472,886	12.79
Boilers	NASA	Boiler	Replace electric w/ high eff. f	ROF	7b	Electric	Fuel Oil	\$27,090	-\$44,628	\$152,100	-\$826	\$8,763	\$115,408	\$88,318	4.26
Boilers	Navy	Boiler	Replace electric w/ f.o. boiler	RI	8a	Electric	Fuel Oil	\$29,000	\$2,254	\$48,983	-\$826	\$5,481	\$55,892	\$26,892	1.93
Boilers	Navy	Boiler	Replace electric w/ f.o. boiler	ROF	8a	Electric	Fuel Oil	\$19,591	-\$14,056	\$19,897	-\$826	\$5,481	\$10,496	-\$9,095	0.54
Boilers	Navy	Boiler	Replace electric w/ high eff. f	RI	8b	Electric	Fuel Oil	\$30,700	\$17,091	\$48,983	-\$826	\$5,481	\$70,728	\$40,028	2.30
Boilers	Navy	Boiler	Replace electric w/ high eff. f	ROF	8b	Electric	Fuel Oil	\$20,740	-\$5,831	\$19,897	-\$826	\$5,481	\$18,721	-\$2,019	0.90
Boilers	USAF	Boiler	Replace electric w/ f.o. boiler	RI	9a	Electric	Fuel Oil	\$78,900	\$35,651	\$772,968	-\$826	\$27,310	\$835,102	\$756,202	10.58
Boilers	USAF	Boiler	Replace electric w/ f.o. boiler	ROF	9a	Electric	Fuel Oil	\$53,302	-\$221,853	\$313,987	-\$826	\$27,310	\$118,617	\$65,315	2.23
Boilers	USAF	Boiler	Replace electric w/ high eff. f	RI	9b	Electric	Fuel Oil	\$97,100	\$269,617	\$772,968	-\$826	\$27,310	\$1,069,069	\$971,969	11.01
Boilers	USAF	Boiler	Replace electric w/ high eff. f	ROF	9b	Electric	Fuel Oil	\$65,597	-\$92,150	\$313,987	-\$826	\$27,310	\$248,321	\$182,724	3.79
Boilers	All	Boiler	High Eff Boiler	RI	10	Fuel Oil	Fuel Oil	\$595,075	\$1,222,939	\$0	\$0	\$259,414	\$1,482,353	\$887,278	2.49
Boilers	All	Boiler	High Eff Boiler	ROF	10	Fuel Oil	Fuel Oil	\$402,011	\$677,960	\$0	\$0	\$259,414	\$937,374	\$535,362	2.33
Boilers	All	Boiler	Replace electric w/ f.o. boiler	RI	11a	Electric	Fuel Oil	\$294,115	\$93,751	\$2,032,377	-\$4,544	\$77,049	\$2,198,633	\$1,904,518	7.48
Boilers	All	Boiler	Replace electric w/ f.o. boiler	ROF	11a	Electric	Fuel Oil	\$198,694	-\$583,331	\$825,571	-\$4,544	\$77,049	\$314,744	\$116,051	1.58
Boilers	All	Boiler	Replace electric w/ high eff. f	RI	11b	Electric	Fuel Oil	\$329,875	\$708,945	\$2,032,377	-\$4,544	\$77,049	\$2,813,827	\$2,483,952	8.53
Boilers	All	Boiler	Replace electric w/ high eff. f	ROF	11b	Electric	Fuel Oil	\$222,852	-\$242,286	\$825,571	-\$4,544	\$77,049	\$655,789	\$432,938	2.94
Motors	ADMIN	Fan Motors	Install Energy Efficient Motor	RI	1	Elec	Elec	\$43,489	\$55,648	\$16,394	\$0	\$11,551	\$83,593	\$40,104	1.92
Motors	BRK/ADM	Fan Motors	Install Energy Efficient Motor	RI	2	Elec	Elec	\$254	\$326	\$72	\$0	\$68	\$465	\$211	1.83
Motors	COMCATN	Fan Motors	Install Energy Efficient Motor	RI	3	Elec	Elec	\$30,163	\$38,596	\$11,371	\$0	\$8,011	\$57,977	\$27,815	1.92
Motors	DET RR	Fan Motors	Install Energy Efficient Motor	RI	4	Elec	Elec	\$218	\$278	\$82	\$0	\$58	\$418	\$201	1.92
Motors	FUELDSP	Fan Motors	Install Energy Efficient Motor	RI	5	Elec	Elec	\$329	\$421	\$124	\$0	\$87	\$633	\$304	1.92
Motors	HANGAR	Fan Motors	Install Energy Efficient Motor	RI	6	Elec	Elec	\$5,561	\$7,115	\$2,096	\$0	\$1,477	\$10,689	\$5,128	1.92
Motors	LAB-MED	Fan Motors	Install Energy Efficient Motor	RI	7	Elec	Elec	\$1,656	\$2,119	\$624	\$0	\$440	\$3,182	\$1,527	1.92
Motors	MTRPGOL	Fan Motors	Install Energy Efficient Motor	RI	8	Elec	Elec	\$9,378	\$12,000	\$3,535	\$0	\$2,491	\$18,027	\$8,648	1.92
Motors	MWR	Fan Motors	Install Energy Efficient Motor	RI	9	Elec	Elec	\$1,864	\$2,386	\$703	\$0	\$495	\$3,584	\$1,719	1.92
Motors	NASLEAS	Fan Motors	Install Energy Efficient Motor	RI	10	Elec	Elec	\$100,516	\$128,618	\$37,892	\$0	\$26,697	\$193,206	\$92,690	1.92
Motors	NASOWN	Fan Motors	Install Energy Efficient Motor	RI	11	Elec	Elec	\$102,307	\$130,910	\$38,567	\$0	\$27,173	\$196,650	\$94,343	1.92
Motors	OTHER	Fan Motors	Install Energy Efficient Motor	RI	12	Elec	Elec	\$1,315	\$1,682	\$496	\$0	\$349	\$2,527	\$1,212	1.92
Motors	PLT BLD	Fan Motors	Install Energy Efficient Motor	RI	13	Elec	Elec	\$4,797	\$6,137	\$1,808	\$0	\$1,274	\$9,220	\$4,423	1.92
Motors	PLT BLD	Fan Motors	Install Energy Efficient Motor	RI	14	Elec	Elec	\$9,411	\$12,042	\$3,548	\$0	\$2,499	\$18,089	\$8,678	1.92
Motors	R&D	Fan Motors	Install Energy Efficient Motor	RI	15	Elec	Elec	\$169,751	\$217,209	\$63,992	\$0	\$45,086	\$326,287	\$156,536	1.92
Motors	RT STRNT	Fan Motors	Install Energy Efficient Motor	RI	16	Elec	Elec	\$2,257	\$2,888	\$811	\$0	\$599	\$4,338	\$2,081	1.92
Motors	SECURITY	Fan Motors	Install Energy Efficient Motor	RI	17	Elec	Elec	\$5,152	\$6,593	\$1,942	\$0	\$1,368	\$9,903	\$4,751	1.92
Motors	SHOP	Fan Motors	Install Energy Efficient Motor	RI	18	Elec	Elec	\$30,069	\$38,475	\$11,315	\$0	\$7,986	\$57,797	\$27,728	1.92
Motors	SHOP-ELEC	Fan Motors	Install Energy Efficient Motor	RI	19	Elec	Elec	\$10,586	\$13,545	\$3,990	\$0	\$2,811	\$20,347	\$9,761	1.92

Table 3.5
All EROs: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	Rt or ROF	ID	Existing Fuel	Resulting Fuel	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio
Motors	SHOP-WPN	Fan Motors	Install Energy Efficient Motor	Rt	20	Elec	Elec	\$707	\$804	\$266	\$0	\$188	\$1 359	\$652	1.92
Motors	STOR-UH	Fan Motors	Install Energy Efficient Motor	Rt	21	Elec	Elec	\$21 348	\$27 316	\$8 048	\$0	\$5 670	\$41 034	\$19 686	1.92
Motors	TRAINING	Fan Motors	Install Energy Efficient Motor	Rt	22	Elec	Elec	\$761	\$974	\$287	\$0	\$202	\$1 464	\$702	1.92
Motors	WHS	Fan Motors	Install Energy Efficient Motor	Rt	23	Elec	Elec	\$53 496	\$68 452	\$20 167	\$0	\$14 208	\$102 827	\$49 331	1.92
Motors	Area 2	Chilled Water Pump Motors	Install Energy Efficient Motor	Rt	1C	Elec	Elec	\$1 350	\$1 631	\$0	\$0	\$359	\$1 990	\$639	1.47
Motors	Area 3	Chilled Water Pump Motors	Install Energy Efficient Motor	Rt	2C	Elec	Elec	\$2 363	\$2 854	\$0	\$0	\$628	\$3 482	\$1 118	1.47
Motors	Area 4	Chilled Water Pump Motors	Install Energy Efficient Motor	Rt	3C	Elec	Elec	\$281	\$340	\$0	\$0	\$75	\$414	\$133	1.47
Motors	Area 5	Chilled Water Pump Motors	Install Energy Efficient Motor	Rt	4C	Elec	Elec	\$9 903	\$11 959	\$0	\$0	\$2 630	\$14 590	\$4 687	1.47
Motors	Area 6	Chilled Water Pump Motors	Install Energy Efficient Motor	Rt	5C	Elec	Elec	\$7 033	\$8 494	\$0	\$0	\$1 868	\$10 362	\$3 329	1.47
Motors	Area 7	Chilled Water Pump Motors	Install Energy Efficient Motor	Rt	6C	Elec	Elec	\$5 514	\$6 659	\$0	\$0	\$1 465	\$8 124	\$2 610	1.47
Motors	Area 8	Chilled Water Pump Motors	Install Energy Efficient Motor	Rt	7C	Elec	Elec	\$15 080	\$18 211	\$0	\$0	\$4 005	\$22 216	\$7 136	1.47
Motors	Area 1W	Chilled Water Pump Motors	Install Energy Efficient Motor	Rt	8C	Elec	Elec	\$15 361	\$18 551	\$0	\$0	\$4 080	\$22 631	\$7 270	1.47
Motors	Area 3A	Chilled Water Pump Motors	Install Energy Efficient Motor	Rt	9C	Elec	Elec	\$45 442	\$54 878	\$0	\$0	\$12 069	\$66 947	\$21 505	1.47
Motors	Area 1N	Chilled Water Pump Motors	Install Energy Efficient Motor	Rt	10C	Elec	Elec	\$10 398	\$12 557	\$0	\$0	\$2 762	\$15 319	\$4 921	1.47
Motors	ADJAIN	Fan Motors	Install Energy Efficient Motor	ROF	1	Elec	Elec	\$33 048	\$34 793	\$10 250	\$0	\$24 587	\$69 630	\$36 581	2.11
Motors	BRK/ADJ	Fan Motors	Install Energy Efficient Motor	ROF	2	Elec	Elec	\$193	\$204	\$45	\$0	\$144	\$392	\$199	2.03
Motors	COMCATN	Fan Motors	Install Energy Efficient Motor	ROF	3	Elec	Elec	\$22 921	\$24 131	\$7 109	\$0	\$17 052	\$48 293	\$25 372	2.11
Motors	DET-RR	Fan Motors	Install Energy Efficient Motor	ROF	4	Elec	Elec	\$165	\$174	\$51	\$0	\$123	\$348	\$183	2.11
Motors	FUELDSP	Fan Motors	Install Energy Efficient Motor	ROF	5	Elec	Elec	\$250	\$263	\$78	\$0	\$186	\$527	\$277	2.11
Motors	HANGAR	Fan Motors	Install Energy Efficient Motor	ROF	6	Elec	Elec	\$4 226	\$4 449	\$1 311	\$0	\$3 144	\$8 903	\$4 677	2.11
Motors	LAB-MED	Fan Motors	Install Energy Efficient Motor	ROF	7	Elec	Elec	\$1 258	\$1 325	\$390	\$0	\$936	\$2 651	\$1 393	2.11
Motors	MTR-POOL	Fan Motors	Install Energy Efficient Motor	ROF	8	Elec	Elec	\$7 127	\$7 503	\$2 210	\$0	\$5 302	\$15 016	\$7 889	2.11
Motors	MWR	Fan Motors	Install Energy Efficient Motor	ROF	9	Elec	Elec	\$1 417	\$1 492	\$439	\$0	\$1 054	\$2 985	\$1 568	2.11
Motors	NASLEAS	Fan Motors	Install Energy Efficient Motor	ROF	10	Elec	Elec	\$76 384	\$80 416	\$23 691	\$0	\$56 826	\$160 934	\$84 550	2.11
Motors	NASOWN	Fan Motors	Install Energy Efficient Motor	ROF	11	Elec	Elec	\$77 745	\$81 849	\$24 114	\$0	\$57 839	\$163 802	\$86 057	2.11
Motors	OTHER	Fan Motors	Install Energy Efficient Motor	ROF	12	Elec	Elec	\$999	\$1 057	\$310	\$0	\$743	\$2 105	\$1 106	2.11
Motors	PLT-BLD	Fan Motors	Install Energy Efficient Motor	ROF	13	Elec	Elec	\$3 645	\$3 837	\$1 131	\$0	\$2 712	\$7 680	\$4 035	2.11
Motors	PLT-EQU	Fan Motors	Install Energy Efficient Motor	ROF	14	Elec	Elec	\$7 151	\$7 529	\$2 218	\$0	\$5 320	\$15 067	\$7 916	2.11
Motors	R&D	Fan Motors	Install Energy Efficient Motor	ROF	15	Elec	Elec	\$128 997	\$135 806	\$40 010	\$0	\$95 968	\$271 784	\$142 787	2.11
Motors	RESTRNT	Fan Motors	Install Energy Efficient Motor	ROF	16	Elec	Elec	\$1 715	\$1 805	\$532	\$0	\$1 276	\$3 613	\$1 898	2.11
Motors	SECURITY	Fan Motors	Install Energy Efficient Motor	ROF	17	Elec	Elec	\$3 915	\$4 122	\$1 214	\$0	\$2 913	\$8 249	\$4 334	2.11
Motors	SHOP	Fan Motors	Install Energy Efficient Motor	ROF	18	Elec	Elec	\$22 850	\$24 056	\$7 087	\$0	\$16 999	\$48 143	\$25 293	2.11
Motors	SHOP-ELEC	Fan Motors	Install Energy Efficient Motor	ROF	19	Elec	Elec	\$8 044	\$8 469	\$2 495	\$0	\$5 984	\$16 948	\$8 904	2.11
Motors	STOR-UH	Fan Motors	Install Energy Efficient Motor	ROF	20	Elec	Elec	\$537	\$565	\$167	\$0	\$400	\$1 132	\$595	2.11
Motors	TRAINING	Fan Motors	Install Energy Efficient Motor	ROF	21	Elec	Elec	\$16 223	\$17 079	\$5 032	\$0	\$12 069	\$34 180	\$17 957	2.11
Motors	WHS	Fan Motors	Install Energy Efficient Motor	ROF	22	Elec	Elec	\$579	\$609	\$179	\$0	\$430	\$1 219	\$640	2.11
Motors	Area 2	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	23	Elec	Elec	\$40 652	\$42 798	\$12 609	\$0	\$30 244	\$85 651	\$44 998	2.11
Motors	Area 3	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	1C	Elec	Elec	\$1 026	\$1 020	\$0	\$0	\$763	\$1 783	\$757	1.74
Motors	Area 4	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	2C	Elec	Elec	\$1 796	\$1 784	\$0	\$0	\$1 336	\$3 120	\$1 325	1.74
Motors	Area 5	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	3C	Elec	Elec	\$214	\$212	\$0	\$0	\$159	\$371	\$158	1.74
Motors	Area 6	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	4C	Elec	Elec	\$7 526	\$7 477	\$0	\$0	\$5 599	\$13 076	\$5 551	1.74
Motors	Area 7	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	5C	Elec	Elec	\$5 345	\$5 311	\$0	\$0	\$3 976	\$9 287	\$3 942	1.74
Motors	Area 8	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	6C	Elec	Elec	\$4 190	\$4 164	\$0	\$0	\$3 117	\$7 281	\$3 091	1.74
Motors	Area 1W	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	7C	Elec	Elec	\$11 459	\$11 386	\$0	\$0	\$8 525	\$19 911	\$8 452	1.74
Motors	Area 3A	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	8C	Elec	Elec	\$11 673	\$11 599	\$0	\$0	\$8 664	\$20 283	\$8 610	1.74
Motors	Area 1N	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	9C	Elec	Elec	\$34 532	\$34 311	\$0	\$0	\$25 694	\$60 002	\$25 470	1.74
Motors	Area 1N	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	10C	Elec	Elec	\$7 902	\$7 851	\$0	\$0	\$5 875	\$13 730	\$5 828	1.74
Heatpipes	OPTICS LAB	AC/Boilers	Install Heatpipes	Rt	1	Fuel Oil	Fuel Oil	\$59 800	\$159 043	na	na	na	\$159 043	\$99 243	2.66
Heatpipes	RCC MECH BLD	AC/Boilers	Install Heatpipes	Rt	2	Fuel Oil	Fuel Oil	\$130 000	\$613 731	na	na	na	\$613 731	\$483 731	4.72
Heatpipes	HANGER R&D	AC/Boilers	Install Heatpipes	Rt	3	Elec	Elec	\$92 100	\$165 086	na	na	na	\$165 086	\$72 986	1.79
Heatpipes	PST	AC/Boilers	Install Heatpipes	Rt	4	Fuel Oil	Fuel Oil	\$69 400	\$184 574	na	na	na	\$184 574	\$115 174	2.66
Heatpipes	HANGER S	AC/Boilers	Install Heatpipes	Rt	5	Fuel Oil	Fuel Oil	\$146 000	\$679 471	na	na	na	\$679 471	\$539 471	4.85
Heatpipes	HANGER N	AC/Boilers	Install Heatpipes	Rt	6	Fuel Oil	Fuel Oil	\$75 000	\$413 184	na	na	na	\$413 184	\$338 184	5.51
Heatpipes	HANGER L	AC/Boilers	Install Heatpipes	Rt	7	Elec	Elec	\$28 000	\$145 651	na	na	na	\$145 651	\$117 651	5.20
Heatpipes	CX 41 AC SHR	AC/Boilers	Install Heatpipes	Rt	8	Elec	Elec	\$452 760	\$1 775 909	na	na	na	\$1 775 909	\$1 323 149	3.92
Heatpipes	CX 41	AC/Boilers	Install Heatpipes	Rt	9	Fuel Oil	Fuel Oil	\$26 500	\$151 596	na	na	na	\$151 596	\$123 096	5.32
Heatpipes	T-SE	AC/Boilers	Install Heatpipes	Rt	10	Fuel Oil	Fuel Oil	\$60 520	\$300 636	na	na	na	\$300 636	\$244 118	5.32
Heatpipes	CTL COMP C-1	AC/Boilers	Install Heatpipes	Rt	11	Fuel Oil	Fuel Oil	\$75 200	\$389 614	na	na	na	\$389 614	\$314 414	5.18
Heatpipes	RCT STOR BLD	AC/Boilers	Install Heatpipes	Rt	12	Fuel Oil	Fuel Oil	\$12 900	\$71 301	na	na	na	\$71 301	\$58 401	5.53
Heatpipes	SSA LAB	AC/Boilers	Install Heatpipes	Rt	13	Elec	Elec	\$66 000	\$527 078	na	na	na	\$527 078	\$461 078	7.99
Heatpipes	MAIN PLX	AC/Boilers	Install Heatpipes	Rt	14	Fuel Oil	Fuel Oil	\$48 000	\$255 319	na	na	na	\$255 319	\$207 319	5.32

Table 3.5
All EROs: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio
Heatpipes	M/ASMB BD AC	AC/Boilers	Install Heatpipes	RI	15	Fuel Oil	Fuel Oil	\$180,000	\$929,662	na	na	na	\$929,662	\$749,662	5.16
Heatpipes	GPS PROP FAC	AC/Boilers	Install Heatpipes	RI	16	Fuel Oil	Fuel Oil	\$42,300	\$112,500	na	na	na	\$112,500	\$70,200	2.66
Heatpipes	CX 30 BI KHSE	AC/Boilers	Install Heatpipes	RI	17	Fuel Oil	Fuel Oil	\$40,000	\$206,592	na	na	na	\$206,592	\$166,592	5.16
Heatpipes	HANGER AO-AM	AC/Boilers	Install Heatpipes	RI	18	Fuel Oil	Fuel Oil	\$130,100	\$619,981	na	na	na	\$619,981	\$489,881	4.77
Heatpipes	HANGER AE	AC/Boilers	Install Heatpipes	RI	19	Fuel Oil	Fuel Oil	\$161,300	\$833,080	na	na	na	\$833,080	\$671,780	5.16
Heatpipes	MIS CK BD-AK	AC/Boilers	Install Heatpipes	RI	20	Fuel Oil	Fuel Oil	\$107,400	\$277,349	na	na	na	\$277,349	\$169,949	2.58
Heatpipes	HANGER AF	AC/Boilers	Install Heatpipes	RI	21	Fuel Oil	Fuel Oil	\$167,300	\$432,035	na	na	na	\$432,035	\$264,735	2.58
Heatpipes	MK VICK BLD	AC/Boilers	Install Heatpipes	RI	22	Fuel Oil	Fuel Oil	\$12,500	\$66,489	na	na	na	\$66,489	\$53,989	5.32
Heatpipes	DEL TA SPN BD	AC/Boilers	Install Heatpipes	RI	23	Fuel Oil	Fuel Oil	\$42,000	\$111,702	na	na	na	\$111,702	\$69,702	2.66
Heatpipes	CTL BD SP IS	AC/Boilers	Install Heatpipes	RI	24	Fuel Oil	Fuel Oil	\$20,300	\$53,989	na	na	na	\$53,989	\$33,689	2.66
Heatpipes	SMAB WEST	AC/Boilers	Install Heatpipes	RI	25	Fuel Oil	Fuel Oil	\$178,800	\$923,464	na	na	na	\$923,464	\$744,664	5.16
Heatpipes	VIB	AC/Boilers	Install Heatpipes	RI	26	Fuel Oil	Fuel Oil	\$184,200	\$874,379	na	na	na	\$874,379	\$690,179	4.75
Heatpipes	COMM CTL FAC	AC/Boilers	Install Heatpipes	RI	27	HW	Fuel Oil	\$31,200	\$165,957	na	na	na	\$165,957	\$134,757	5.32
Generator	N Substation	Generator	1-200 kW unit	RI	1	na	NG	\$460,000	-\$13,510	\$238,950	-\$7,837	\$0	\$217,604	-\$242,396	0.47
Generator	N Substation	Generator	2-200 kW units	RI	2	na	NG	\$860,000	-\$53,635	\$477,900	-\$31,113	\$0	\$393,152	-\$466,848	0.46
Generator	N Substation	Generator	3-200 kW units	RI	3	na	NG	\$1,260,000	-\$108,071	\$716,850	-\$62,690	\$0	\$546,089	-\$713,911	0.43
Generator	N Substation	Generator	4-200 kW units	RI	4	na	NG	\$1,660,000	-\$167,100	\$955,800	-\$96,932	\$0	\$691,769	-\$968,231	0.42
Generator	N Substation	Generator	5-200 kW units	RI	5	na	NG	\$2,060,000	-\$227,310	\$1,194,750	-\$131,659	\$0	\$835,581	-\$1,224,419	0.41
Generator	N Substation	Generator	5-200 1-500 kW	RI	6	na	NG	\$3,910,000	-\$395,402	\$1,792,125	-\$226,898	\$0	\$1,169,825	-\$1,740,175	0.40
Generator	N Substation	Generator	5-200 2-500	RI	7	na	NG	\$3,760,000	-\$583,594	\$2,389,500	-\$332,337	\$0	\$1,473,569	-\$2,286,431	0.39
Generator	N Substation	Generator	5-200 3-500	RI	8	na	NG	\$4,610,000	-\$795,862	\$2,986,875	-\$450,639	\$0	\$1,740,374	-\$2,869,626	0.38
Generator	N Substation	Generator	5-200 4-500	RI	9	na	NG	\$5,460,000	-\$1,058,170	\$3,584,250	-\$596,526	\$0	\$1,929,554	-\$3,530,446	0.35
Generator	N Substation	Generator	5-200 5-500	RI	10	na	NG	\$6,310,000	-\$1,449,873	\$4,181,625	-\$814,472	\$0	\$1,917,280	-\$4,392,720	0.30
Generator	N Substation	Generator	5-200 6-500	RI	11	na	NG	\$7,160,000	-\$1,890,306	\$4,779,000	-\$1,058,845	\$0	\$1,829,849	-\$5,330,151	0.26
Generator	N Substation	Generator	5-200 6-500, 1-1000	RI	12	na	NG	\$8,860,000	-\$2,772,769	\$5,973,750	-\$1,565,860	\$0	\$1,635,121	-\$7,224,879	0.18
Generator	N Substation	Generator	5-200 6-500, 2-1000	RI	13	na	NG	\$10,560,000	-\$3,645,296	\$7,168,500	-\$2,072,953	\$0	\$1,450,251	-\$9,109,749	0.14
Generator	N Substation	Generator	5-200 6-500, 2-1000, 1-3000	RI	14	na	NG	\$15,060,000	-\$6,226,858	\$10,752,750	-\$3,594,231	\$0	\$931,661	-\$14,128,339	0.06
Generator	N Substation	Generator	5-200 6-500, 2-1000, 2-3000	RI	15	na	NG	\$19,560,000	-\$8,746,943	\$14,337,000	-\$5,115,509	\$0	\$474,548	-\$19,085,452	0.02
Generator	N Substation	Generator	2-400 kW units	RI	4a	na	NG	\$1,420,000	-\$125,660	\$955,800	-\$96,932	\$0	\$733,208	-\$686,792	0.52
Generator	N Substation	Generator	2-500 kW units	RI	5a	na	NG	\$1,700,000	-\$242,144	\$1,194,750	-\$131,859	\$0	\$820,747	-\$879,253	0.48
Generator	N Substation	Generator	3-500 kW units	RI	6a	na	NG	\$2,550,000	-\$416,674	\$1,792,125	-\$226,898	\$0	\$1,148,553	-\$1,401,447	0.45
Generator	N Substation	Generator	2-1000 kW units	RI	7a	na	NG	\$3,400,000	-\$535,522	\$2,389,500	-\$332,337	\$0	\$1,521,641	-\$1,878,359	0.45
Generator	N Substation	Generator	2-1000 1-500 kW	RI	8a	na	NG	\$4,250,000	-\$759,951	\$2,986,875	-\$450,639	\$0	\$1,776,285	-\$2,473,715	0.42
Generator	N Substation	Generator	3-1000 kW units	RI	9a	na	NG	\$5,100,000	-\$961,232	\$3,584,250	-\$596,526	\$0	\$2,026,493	-\$3,073,507	0.40
Generator	N Substation	Generator	3-1000 1-500 kW	RI	10a	na	NG	\$5,950,000	-\$1,358,243	\$4,181,625	-\$814,472	\$0	\$2,008,910	-\$3,941,090	0.34
Generator	N Substation	Generator	4-1000 kW units	RI	11a	na	NG	\$6,800,000	-\$1,706,206	\$4,779,000	-\$1,058,845	\$0	\$2,013,949	-\$4,786,051	0.30
Generator	N Substation	Generator	5-1000 kW units	RI	12a	na	NG	\$8,500,000	-\$2,523,203	\$5,973,750	-\$1,565,860	\$0	\$1,884,687	-\$6,615,313	0.22
Generator	N Substation	Generator	2-3000 kW units	RI	13a	na	NG	\$9,000,000	-\$2,889,444	\$7,168,500	-\$2,072,953	\$0	\$2,206,103	-\$6,793,897	0.25
Generator	N Substation	Generator	3-3000 kW units	RI	14a	na	NG	\$13,500,000	-\$5,009,920	\$10,752,750	-\$3,594,231	\$0	\$2,148,599	-\$11,351,401	0.16
Generator	N Substation	Generator	4-3000 kW units	RI	15a	na	NG	\$18,000,000	-\$7,130,396	\$14,337,000	-\$5,115,509	\$0	\$2,091,094	-\$15,908,906	0.12
Generator	S Substation	Generator	1-200 kW unit	RI	1	na	NG	\$460,000	-\$29,173	\$238,950	-\$16,523	\$0	\$192,854	-\$267,146	0.42
Generator	S Substation	Generator	2-200 kW units	RI	2	na	NG	\$860,000	-\$85,910	\$477,900	-\$49,835	\$0	\$342,154	-\$517,846	0.40
Generator	S Substation	Generator	3-200 kW units	RI	3	na	NG	\$1,260,000	-\$154,324	\$716,850	-\$89,521	\$0	\$473,005	-\$786,995	0.38
Generator	S Substation	Generator	4-200 kW units	RI	4	na	NG	\$1,660,000	-\$235,826	\$955,800	-\$136,799	\$0	\$583,175	-\$1,076,825	0.35
Generator	S Substation	Generator	5-200 kW units	RI	5	na	NG	\$2,060,000	-\$335,449	\$1,194,750	-\$194,589	\$0	\$664,717	-\$1,395,288	0.32
Generator	S Substation	Generator	5-200 1-500 kW	RI	6	na	NG	\$2,910,000	-\$753,460	\$1,792,125	-\$412,368	\$0	\$606,292	-\$2,303,703	0.21
Generator	S Substation	Generator	5-200 2-500	RI	7	na	NG	\$3,760,000	-\$1,204,487	\$2,389,500	-\$665,914	\$0	\$499,099	-\$3,260,901	0.13
Generator	S Substation	Generator	5-200 3-500	RI	8	na	NG	\$4,610,000	-\$1,659,159	\$2,986,875	-\$939,460	\$0	\$388,256	-\$4,221,744	0.08
Generator	S Substation	Generator	5-200 4-500	RI	9	na	NG	\$5,460,000	-\$2,116,262	\$3,584,250	-\$1,193,007	\$0	\$274,982	-\$5,185,018	0.05
Generator	S Substation	Generator	5-200 5-500	RI	10	na	NG	\$6,310,000	-\$2,575,066	\$4,181,625	-\$1,446,553	\$0	\$160,006	-\$6,149,994	0.03
Generator	S Substation	Generator	5-200 6-500	RI	11	na	NG	\$7,160,000	-\$3,035,107	\$4,779,000	-\$1,700,100	\$0	\$43,793	-\$7,116,207	0.01
Generator	S Substation	Generator	5-200 6-500, 1-1000	RI	12	na	NG	\$8,860,000	-\$3,908,416	\$5,973,750	-\$2,207,192	\$0	\$141,858	-\$9,001,858	-0.02
Generator	S Substation	Generator	5-200 6-500, 2-1000	RI	13	na	NG	\$10,560,000	-\$4,773,080	\$7,168,500	-\$2,714,285	\$0	\$318,865	-\$10,878,865	-0.03
Generator	S Substation	Generator	2-400 kW units	RI	4a	na	NG	\$1,420,000	-\$177,343	\$955,800	-\$136,799	\$0	\$641,658	-\$778,342	0.45
Generator	S Substation	Generator	2-500 kW units	RI	5a	na	NG	\$1,700,000	-\$357,341	\$1,194,750	-\$194,589	\$0	\$642,820	-\$1,057,180	0.38
Generator	S Substation	Generator	3-500 kW units	RI	6a	na	NG	\$2,550,000	-\$793,996	\$1,792,125	-\$432,368	\$0	\$565,761	-\$1,984,239	0.22
Generator	S Substation	Generator	2-1000 kW units	RI	7a	na	NG	\$3,400,000	-\$1,105,271	\$2,389,500	-\$665,914	\$0	\$598,315	-\$2,801,685	0.18
Generator	S Substation	Generator	2-1000 1-500 kW	RI	8a	na	NG	\$4,250,000	-\$1,584,293	\$2,986,875	-\$939,460	\$0	\$463,121	-\$3,786,879	0.11
Generator	S Substation	Generator	3-1000 kW units	RI	9a	na	NG	\$5,100,000	-\$1,922,392	\$3,584,250	-\$1,193,007	\$0	\$468,851	-\$4,631,149	0.09
Generator	S Substation	Generator	3-1000 1-500 kW	RI	10a	na	NG	\$5,950,000	-\$2,412,324	\$4,181,625	-\$1,446,553	\$0	\$322,748	-\$5,627,252	0.05
Generator	S Substation	Generator	4-1000 kW units	RI	11a	na	NG	\$6,800,000	-\$2,739,514	\$4,779,000	-\$1,700,100	\$0	\$339,387	-\$6,460,613	0.05

Table 3.5
All EROs: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio
Generator	S Substation	Generator	5-1000 kW units	RI	12a	na	NG	\$8,500,000	-\$3,556,635	\$5,973,750	-\$2,207,192	\$0	\$209,923	-\$8,290,077	0.02
Generator	S Substation	Generator	2-3000 kW units	RI	13a	na	NG	\$9,000,000	-\$3,783,382	\$7,168,500	-\$2,714,285	\$0	\$670,833	-\$8,329,167	0.07
Generator	Titan Substation	Generator	1-200 kW unit	RI	1	na	NG	\$460,000	-\$37,205	\$238,950	-\$21,582	\$0	\$180,163	-\$279,837	0.39
Generator	Titan Substation	Generator	2-200 kW units	RI	2	na	NG	\$860,000	-\$119,125	\$477,900	-\$69,103	\$0	\$289,672	-\$570,328	0.34
Generator	Titan Substation	Generator	3-200 kW units	RI	3	na	NG	\$1,260,000	-\$219,438	\$716,850	-\$127,293	\$0	\$370,119	-\$889,881	0.29
Generator	Titan Substation	Generator	4-200 kW units	RI	4	na	NG	\$1,660,000	-\$338,285	\$955,800	-\$196,234	\$0	\$421,280	-\$1,238,720	0.25
Generator	Titan Substation	Generator	5-200 kW units	RI	5	na	NG	\$2,060,000	-\$490,521	\$1,194,750	-\$284,544	\$0	\$419,685	-\$1,640,315	0.20
Generator	Titan Substation	Generator	5-200 1-500 kW	RI	6	na	NG	\$2,910,000	-\$929,053	\$1,792,125	-\$533,130	\$0	\$329,941	-\$2,580,059	0.11
Generator	Titan Substation	Generator	5-200 2-500	RI	7	na	NG	\$3,760,000	-\$1,381,429	\$2,389,500	-\$786,677	\$0	\$221,394	-\$3,538,606	0.06
Generator	Titan Substation	Generator	5-200 3-500	RI	8	na	NG	\$4,610,000	-\$1,837,113	\$2,986,875	-\$1,040,223	\$0	\$109,538	-\$4,500,462	0.02
Generator	Titan Substation	Generator	5-200 4-500	RI	9	na	NG	\$5,460,000	-\$2,295,003	\$3,584,250	-\$1,293,710	\$0	-\$4,523	-\$5,464,523	-0.00
Generator	Titan Substation	Generator	5-200 5-500	RI	10	na	NG	\$6,310,000	-\$2,754,437	\$4,181,625	-\$1,547,316	\$0	-\$120,128	-\$6,430,128	-0.02
Generator	Titan Substation	Generator	5-200 6-500	RI	11	na	NG	\$7,160,000	-\$3,214,994	\$4,779,000	-\$1,800,862	\$0	-\$236,857	-\$7,396,857	-0.03
Generator	Titan Substation	Generator	5-200 6-500, 1-1000	RI	12	na	NG	\$8,060,000	-\$4,086,843	\$5,973,750	-\$2,307,955	\$0	-\$421,048	-\$9,281,048	-0.05
Generator	Titan Substation	Generator	2-400 kW units	RI	4a	na	NG	\$1,420,000	-\$254,393	\$955,800	-\$196,234	\$0	\$505,173	-\$914,827	0.36
Generator	Titan Substation	Generator	2-500 kW units	RI	5a	na	NG	\$1,700,000	-\$322,533	\$1,194,750	-\$284,544	\$0	\$387,673	-\$1,312,327	0.23
Generator	Titan Substation	Generator	3-500 kW units	RI	6a	na	NG	\$2,550,000	-\$579,036	\$1,792,125	-\$533,130	\$0	\$279,959	-\$2,270,041	0.11
Generator	Titan Substation	Generator	2-1000 kW units	RI	7a	na	NG	\$3,400,000	-\$1,267,639	\$2,389,500	-\$786,677	\$0	\$335,184	-\$3,064,816	0.10
Generator	Titan Substation	Generator	2-1000 1-500 kW	RI	8a	na	NG	\$4,250,000	-\$1,754,218	\$2,986,875	-\$1,040,223	\$0	\$192,434	-\$4,057,566	0.05
Generator	Titan Substation	Generator	3-1000 kW units	RI	9a	na	NG	\$5,100,000	-\$2,084,760	\$3,584,250	-\$1,293,710	\$0	\$205,721	-\$4,894,279	0.04
Generator	Titan Substation	Generator	3-1000 1-500 kW	RI	10a	na	NG	\$5,950,000	-\$2,580,359	\$4,181,625	-\$1,547,316	\$0	\$53,950	-\$5,896,050	0.01
Generator	Titan Substation	Generator	4-1000 kW units	RI	11a	na	NG	\$6,800,000	-\$2,901,881	\$4,779,000	-\$1,800,862	\$0	\$76,257	-\$6,723,743	0.01
Generator	Titan Substation	Generator	5-1000 kW units	RI	12a	na	NG	\$8,500,000	-\$3,719,002	\$5,973,750	-\$2,307,955	\$0	-\$53,207	-\$8,553,207	-0.01
Generator	N Substation	Generator	DGEN-1	RI	1	na	Diesel	\$25,900	-\$20,001	\$238,950	-\$5,198	\$0	\$213,751	\$187,551	8.25
Generator	N Substation	Generator	DGEN-2	RI	2	na	Diesel	\$44,488	-\$79,407	\$477,900	-\$27,898	\$0	\$370,595	\$326,108	8.33
Generator	N Substation	Generator	DGEN-3	RI	3	na	Diesel	\$68,508	-\$159,999	\$716,850	-\$70,840	\$0	\$486,011	\$417,503	7.09
Generator	N Substation	Generator	DGEN-4	RI	4	na	Diesel	\$96,230	-\$247,390	\$955,800	-\$132,150	\$0	\$576,259	\$480,029	5.99
Generator	N Substation	Generator	DGEN-5	RI	5	na	Diesel	\$127,616	-\$336,531	\$1,194,750	-\$210,535	\$0	\$647,684	\$520,067	5.08
Generator	N Substation	Generator	DGEN-6	RI	6	na	Diesel	\$171,075	-\$579,092	\$1,792,125	-\$353,356	\$0	\$859,677	\$688,602	5.03
Generator	N Substation	Generator	DGEN-7	RI	7	na	Diesel	\$225,025	-\$848,193	\$2,389,500	-\$549,796	\$0	\$991,511	\$766,485	4.41
Generator	N Substation	Generator	DGEN-8	RI	8	na	Diesel	\$290,394	-\$1,150,124	\$2,986,875	-\$813,793	\$0	\$1,022,957	\$732,564	3.52
Generator	N Substation	Generator	DGEN-9	RI	9	na	Diesel	\$369,555	-\$1,522,458	\$3,584,250	-\$1,183,904	\$0	\$877,888	\$508,333	2.38
Generator	N Substation	Generator	DGEN-10	RI	10	na	Diesel	\$485,934	-\$2,078,703	\$4,181,625	-\$1,774,713	\$0	\$328,149	-\$157,785	0.68
Generator	N Substation	Generator	DGEN-11	RI	11	na	Diesel	\$623,477	-\$2,702,394	\$4,779,000	-\$2,523,404	\$0	-\$446,798	-\$1,070,275	-0.72
Generator	N Substation	Generator	DGEN-12	RI	12	na	Diesel	\$832,956	-\$3,996,403	\$5,973,750	-\$3,728,418	\$0	-\$1,751,070	-\$2,584,026	-2.10
Generator	N Substation	Generator	DGEN-13	RI	13	na	Diesel	\$1,081,695	-\$5,290,609	\$7,168,500	-\$5,094,167	\$0	-\$3,216,276	-\$4,297,971	-2.97
Generator	N Substation	Generator	DGEN-14	RI	14	na	Diesel	\$1,574,323	-\$9,173,229	\$10,752,750	-\$7,581,431	\$0	\$6,001,911	\$7,576,234	-3.81
Generator	N Substation	Generator	DGEN-15	RI	15	na	Diesel	\$2,184,169	-\$13,055,849	\$14,337,000	-\$10,496,741	\$0	\$9,215,590	-\$11,399,759	-4.22
Generator	S Substation	Generator	DGEN-1	RI	1	na	Diesel	\$25,900	-\$43,190	\$238,950	-\$11,225	\$0	\$184,534	\$158,634	7.12
Generator	S Substation	Generator	DGEN-2	RI	2	na	Diesel	\$45,263	-\$127,190	\$477,900	-\$44,686	\$0	\$306,024	\$260,761	6.76
Generator	S Substation	Generator	DGEN-3	RI	3	na	Diesel	\$71,336	-\$228,476	\$716,850	-\$101,159	\$0	\$387,215	\$315,879	5.43
Generator	S Substation	Generator	DGEN-4	RI	4	na	Diesel	\$102,150	-\$349,140	\$955,800	-\$186,503	\$0	\$420,158	\$318,008	4.11
Generator	S Substation	Generator	DGEN-5	RI	5	na	Diesel	\$138,498	-\$496,632	\$1,194,750	-\$310,694	\$0	\$387,425	\$248,927	2.80
Generator	S Substation	Generator	DGEN-6	RI	6	na	Diesel	\$201,018	-\$1,103,493	\$1,792,125	-\$673,341	\$0	\$15,291	-\$185,726	0.08
Generator	S Substation	Generator	DGEN-7	RI	7	na	Diesel	\$283,732	-\$1,750,596	\$2,389,500	-\$1,134,731	\$0	-\$495,827	-\$779,559	-1.75
Generator	S Substation	Generator	DGEN-8	RI	8	na	Diesel	\$385,989	-\$2,397,700	\$2,986,875	-\$1,696,540	\$0	\$1,107,365	-\$1,493,354	-2.87
Generator	S Substation	Generator	DGEN-9	RI	9	na	Diesel	\$507,789	-\$3,044,803	\$3,584,250	-\$2,367,721	\$0	\$1,828,274	-\$2,336,063	-3.60
Generator	S Substation	Generator	DGEN-10	RI	10	na	Diesel	\$669,049	-\$3,691,906	\$4,181,625	-\$3,152,108	\$0	\$2,662,390	-\$3,331,439	-3.98
Generator	S Substation	Generator	DGEN-11	RI	11	na	Diesel	\$848,780	-\$4,339,010	\$4,779,000	-\$4,051,621	\$0	-\$3,611,630	-\$4,460,410	-4.26
Generator	S Substation	Generator	DGEN-12	RI	12	na	Diesel	\$1,099,321	-\$5,633,216	\$5,973,750	-\$5,255,472	\$0	-\$5,914,938	-\$6,014,260	-4.47
Generator	S Substation	Generator	DGEN-13	RI	13	na	Diesel	\$1,389,113	-\$6,927,423	\$7,168,500	-\$6,670,205	\$0	-\$6,429,127	-\$7,818,240	-4.63
Generator	Titan Substation	Generator	DGEN-1	RI	1	na	Diesel	\$25,900	-\$55,082	\$238,950	-\$14,316	\$0	\$169,552	\$143,652	6.55
Generator	Titan Substation	Generator	DGEN-2	RI	2	na	Diesel	\$46,060	-\$176,365	\$477,900	-\$61,562	\$0	\$239,573	\$193,513	5.20
Generator	Titan Substation	Generator	DGEN-3	RI	3	na	Diesel	\$75,317	-\$324,877	\$716,850	-\$114,811	\$0	\$248,132	\$172,814	3.29
Generator	Titan Substation	Generator	DGEN-4	RI	4	na	Diesel	\$110,833	-\$500,830	\$955,800	-\$267,532	\$0	\$187,437	\$76,604	1.69
Generator	Titan Substation	Generator	DGEN-5	RI	5	na	Diesel	\$154,202	-\$726,215	\$1,194,750	-\$451,322	\$0	\$14,213	\$139,989	0.09
Generator	Titan Substation	Generator	DGEN-6	RI	6	na	Diesel	\$223,619	-\$1,360,660	\$1,792,125	-\$430,262	\$0	\$398,797	\$622,416	-1.78
Generator	Titan Substation	Generator	DGEN-7	RI	7	na	Diesel	\$312,764	-\$2,007,764	\$2,389,500	-\$1,801,426	\$0	\$919,690	\$1,232,473	-2.94
Generator	Titan Substation	Generator	DGEN-8	RI	8	na	Diesel	\$421,404	-\$2,654,867	\$2,986,875	-\$1,878,904	\$0	\$1,546,497	\$1,967,987	-3.67
Generator	Titan Substation	Generator	DGEN-9	RI	9	na	Diesel	\$549,741	-\$3,301,970	\$3,584,250	-\$2,567,701	\$0	\$2,285,422	\$2,835,162	-4.16
Generator	Titan Substation	Generator	DGEN-10	RI	10	na	Diesel	\$717,451	-\$3,949,074	\$4,181,625	-\$3,371,675	\$0	\$3,139,124	\$3,856,575	-4.38

Table 3.5
All EROs: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio
Generator	Titan Substation	Generator	DGEN-11	RI	11	na	Diesel	\$903,631	\$4,596,177	\$4,779,000	\$4,291,755	\$0	\$4,108,932	-\$5,012,563	-4.55
Generator	Titan Substation	Generator	DGEN-12	RI	12	na	Diesel	\$1,160,623	\$5,890,384	\$5,973,750	\$5,495,395	\$0	\$5,412,028	-\$6,572,651	-4.66

Table 3.6
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MMBtu)	First-Year Demand Savings (kW mo)	Full Implement Energy Savings (MMBtu)	Full Implement Demand Savings (kW mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
Boilers	NASA	Boiler	Replace electric w/ high eff 10 boiler	RI	7b	Electric	Fuel Oil	-1,710	3 761	-1,710	3 761	\$472 886	12.79
Boilers	USAF	Boiler	Replace electric w/ high eff 10 boiler	RI	9b	Electric	Fuel Oil	-3,531	7 764	-3,531	7 764	\$971 969	11.01
Heatpipes	S&A LAB	AC/Boilers	Install Heatpipes	RI	13	Elec	Elec	2,624	na	2,624	na	\$461 078	7.99
Boilers	USAF	Boiler	Replace electric w/ high eff 10 boiler	RI	6b	Electric	Fuel Oil	-3,820	8 398	-3,820	8 398	\$998 880	7.17
Envelope	Other	Envelope	Weatherization Package	RI	37	na	na	263	270.9	263	270.9	\$57 896	6.15
Heatpipes	RCT STOR BLD	AC/Boilers	Install Heatpipes	RI	12	Fuel Oil	Fuel Oil	451	na	451	na	\$58 401	5.53
Heatpipes	HANGER N	AC/Boilers	Install Heatpipes	RI	6	Fuel Oil	Fuel Oil	2,612	na	2,612	na	\$338 184	5.51
Heatpipes	CX 41	AC/Boilers	Install Heatpipes	RI	9	Fuel Oil	Fuel Oil	959	na	959	na	\$123 096	5.32
Heatpipes	COMM CTL FAC	AC/Boilers	Install Heatpipes	RI	27	Fuel Oil	Fuel Oil	1,050	na	1,050	na	\$134 757	5.32
Heatpipes	TGSF	AC/Boilers	Install Heatpipes	RI	10	Fuel Oil	Fuel Oil	1,901	na	1,901	na	\$244 118	5.32
Heatpipes	M ANNEX	AC/Boilers	Install Heatpipes	RI	14	Fuel Oil	Fuel Oil	1,615	na	1,615	na	\$207 319	5.32
Heatpipes	MK VI CK BLD	AC/Boilers	Install Heatpipes	RI	22	Fuel Oil	Fuel Oil	421	na	421	na	\$53 989	5.32
Heatpipes	HANGER L	AC/Boilers	Install Heatpipes	RI	7	Elec	Elec	921	na	921	na	\$117 651	5.20
Generator	Titan Substation	Generator	DGEN-2	RI	2	na	Diesel	-2 189	4 800	2 189	4 800	\$193 513	5.20
Heatpipes	CTL COMP COM	AC/Boilers	Install Heatpipes	RI	11	Fuel Oil	Fuel Oil	2,465	na	2,465	na	\$314 414	5.18
Heatpipes	CX 30 BLKHSE	AC/Boilers	Install Heatpipes	RI	17	Fuel Oil	Fuel Oil	1,307	na	1,307	na	\$166 592	5.16
Heatpipes	M/ASMB BLD AC	AC/Boilers	Install Heatpipes	RI	15	Fuel Oil	Fuel Oil	5,882	na	5,882	na	\$749 662	5.16
Heatpipes	SMAB WEST	AC/Boilers	Install Heatpipes	RI	25	Fuel Oil	Fuel Oil	5,843	na	5,843	na	\$744 664	5.16
Heatpipes	HANGER AL	AC/Boilers	Install Heatpipes	RI	19	Fuel Oil	Fuel Oil	5,271	na	5,271	na	\$671 780	5.16
Int light	FUELDSP	INC 60 CEIL	CFL 13 + BLST UNIT	RI	10	Elect	Elect	35	14	35	14	\$4 244	5.04
Int light	SECURITY other	INC 60 CEIL	CFL 13 + BLST UNIT	RI	44	Elect	Elect	139	56	139	56	\$16 825	5.04
Int light	SHOP-WPN	INC 60 CEIL	CFL 13 + BLST UNIT	RI	53	Elect	Elect	191	77	191	77	\$23 039	5.04
Int light	HANGAR	INC 60 CEIL	CFL 13 + BLST UNIT	RI	13	Elect	Elect	595	239	595	239	\$71 847	5.04
Int light	MTRPOOL	INC 60 CEIL	CFL 13 + BLST UNIT	RI	19	Elect	Elect	1,013	407	1,013	407	\$122 321	5.04
Int light	STOR-UH	INC 60 CEIL	CFL 13 + BLST UNIT	RI	56	Elect	Elect	1,152	463	1,152	463	\$139 146	5.04
Int light	SECURITY record	INC 60 CEIL	CFL 13 + BLST UNIT	RI	43	Elect	Elect	1,391	558	1,391	558	\$167 946	5.04
Int light	SHOP	INC 60 CEIL	CFL 13 + BLST UNIT	RI	47	Elect	Elect	3,248	1 304	3 248	1 304	\$392 126	5.04
Int light	MWR	INC 60 CEIL	CFL 13 + BLST UNIT	RI	21	Elect	Elect	201	81	201	81	\$24 252	5.04
Int light	SHOP-ELEC	INC 60 CEIL	CFL 13 + BLST UNIT	RI	50	Elect	Elect	5,716	2 295	5,716	2 295	\$690 123	5.04
Heatpipes	HANGER S	AC/Boilers	Install Heatpipes	RI	5	Fuel Oil	Fuel Oil	4,303	na	4,303	na	\$539 471	4.85
Heatpipes	HANGER AD AM	AC/Boilers	Install Heatpipes	RI	18	Fuel Oil	Fuel Oil	3,927	na	3,927	na	\$489 881	4.77
Heatpipes	VIB	AC/Boilers	Install Heatpipes	RI	26	Fuel Oil	Fuel Oil	5,539	na	5,539	na	\$690 179	4.75
Heatpipes	RCC MECH BLD	AC/Boilers	Install Heatpipes	RI	2	Fuel Oil	Fuel Oil	3,888	na	3,888	na	\$483 731	4.72
Generator	N Substation	Generator	DGEN-7	RI	7	na	Diesel	-10 526	24 000	10 526	24 000	\$766 485	4.41
Int light	HANGAR	FL 2X4 4-40 STD	FL 2X4 3F32T8 ELC3 REF	RI	11	Elect	Elect	1,059	425	1,059	425	\$161 498	4.36
Int light	FUELDSP	FL 2X4 4-40 STD	FL 2X4 3F32T8 ELC3 REF	RI	9	Elect	Elect	39	16	39	16	\$5 908	4.36
Int light	LAB-MED	INC 60 CEIL	CFL 13 + BLST UNIT	RI	16	Elect	Elect	137	72	137	72	\$17 369	4.26
Int light	RESTRNT cashier	INC 60 CEIL	CFL 13 + BLST UNIT	RI	38	Elect	Elect	18	10	18	10	\$2 283	4.20
Int light	RESTRNT cleaning	INC 60 CEIL	CFL 13 + BLST UNIT	RI	39	Elect	Elect	18	10	18	10	\$2 283	4.20
Int light	RESTRNT dining	INC 60 CEIL	CFL 13 + BLST UNIT	RI	40	Elect	Elect	32	17	32	17	\$4 086	4.20
Generator	S Substation	Generator	DGEN-4	RI	4	na	Diesel	-4 333	9 600	4 333	9 600	\$318 009	4.11
Heatpipes	CX 41 AC SHR	AC/Boilers	Install Heatpipes	RI	8	Elec	Elec	8 680	na	8 680	na	\$1 323 149	3.92
Int light	NASLEAS	INC 60 CEIL	CFL 13 + BLST UNIT	RI	23	Elect	Elect	6,827	4 358	6,827	4 358	\$896 387	3.76
Int light	ADMIN	INC 60 CEIL	CFL 13 + BLST UNIT	RI	2	Elect	Elect	7,385	4 714	7,385	4 714	\$969 574	3.76
Int light	NASOWN	INC 60 CEIL	CFL 13 + BLST UNIT	RI	25	Elect	Elect	6,949	4 436	6,949	4 436	\$912 351	3.76
Int light	LAB MED	FL 2X4 4-40 STD	FL 2X4 3F32T8 ELC3 REF	RI	14	Elect	Elect	500	262	500	262	\$77 372	3.62
Int light	BRK/ADM	INC 60 CEIL	CFL 18 GLOBE UNIT	RI	4	Elect	Elect	16	10	16	10	\$1 734	3.55
Int light	RESTRNT cashier	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	35	Elect	Elect	12	6	12	6	\$1 971	3.54
Int light	RESTRNT cleaning	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	36	Elect	Elect	12	6	12	6	\$1 971	3.54
Int light	RESTRNT dining	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	37	Elect	Elect	21	11	21	11	\$3 549	3.54
Int light	TRAINING	INC 60 CEIL	CFL 13 + BLST UNIT	RI	58	Elect	Elect	228	165	228	165	\$30 795	3.51
Int light	OTHER	INC 60 CEIL	CFL 13 + BLST UNIT	RI	27	Elect	Elect	203	147	203	147	\$27 405	3.51
Int light	COMCATN	INC 60 CEIL	CFL 13 + BLST UNIT	RI	6	Elect	Elect	4,518	3 269	4,518	3 269	\$610 917	3.51
Int light	R&D	INC 60 CEIL	CFL 13 + BLST UNIT	RI	34	Elect	Elect	4,869	3 524	4,869	3 524	\$658 476	3.51
AC	Area 1W	heat pump	install TES	ROF	84	Elect	Elect	0	0	334	1 150	\$121 527	3.46

Table 3.6
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	Rt or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW mo)	Implement Energy Savings (MBtu)	Implement Demand Savings (kW mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
Int light	DET RR	INC 60 CEIL	CFL 13 + BLST UNIT	RI	8	Elect	Elect	18	16	18	16	\$2 509	3 15
Int light	NASOWN	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	24	Elect	Elect	4 690	2 994	4 690	2 994	\$785 101	3 15
Int light	NASLEAS	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	22	Elect	Elect	4 607	2 941	4 607	2 941	\$771 257	3 15
AC	Area 5	direct expansion	install TES	ROF	52	Elect	Elect	0	0	75	256	\$25 103	3 03
AC	Area 8	direct expansion	install TES	ROF	55	Elect	Elect	0	0	75	256	\$25 103	3 03
Int light	WHS	INC 60 CEIL	CFL 13 + BLST UNIT	RI	61	Elect	Elect	1 204	1 160	1 204	1 160	\$173 654	3 01
Int light	COMCATN	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	5	Elect	Elect	3 049	2 206	3 049	2 206	\$515 588	2 91
Int light	R&D	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	33	Elect	Elect	4 382	3 171	4 382	3 171	\$741 055	2 91
AC	Area 4	chilled water	install TES	ROF	1	Elect	Elect	0	0	75	256	\$23 347	2 89
AC	Area 5	chilled water	install TES	ROF	2	Elect	Elect	0	0	75	256	\$23 347	2 89
AC	Area 6	chilled water	install TES	ROF	3	Elect	Elect	0	0	75	256	\$23 347	2 89
AC	Area 3A	chilled water	install TES	ROF	5	Elect	Elect	0	0	75	256	\$23 347	2 89
AC	Area 5	direct expansion	install TES	ROF	58	Elect	Elect	0	0	90	307	\$27 852	2 88
AC	Area 7	chilled water	install TES	ROF	4	Elect	Elect	0	0	75	256	\$23 174	2 88
AC	Area 3A	direct expansion	install TES	ROF	75	Elect	Elect	0	0	179	613	\$55 314	2 87
Int light	SECURITY records	FL 2X4 4-34 STD	FL 2X4 3F32T8 ELC3 REF	RI	41	Elect	Elect	1 241	498	1 241	496	\$160 967	2 85
Int light	SECURITY other	FL 2X4 4-34 STD	FL 2X4 3F32T8 ELC3 REF	RI	42	Elect	Elect	123	50	123	50	\$16 015	2 85
Int light	PLT-BLD	INC 60 CEIL	CFL 13 + BLST UNIT	RI	30	Elect	Elect	1 015	611	1 015	611	\$117 971	2 81
Int light	PLT-EQU	INC 60 CEIL	CFL 13 + BLST UNIT	RI	32	Elect	Elect	1 186	714	1 186	714	\$137 780	2 81
AC	Area 3A	direct expansion	install TES	ROF	64	Elect	Elect	0	0	105	358	\$31 132	2 80
AC	Area 5	direct expansion	install TES	ROF	65	Elect	Elect	0	0	120	409	\$34 413	2 74
Envelope	60740	Envelope	Double Paned Window	RI	24	na	na	89	9 1	89	9 1	\$9 595	2 70
Envelope	49750	Envelope	Double Paned Window	RI	20	na	na	110	11 1	110	11 1	\$11 775	2 70
Envelope	1641	Envelope	Double Paned Window	RI	13	na	na	255	25 9	255	25 9	\$27 408	2 70
Envelope	1722	Envelope	Double Paned Window	RI	16	na	na	119	12 1	119	12 1	\$12 769	2 70
AC	Area 3A	direct expansion	install TES	ROF	78	Elect	Elect	0	0	121	712	\$66 564	2 68
AC	Area 1	direct expansion	install TES	ROF	68	Elect	Elect	0	0	149	511	\$41 588	2 68
AC	Area 6	direct expansion	install TES	ROF	69	Elect	Elect	0	0	149	511	\$41 588	2 68
AC	Area 3A	direct expansion	install TES	ROF	72	Elect	Elect	0	0	149	511	\$41 588	2 68
AC	Area 1N	direct expansion	install TES	ROF	76	Elect	Elect	0	0	179	613	\$49 733	2 68
Boilers	NASA	Boiler	High Eff Boiler	RI	2	Fuel Oil	Fuel Oil	2 116	0	2 116	0	\$250 568	2 66
AC	Area 2	direct expansion	install TES	ROF	79	Elect	Elect	0	0	151	890	\$82 123	2 66
AC	Area 4	direct expansion	install TES	ROF	80	Elect	Elect	0	0	151	890	\$82 123	2 66
AC	Area 1W	direct expansion	install TES	ROF	81	Elect	Elect	0	0	151	890	\$82 123	2 66
AC	Area 3A	direct expansion	install TES	ROF	82	Elect	Elect	0	0	151	890	\$82 123	2 66
AC	Area 6	chilled water	install TES	ROF	6	Elect	Elect	0	0	90	307	\$24 614	2 66
Heatpipes	PSL	AC/Boilers	Install Heatpipes	RI	4	Fuel Oil	Fuel Oil	1 167	na	1 167	na	\$115 174	2 66
Heatpipes	DELTA SPN BD	AC/Boilers	Install Heatpipes	RI	23	Fuel Oil	Fuel Oil	706	na	706	na	\$69 702	2 66
Heatpipes	OPTICS LAB	AC/Boilers	Install Heatpipes	RI	1	Fuel Oil	Fuel Oil	1 006	na	1 006	na	\$99 243	2 66
Heatpipes	CTL BD SP 1S	AC/Boilers	Install Heatpipes	RI	24	Fuel Oil	Fuel Oil	341	na	341	na	\$33 689	2 66
Heatpipes	GPS PROP 1 AC	AC/Boilers	Install Heatpipes	RI	16	Fuel Oil	Fuel Oil	711	na	711	na	\$70 200	2 66
AC	Area 3A	direct expansion	install TES	ROF	73	Elect	Elect	0	0	164	562	\$43 947	2 62
AC	Area 3	direct expansion	install TES	ROF	83	Elect	Elect	0	0	190	1 122	\$100 101	2 61
Int light	DET-RR	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	7	Elect	Elect	2	2	2	2	\$373	2 60
Heatpipes	HANGER AF	AC/Boilers	Install Heatpipes	RI	21	Fuel Oil	Fuel Oil	2 733	na	2 733	na	\$264 735	2 58
Heatpipes	MIS CK BD AK	AC/Boilers	Install Heatpipes	RI	20	Fuel Oil	Fuel Oil	1 755	na	1 755	na	\$169 949	2 58
AC	Area 1W	Window AC	install efficient window units	ROF	5	Elect	Elect	0	0	14	1	\$2 127	2 58
AC	Area 2	Window AC	install efficient window units	ROF	8	Elect	Elect	0	0	28	3	\$4 253	2 58
AC	Area 3	Window AC	install efficient window units	ROF	11	Elect	Elect	0	0	42	4	\$6 380	2 58
Boilers	Navy	Boiler	High Eff Boiler	RI	3	Fuel Oil	Fuel Oil	567	0	567	0	\$64 854	2 52
AC	Area 7	Window AC	install efficient window units	ROF	19	Elect	Elect	0	0	65	7	\$9 924	2 49
AC	Area 5	Window AC	install efficient window units	ROF	15	Elect	Elect	0	0	289	31	\$43 950	2 49
AC	Area 1	Window AC	install efficient window units	ROF	2	Elect	Elect	0	0	9	1	\$1 418	2 49
AC	Other	Window AC	install efficient window units	ROF	24	Elect	Elect	0	0	9	1	\$1 418	2 49
AC	Area 6	Window AC	install efficient window units	ROF	17	Elect	Elect	0	0	103	11	\$15 595	2 49

Table 3.6
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	Rt or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First Year Demand Savings (kW mo)	Full Implement Energy Savings (MBtu)	Full Implement Demand Savings (kW mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 1W	Window AC	install efficient window units	ROF	4	Elect	Elect	0	0	47	5	\$7,009	2.49
AC	Area 3	Window AC	install efficient window units	ROF	10	Elect	Elect	0	0	914	98	\$138,938	2.49
AC	Area 2	Window AC	install efficient window units	ROF	7	Elect	Elect	0	0	19	2	\$2,835	2.49
AC	Area 4	Window AC	install efficient window units	ROF	13	Elect	Elect	0	0	149	16	\$22,684	2.49
AC	Area 1N	Window AC	install efficient window units	ROF	23	Elect	Elect	0	0	28	3	\$4,253	2.49
AC	Area 8	Window AC	install efficient window units	ROF	21	Elect	Elect	0	0	280	30	\$42,532	2.49
AC	Area 5	chilled water	install TES	ROF	8	Elect	Elect	0	0	-105	358	\$25,590	2.48
AC	Area 2	chilled water	install TES	ROF	28	Elect	Elect	0	0	-181	1,068	\$87,720	2.48
Boilers	USAF	Boiler	High Eff Boiler	Rt	1	Fuel Oil	Fuel Oil	4,889	0	4,889	0	\$556,206	2.47
AC	Area 6	chilled water	install TES	ROF	9	Elect	Elect	0	0	-120	409	\$28,923	2.46
AC	Area 1W	chilled water	install TES	ROF	10	Elect	Elect	0	0	-120	409	\$28,923	2.46
Int light	MWR	FL 2X4 3-60 STD	MH 175 PEND	Rt	20	Elect	Elect	44	18	44	18	\$15,069	2.37
Int light	SHOP-WPN	FL 2X4 3-60 STD	MH 175 PEND	Rt	51	Elect	Elect	29	12	29	12	\$9,896	2.37
Int light	SHOP-ELEC	FL 2X4 3-60 STD	MH 175 PEND	Rt	48	Elect	Elect	860	345	860	345	\$294,183	2.37
Int light	MTRPOOL	FL 2X4 3-60 STD	MH 175 PEND	Rt	17	Elect	Elect	153	61	153	61	\$52,179	2.37
Int light	STOR-LH	FL 2X4 3-60 STD	MH 175 PEND	Rt	54	Elect	Elect	174	70	174	70	\$59,376	2.37
Int light	SHOP	FL 2X4 3-60 STD	MH 175 PEND	Rt	45	Elect	Elect	489	196	489	196	\$167,108	2.37
Int light	Exit Lights	INC 2-20 W	EXIT - LED	Rt	62	Elect	Elect	9,604	3,856	9,604	3,856	\$1,738,921	2.32
AC	Area 3A	chilled water	install TES	ROF	11	Elect	Elect	0	0	-164	562	\$35,849	2.32
AC	Area 8	chilled water	install TES	ROF	50	Elect	Elect	0	0	-1,666	7,679	\$741,638	2.32
AC	Area 3	chilled water	install TES	ROF	16	Elect	Elect	0	0	-209	715	\$45,542	2.32
AC	Area 3A	chilled water	install TES	ROF	17	Elect	Elect	0	0	-209	715	\$45,542	2.32
Envelope	1748	Envelope	Double Paned Window	Rt	18	na	na	150	15.2	150	15.2	\$14,448	2.30
Envelope	60600	Envelope	Double Paned Window	Rt	23	na	na	120	12.2	120	12.2	\$11,601	2.30
Envelope	1724	Envelope	Double Paned Window	Rt	17	na	na	128	13.0	128	13.0	\$12,376	2.30
Envelope	1645	Envelope	Double Paned Window	Rt	14	na	na	285	28.9	285	28.9	\$27,512	2.30
Envelope	54915	Envelope	Double Paned Window	Rt	21	na	na	219	22.2	219	22.2	\$21,104	2.30
Envelope	55005	Envelope	Double Paned Window	Rt	22	na	na	167	17.0	167	17.0	\$16,137	2.30
Boilers	Navy	Boiler	Replace electric w/ high eff fo boiler	Rt	8b	Electric	Fuel Oil	-224	492	-224	492	\$40,028	2.30
AC	Area 1N	chilled water	install TES	ROF	19	Elect	Elect	0	0	-113	668	\$48,256	2.30
AC	Area 1W	chilled water	install TES	ROF	34	Elect	Elect	0	0	-272	1,602	\$1,384,7	2.28
AC	Area 3A	chilled water	install TES	ROF	20	Elect	Elect	0	0	-121	712	\$50,496	2.28
AC	Area 6	chilled water	install TES	ROF	12	Elect	Elect	0	0	-179	613	\$37,850	2.28
AC	Area 8	chilled water	install TES	ROF	13	Elect	Elect	0	0	-179	613	\$37,850	2.28
AC	Area 1W	chilled water	install TES	ROF	14	Elect	Elect	0	0	-179	613	\$37,850	2.28
AC	Area 3A	chilled water	install TES	ROF	38	Elect	Elect	0	0	-318	1,226	\$133,319	2.27
AC	Area 7	chilled water	install TES	ROF	36	Elect	Elect	0	0	-278	1,073	\$116,654	2.27
AC	Area 3A	chilled water	install TES	ROF	37	Elect	Elect	0	0	-298	1,150	\$124,987	2.27
AC	Area 3A	chilled water	install TES	ROF	35	Elect	Elect	0	0	-265	1,022	\$111,099	2.27
AC	Area 3A	chilled water	install TES	ROF	21	Elect	Elect	0	0	-128	757	\$52,736	2.26
AC	Area 6	chilled water	install TES	ROF	22	Elect	Elect	0	0	-136	801	\$54,976	2.24
AC	Area 1W	Window AC	install efficient window units	ROF	3	Elect	Elect	0	0	9	1	\$1,418	2.23
AC	Area 2	Window AC	install efficient window units	ROF	6	Elect	Elect	0	0	9	1	\$1,418	2.23
AC	Area 1N	Window AC	install efficient window units	ROF	22	Elect	Elect	0	0	9	1	\$1,418	2.23
AC	Area 4	Window AC	install efficient window units	ROF	12	Elect	Elect	0	0	75	8	\$11,342	2.23
AC	Area 1	Window AC	install efficient window units	ROF	1	Elect	Elect	0	0	5	0	\$709	2.23
AC	Area 7	Window AC	install efficient window units	ROF	18	Elect	Elect	0	0	89	9	\$13,468	2.23
AC	Area 8	Window AC	install efficient window units	ROF	20	Elect	Elect	0	0	98	10	\$14,886	2.23
AC	Area 5	Window AC	install efficient window units	ROF	14	Elect	Elect	0	0	23	2	\$3,544	2.23
AC	Area 6	Window AC	install efficient window units	ROF	16	Elect	Elect	0	0	23	2	\$3,544	2.23
AC	Area 3	Window AC	install efficient window units	ROF	9	Elect	Elect	0	0	37	4	\$5,671	2.23
AC	Area 3A	chilled water	install TES	ROF	49	Elect	Elect	0	0	877	1,120	\$278,709	2.22
AC	Area 3A	chilled water	install TES	ROF	48	Elect	Elect	0	0	851	1,000	\$267,509	2.22
AC	Area 7	chilled water	install TES	ROF	25	Elect	Elect	0	0	158	735	\$62,874	2.21
AC	Area 3A	chilled water	install TES	ROF	26	Elect	Elect	0	0	164	779	\$65,575	2.21

Table 3.6
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	Rt or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW mo)	Full Implement Energy Savings (MBtu)	Full Implement Demand Savings (kW mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 3	chilled water	install TES	ROF	31	Elect	Elect	0	0	-211	1 246	\$82 295	2 19
AC	Area 1W	chilled water	install TES	ROF	32	Elect	Elect	0	0	-211	1 246	\$82 295	2 19
AC	Area 1W	chilled water	install TES	ROF	39	Elect	Elect	0	0	-331	1 278	\$129 699	2 18
AC	Area 1W	chilled water	install TES	ROF	29	Elect	Elect	0	0	-181	1 068	\$69 953	2 18
AC	Area 3A	chilled water	install TES	ROF	33	Elect	Elect	0	0	-241	1 424	\$91 562	2 16
AC	Area 1W	chilled water	install TES	ROF	40	Elect	Elect	0	0	-364	1 405	\$138 999	2 15
AC	Area 5	chilled water	install TES	ROF	42	Elect	Elect	0	0	-398	1 533	\$148 272	2 13
AC	Area 1W	chilled water	install TES	ROF	43	Elect	Elect	0	0	-398	1 533	\$148 272	2 13
AC	Area 5	chilled water	install TES	ROF	44	Elect	Elect	0	0	-424	1 635	\$155 706	2 11
AC	Area 3A	chilled water	install TES	ROF	45	Elect	Elect	0	0	-424	1 635	\$155 706	2 11
AC	Area 3A	chilled water	install TES	ROF	47	Elect	Elect	0	0	-496	1 911	\$178 154	2 08
Envelope	49635	Envelope	Double Paned Window	Rt	19	na	na	133	13 5	133	13 5	\$11 375	2 01
Envelope	1704	Envelope	Double Paned Window	Rt	15	na	na	239	24 2	239	24 2	\$20 488	2 01
AC	Area 6	chilled water	install TES	ROF	46	Elect	Elect	0	0	-477	1 840	\$159 187	2 01
Motors	R&D	Fan Motors	Install Energy Efficient Motor	Rt	15	Elec	Elec	1 369 26	642 76	1 369 26	642 76	\$156 536	1 92
Motors	TRAIN	Fan Motors	Install Energy Efficient Motor	Rt	22	Elec	Elec	8 14	2 88	8 14	2 88	\$702	1 92
Motors	WHS	Fan Motors	Install Energy Efficient Motor	Rt	23	Elec	Elec	431 51	202 56	431 51	202 56	\$49 331	1 92
Motors	NASOWN	Fan Motors	Install Energy Efficient Motor	Rt	11	Elec	Elec	825 24	387 39	825 24	387 39	\$84 343	1 92
Motors	LAB-MED	Fan Motors	Install Energy Efficient Motor	Rt	7	Elec	Elec	13 35	6 27	13 35	6 27	\$1 527	1 92
Motors	SECURITY	Fan Motors	Install Energy Efficient Motor	Rt	17	Elec	Elec	41 56	19 51	41 56	19 51	\$4 751	1 92
Motors	DET-RR	Fan Motors	Install Energy Efficient Motor	Rt	4	Elec	Elec	1 75	0 82	1 75	0 82	\$201	1 92
Motors	SHOP-WPN	Fan Motors	Install Energy Efficient Motor	Rt	20	Elec	Elec	5 70	2 68	5 70	2 68	\$652	1 92
Motors	OTHER	Fan Motors	Install Energy Efficient Motor	Rt	12	Elec	Elec	10 61	4 98	10 61	4 98	\$1 212	1 92
Motors	COMCATN	Fan Motors	Install Energy Efficient Motor	Rt	3	Elec	Elec	243 30	114 21	243 30	114 21	\$27 815	1 92
Motors	SHOP-ELEC	Fan Motors	Install Energy Efficient Motor	Rt	19	Elec	Elec	85 39	40 08	85 39	40 08	\$9 761	1 92
Motors	PLT-EQU	Fan Motors	Install Energy Efficient Motor	Rt	14	Elec	Elec	75 91	35 63	75 91	35 63	\$8 678	1 92
Motors	MWR	Fan Motors	Install Energy Efficient Motor	Rt	9	Elec	Elec	15 04	7 06	15 04	7 06	\$1 719	1 92
Motors	MTRPOOL	Fan Motors	Install Energy Efficient Motor	Rt	8	Elec	Elec	75 65	35 51	75 65	35 51	\$8 648	1 92
Motors	ADMIN	Fan Motors	Install Energy Efficient Motor	Rt	1	Elec	Elec	350 80	164 67	350 80	164 67	\$40 104	1 92
Motors	HANGAR	Fan Motors	Install Energy Efficient Motor	Rt	6	Elec	Elec	44 85	21 06	44 85	21 06	\$5 128	1 92
Motors	NASLEAS	Fan Motors	Install Energy Efficient Motor	Rt	10	Elec	Elec	810 79	380 60	810 79	380 60	\$92 690	1 92
Motors	PLT BLD	Fan Motors	Install Energy Efficient Motor	Rt	13	Elec	Elec	38 69	18 16	38 69	18 16	\$4 423	1 92
Motors	STOR-UH	Fan Motors	Install Energy Efficient Motor	Rt	21	Elec	Elec	172 20	80 83	172 20	80 83	\$19 686	1 92
Motors	FUELDSP	Fan Motors	Install Energy Efficient Motor	Rt	5	Elec	Elec	2 66	1 25	2 66	1 25	\$304	1 92
Motors	RESTRNT	Fan Motors	Install Energy Efficient Motor	Rt	16	Elec	Elec	18 20	8 54	18 20	8 54	\$2 081	1 92
Motors	SHOP	Fan Motors	Install Energy Efficient Motor	Rt	18	Elec	Elec	242 54	113 86	242 54	113 86	\$27 728	1 92
Motors	BHK/ADM	Fan Motors	Install Energy Efficient Motor	Rt	2	Elec	Elec	2 05	0 72	2 05	0 72	\$211	1 83
Int light	ADMIN	Fl 2X4 2-34 STD	Fl 2X4 2F40T12ES ELC2	Rt	1	Elect	Elect	1 906	1 217	1 906	1 217	\$213 423	1 82
Heatpipes	HANGER R&D	AC/Boilers	Install Heatpipes	Rt	3	Elect	Elect	835	na	835	na	\$72 986	1 79
Boilers	NASA	Boiler	High Eff Boiler	Rt	5	Fuel Oil	Fuel Oil	60	0	60	0	\$5 177	1 74
Motors	Area 3	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	2C	Elect	Elect	0 00	0 00	17 96	0 00	\$1 325	1 74
Motors	Area 6	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	5C	Elect	Elect	0 00	0 00	53 45	0 00	\$3 942	1 74
Motors	Area 7	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	6C	Elect	Elect	0 00	0 00	41 91	0 00	\$3 091	1 74
Motors	Area 1N	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	10C	Elect	Elect	0 00	0 00	79 03	0 00	\$5 828	1 74
Motors	Area 5	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	4C	Elect	Elect	0 00	0 00	75 26	0 00	\$5 551	1 74
Motors	Area 3A	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	9C	Elect	Elect	0 00	0 00	345 36	0 00	\$25 470	1 74
Motors	Area 4	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	3C	Elect	Elect	0 00	0 00	2 14	0 00	\$158	1 74
Motors	Area 8	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	7C	Elect	Elect	0 00	0 00	114 61	0 00	\$8 452	1 74
Motors	Area 1W	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	8C	Elect	Elect	0 00	0 00	116 74	0 00	\$8 610	1 74
Motors	Area 2	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	1C	Elect	Elect	0 00	0 00	10 26	0 00	\$757	1 74
Boilers	USAF	Boiler	High Eff Boiler	Rt	4	Fuel Oil	Fuel Oil	133	0	133	0	\$10 452	1 67
AC	Area 3	direct expansion	install TES	ROF	51	Elect	Elect	0	0	149	511	\$19 581	1 40
AC	Area 6	direct expansion	install TES	ROF	53	Elect	Elect	0	0	149	511	\$19 581	1 40
AC	Area 7	direct expansion	install TES	ROF	54	Elect	Elect	0	0	149	511	\$19 581	1 40
Int light	OTHER	Fl 2X4 3 60 STD	MH 175 PEND	Rt	26	Elect	Elect	44	32	44	32	\$6 712	1 34

Table 3.6
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	Rt or ROF	ID	Existing Fuel	Resulting Fuel	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW-mo)	Full Implement Energy Savings (MBtu)	Full Implement Demand Savings (kW-mo)	Net Present Value (1993 \$)	Savings to Investment Ratio
Int light	TRAINING	FL 2X4 3-60 STD	MH 175 PEND	Rt	57	Elect	Elect	50	36	50	36	\$7 544	1.34
AC	Area 7	direct expansion	install TES	ROF	59	Elect	Elect	0	0	-179	613	\$18 954	1.32
AC	Area 8	direct expansion	install TES	ROF	60	Elect	Elect	0	0	-179	613	\$18 954	1.32
AC	Area 1W	direct expansion	install TES	ROF	61	Elect	Elect	0	0	-179	613	\$18 954	1.32
AC	Area 1W	direct expansion	install TES	ROF	74	Elect	Elect	0	0	-359	1 226	\$37 128	1.31
AC	Area 7	direct expansion	install TES	ROF	63	Elect	Elect	0	0	-209	715	\$19 380	1.28
AC	Area 1N	direct expansion	install TES	ROF	67	Elect	Elect	0	0	-239	818	\$19 826	1.25
AC	Area 5	direct expansion	install TES	ROF	77	Elect	Elect	0	0	-241	1 424	\$35 129	1.22
AC	Area 7	direct expansion	install TES	ROF	70	Elect	Elect	0	0	-299	1 022	\$21 927	1.22
Int light	PLT BLD control boards	FL 2X4 3-60 STD	MH 175 PEND	Rt	29	Elect	Elect	29	18	29	18	\$1 338	1.09
Int light	PLT BLD general	FL 2X4 3-60 STD	MH 175 PEND	Rt	28	Elect	Elect	221	133	221	133	\$10 158	1.09
Int light	PLT EQU	FL 2X4 3-60 STD	MH 175 PEND	Rt	31	Elect	Elect	258	156	258	156	\$11 863	1.09
AC	Area 3A	chilled water	install Efficient Chillers	Rt	30	Elec	Elec	1 006	324	1 006	324	\$5 903	1.05
AC	Area 3A	chilled water	install Efficient Chillers	Rt	27	Elec	Elec	925	298	925	298	\$4 832	1.04
AC	Area 5	chilled water	install Efficient Chillers	Rt	23	Elec	Elec	805	260	805	260	\$2 887	1.03
AC	Area 3A	chilled water	install Efficient Chillers	Rt	24	Elec	Elec	805	260	805	260	\$2 887	1.03
Int light	WHS	FL 2X4 3-60 STD	MH 175 PEND	Rt	59	Elect	Elect	181	175	181	175	\$1 380	1.01
Total								143,130	110,359	129,831	180,782	\$32,357,253	2.95

Table 3.7
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	Rt or ROF	ID	Existing Fuel	Resulting Fuel	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio
Boilers	NASA	Boiler	Replace electric w/ high eff 1 o boiler	Rt	7b	Electric	Fuel Oil	\$40,100	\$130,612	\$374,438	-\$826	\$8,763	\$512,985	\$472,888	12.79
Boilers	USAF	Boiler	Replace electric w/ high eff 1 o boiler	Rt	9b	Electric	Fuel Oil	\$97,100	\$269,617	\$772,968	-\$826	\$27,310	\$1,069,069	\$971,969	11.01
Heatpipes	S&A LAB	AC/Boilers	Install Heatpipes	Rt	13	Elec	Elec	\$66,000	\$527,078	na	na	na	\$527,078	\$461,078	7.99
Boilers	USAF	Boiler	Replace electric w/ high eff 1 o boiler	Rt	8b	Electric	Fuel Oil	\$161,975	\$291,625	\$836,086	-\$2,066	\$35,207	\$1,180,855	\$988,880	7.17
Envelope	Other	Envelope	Weatherization Package	Rt	37	na	na	\$11,232	\$42,153	\$26,875	\$0	\$0	\$69,128	\$57,898	6.15
Heatpipes	RCT STOR BLD	AC/Boilers	Install Heatpipes	Rt	12	Fuel Oil	Fuel Oil	\$12,900	\$71,301	na	na	na	\$71,301	\$58,401	5.53
Heatpipes	HANGER N	AC/Boilers	Install Heatpipes	Rt	8	Fuel Oil	Fuel Oil	\$75,000	\$413,184	na	na	na	\$413,184	\$338,184	5.51
Heatpipes	CX 41	AC/Boilers	Install Heatpipes	Rt	9	Fuel Oil	Fuel Oil	\$28,500	\$151,596	na	na	na	\$151,596	\$123,096	5.32
Heatpipes	COMM CTL FAC	AC/Boilers	Install Heatpipes	Rt	27	Fuel Oil	Fuel Oil	\$31,200	\$165,957	na	na	na	\$165,957	\$134,757	5.32
Heatpipes	TGSF	AC/Boilers	Install Heatpipes	Rt	10	Fuel Oil	Fuel Oil	\$56,520	\$300,638	na	na	na	\$300,638	\$244,118	5.32
Heatpipes	M ANNEX	AC/Boilers	Install Heatpipes	Rt	14	Fuel Oil	Fuel Oil	\$48,000	\$255,319	na	na	na	\$255,319	\$207,319	5.32
Heatpipes	MK VI CK BLD	AC/Boilers	Install Heatpipes	Rt	22	Fuel Oil	Fuel Oil	\$12,500	\$66,409	na	na	na	\$66,409	\$53,909	5.32
Heatpipes	HANGER L	AC/Boilers	Install Heatpipes	Rt	7	Elec	Elec	\$28,000	\$145,651	na	na	na	\$145,651	\$117,651	5.20
Generator	Titan Substation	Generator	DGEN-2	Rt	2	na	Diesel	\$46,060	\$176,365	\$477,900	-\$61,962	\$0	\$239,573	\$193,513	5.20
Heatpipes	CTL COMP COM	AC/Boilers	Install Heatpipes	Rt	11	Fuel Oil	Fuel Oil	\$75,200	\$389,614	na	na	na	\$389,614	\$314,414	5.18
Heatpipes	CX 30 BLKHSE	AC/Boilers	Install Heatpipes	Rt	17	Fuel Oil	Fuel Oil	\$40,000	\$206,592	na	na	na	\$206,592	\$166,592	5.16
Heatpipes	M/ASMB BD-AC	AC/Boilers	Install Heatpipes	Rt	15	Fuel Oil	Fuel Oil	\$180,000	\$929,662	na	na	na	\$929,662	\$749,662	5.16
Heatpipes	SMAB WEST	AC/Boilers	Install Heatpipes	Rt	25	Fuel Oil	Fuel Oil	\$178,800	\$923,464	na	na	na	\$923,464	\$744,664	5.16
Heatpipes	HANGER AE	AC/Boilers	Install Heatpipes	Rt	19	Fuel Oil	Fuel Oil	\$161,300	\$833,080	na	na	na	\$833,080	\$671,780	5.16
Int light	FUELDSP	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	10	Elect	Elect	\$1,052	\$5,553	\$1,405	-\$1,662	na	\$5,296	\$4,244	5.04
Int light	SECURITY other	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	44	Elect	Elect	\$4,169	\$22,014	\$5,570	-\$6,589	na	\$20,994	\$16,825	5.04
Int light	SHOP-WPN	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	53	Elect	Elect	\$5,709	\$30,145	\$7,827	-\$9,023	na	\$28,749	\$23,039	5.04
Int light	HANGER	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	13	Elect	Elect	\$17,803	\$94,005	\$23,784	-\$28,138	na	\$89,650	\$71,847	5.04
Int light	MTRPOOL	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	19	Elect	Elect	\$30,311	\$160,046	\$40,493	-\$47,907	na	\$152,632	\$122,321	5.04
Int light	STOR-UH	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	56	Elect	Elect	\$34,480	\$182,060	\$46,063	-\$54,496	na	\$173,626	\$139,146	5.04
Int light	SECURITY record	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	43	Elect	Elect	\$41,616	\$219,741	\$55,596	-\$65,775	na	\$209,562	\$167,946	5.04
Int light	SHOP	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	47	Elect	Elect	\$97,168	\$513,059	\$129,809	-\$153,574	na	\$489,293	\$392,126	5.04
Int light	MWR	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	21	Elect	Elect	\$6,010	\$31,732	\$8,028	-\$9,498	na	\$30,262	\$24,252	5.04
Int light	SHOP-ELEC	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	50	Elect	Elect	\$171,011	\$902,960	\$228,457	-\$270,284	na	\$861,133	\$690,123	5.04
Heatpipes	HANGER S	AC/Boilers	Install Heatpipes	Rt	5	Fuel Oil	Fuel Oil	\$140,000	\$679,471	na	na	na	\$679,471	\$539,471	4.85
Heatpipes	HANGER AO-AM	AC/Boilers	Install Heatpipes	Rt	18	Fuel Oil	Fuel Oil	\$130,100	\$619,981	na	na	na	\$619,981	\$489,981	4.77
Heatpipes	VIB	AC/Boilers	Install Heatpipes	Rt	26	Fuel Oil	Fuel Oil	\$184,200	\$874,379	na	na	na	\$874,379	\$690,179	4.75
Heatpipes	RCC MECH BLD	AC/Boilers	Install Heatpipes	Rt	2	Fuel Oil	Fuel Oil	\$130,000	\$613,731	na	na	na	\$613,731	\$483,731	4.72
Generator	N Substation	Generator	DGEN-7	Rt	7	na	Diesel	\$225,025	\$848,193	\$2,389,500	-\$549,790	\$0	\$991,511	\$766,485	4.41
Int light	HANGER	FL 2X4 4-40 STD	FL 2X4 3F32T8 ELC3 REF	Rt	11	Elect	Elect	\$48,042	\$167,271	\$42,321	-\$51	na	\$209,540	\$161,498	4.36
Int light	FUELDSP	FL 2X4 4-40 STD	FL 2X4 3F32T8 ELC3 REF	Rt	9	Elect	Elect	\$1,758	\$6,120	\$1,548	-\$2	na	\$7,666	\$5,908	4.36
Int light	LAB MED	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	16	Elect	Elect	\$5,334	\$21,744	\$7,125	-\$6,167	na	\$22,702	\$17,369	4.26
Int light	RESTRNT cashier	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	38	Elect	Elect	\$714	\$2,848	\$953	-\$804	na	\$2,997	\$2,283	4.20
Int light	RESTRNT cleaning	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	39	Elect	Elect	\$714	\$2,848	\$953	-\$804	na	\$2,997	\$2,283	4.20
Int light	RESTRNT dining	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	40	Elect	Elect	\$1,277	\$5,097	\$1,706	-\$1,439	na	\$5,363	\$4,086	4.20
Generator	S Substation	Generator	DGEN-4	Rt	4	na	Diesel	\$102,150	\$349,140	\$955,800	-\$186,503	\$0	\$420,158	\$318,008	4.11
Heatpipes	CX 41 AC SHR	AC/Boilers	Install Heatpipes	Rt	8	Elec	Elec	\$452,760	\$1,775,909	na	na	na	\$1,775,909	\$1,323,149	3.92
Int light	NASLEAS	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	23	Elect	Elect	\$324,781	\$1,081,769	\$433,883	-\$294,483	na	\$1,221,168	\$896,387	3.76
Int light	ADMIN	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	2	Elect	Elect	\$351,299	\$1,170,092	\$469,308	-\$318,527	na	\$1,320,873	\$969,574	3.76
Int light	NASOWN	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	25	Elect	Elect	\$330,566	\$1,101,035	\$441,610	-\$299,726	na	\$1,242,917	\$912,351	3.76
Int light	LAB MED	FL 2X4 4-40 STD	FL 2X4 3F32T8 ELC3 REF	Rt	14	Elect	Elect	\$29,587	\$79,538	\$26,063	\$1,357	na	\$106,959	\$77,372	3.62
Int light	BRK/ADM	INC 60 CEIL	CFL 18 GLOBE UNIT	Rt	4	Elect	Elect	\$679	\$2,592	\$972	-\$1,151	na	\$2,413	\$1,734	3.55
Int light	RESTRNT cashier	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	Rt	35	Elect	Elect	\$777	\$1,892	\$633	-\$223	na	\$2,748	\$1,971	3.54
Int light	RESTRNT cleaning	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	Rt	36	Elect	Elect	\$777	\$1,892	\$633	-\$223	na	\$2,748	\$1,971	3.54
Int light	RESTRNT dining	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	Rt	37	Elect	Elect	\$1,398	\$3,405	\$1,140	-\$402	na	\$4,947	\$3,549	3.54
Int light	TRAINING	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	58	Elect	Elect	\$12,282	\$36,120	\$16,408	-\$9,451	na	\$43,078	\$30,795	3.51
Int light	OTHER	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	27	Elect	Elect	\$10,930	\$32,144	\$14,602	-\$8,410	na	\$38,335	\$27,405	3.51
Int light	COMCATN	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	6	Elect	Elect	\$243,652	\$716,549	\$325,500	-\$187,480	na	\$854,569	\$610,917	3.51
Int light	RSD	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	34	Elect	Elect	\$262,620	\$772,331	\$350,839	-\$202,075	na	\$921,095	\$658,476	3.51
AC	Area 1W	heat pump	install TES	ROF	84	Elect	Elect	\$49,395	\$28,064	\$114,474	-\$9,842	\$74,009	\$170,921	\$121,527	3.46
Int light	DETRK	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	8	Elect	Elect	\$1,164	\$2,815	\$1,555	-\$697	na	\$3,673	\$2,509	3.15
Int light	NASOWN	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	Rt	24	Elect	Elect	\$365,593	\$1,433,087	\$298,042	-\$109,561	na	\$1,150,654	\$785,101	3.15
Int light	NASLEAS	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	Rt	22	Elect	Elect	\$359,146	\$1,299,984	\$292,787	-\$107,631	na	\$1,130,403	\$771,257	3.15
AC	Area 5	direct expansion	install TES	ROF	52	Elect	Elect	\$12,349	\$6,286	\$25,439	-\$2,460	\$15,838	\$37,452	\$25,103	3.03
AC	Area 8	direct expansion	install TES	ROF	55	Elect	Elect	\$12,349	\$6,286	\$25,439	-\$2,460	\$15,838	\$37,452	\$25,103	3.03
Int light	WHIS	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	61	Elect	Elect	\$80,426	\$189,914	\$115,458	-\$45,292	na	\$260,080	\$173,054	3.01
Int light	COMCATN	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	Rt	5	Elect	Elect	\$269,437	\$483,541	\$219,653	-\$81,831	na	\$785,025	\$515,588	2.91
Int light	RSD	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	Rt	33	Elect	Elect	\$387,263	\$694,994	\$315,708	-\$117,610	na	\$1,128,318	\$741,055	2.91

Table 3.7
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	Area 4	chilled water	install TES	ROF	1	Elect	Elect	\$12,349	\$6,286	\$25,439	\$2,460	\$14,082	\$35,695	\$23,347	2.89
AC	Area 5	chilled water	install TES	ROF	2	Elect	Elect	\$12,349	\$6,286	\$25,439	\$2,460	\$14,082	\$35,695	\$23,347	2.89
AC	Area 6	chilled water	install TES	ROF	3	Elect	Elect	\$12,349	\$6,286	\$25,439	\$2,460	\$14,082	\$35,695	\$23,347	2.89
AC	Area 3A	chilled water	install TES	ROF	5	Elect	Elect	\$12,349	\$6,286	\$25,439	\$2,460	\$14,082	\$35,695	\$23,347	2.89
AC	Area 5	direct expansion	install TES	ROF	58	Elect	Elect	\$14,818	\$7,543	\$30,527	\$2,953	\$16,733	\$42,670	\$27,852	2.88
AC	Area 7	chilled water	install TES	ROF	4	Elect	Elect	\$12,349	\$6,286	\$25,439	\$2,460	\$13,908	\$35,522	\$23,174	2.88
AC	Area 3A	direct expansion	install TES	ROF	75	Elect	Elect	\$29,637	\$15,085	\$61,053	\$5,905	\$33,078	\$84,950	\$55,314	2.87
Int light	SECURITY records	FL 2X4 4 34 STD	FL 2X4 3/ 3218 ELC3 REF	RI	41	Elect	Elect	\$86,857	\$196,008	\$49,592	\$2,223	na	\$247,823	\$160,967	2.85
Int light	SECURITY other	FL 2X4 4 34 STD	FL 2X4 3/ 3218 ELC3 REF	RI	42	Elect	Elect	\$8,642	\$19,502	\$4,934	\$221	na	\$24,657	\$16,015	2.85
Int light	PLT-BLD	INC 60 CELL	CFL 13 + BLST UNIT	RI	30	Elect	Elect	\$65,091	\$162,260	\$60,870	\$40,068	na	\$183,062	\$117,971	2.81
Int light	PLT-EQU	INC 60 CELL	CFL 13 + BLST UNIT	RI	32	Elect	Elect	\$76,021	\$189,506	\$71,081	\$46,796	na	\$213,801	\$137,780	2.81
AC	Area 3A	direct expansion	install TES	ROF	64	Elect	Elect	\$17,288	\$8,800	\$35,614	\$3,445	\$18,161	\$48,420	\$31,132	2.80
AC	Area 5	direct expansion	install TES	ROF	65	Elect	Elect	\$19,758	\$10,057	\$40,702	\$3,937	\$19,589	\$54,171	\$34,413	2.74
Envelope	60740	Envelope	Double Paned Window	RI	24	na	na	\$5,628	\$14,320	\$902	\$0	\$0	\$15,223	\$9,595	2.70
Envelope	49/50	Envelope	Double Paned Window	RI	20	na	na	\$6,907	\$17,574	\$1,107	\$0	\$0	\$18,681	\$11,775	2.70
Envelope	1641	Envelope	Double Paned Window	RI	13	na	na	\$16,077	\$40,907	\$2,578	\$0	\$0	\$43,485	\$27,408	2.70
Envelope	1722	Envelope	Double Paned Window	RI	16	na	na	\$7,490	\$19,058	\$1,201	\$0	\$0	\$20,259	\$12,769	2.70
AC	Area 3A	direct expansion	install TES	ROF	78	Elect	Elect	\$39,516	\$9,068	\$70,900	\$7,874	\$36,374	\$106,080	\$66,564	2.68
AC	Area 1	direct expansion	install TES	ROF	68	Elect	Elect	\$24,697	\$12,571	\$50,878	\$4,921	\$23,058	\$66,286	\$41,588	2.68
AC	Area 6	direct expansion	install TES	ROF	69	Elect	Elect	\$24,697	\$12,571	\$50,878	\$4,921	\$23,058	\$66,286	\$41,588	2.68
AC	Area 3A	direct expansion	install TES	ROF	72	Elect	Elect	\$24,697	\$12,571	\$50,878	\$4,921	\$23,058	\$66,286	\$41,588	2.68
AC	Area IN	direct expansion	install TES	ROF	76	Elect	Elect	\$29,637	\$15,085	\$61,053	\$5,905	\$27,497	\$79,370	\$49,733	2.68
Boilers	NASA	Boiler	High Eff Boiler	RI	2	Fuel Oil	Fuel Oil	\$150,575	\$333,301	\$0	\$0	\$67,842	\$401,143	\$250,568	2.66
AC	Area 2	direct expansion	install TES	ROF	79	Elect	Elect	\$49,395	\$11,335	\$88,625	\$9,842	\$44,386	\$131,518	\$82,123	2.66
AC	Area 4	direct expansion	install TES	ROF	80	Elect	Elect	\$49,395	\$11,335	\$88,625	\$9,842	\$44,386	\$131,518	\$82,123	2.66
AC	Area 1W	direct expansion	install TES	ROF	81	Elect	Elect	\$49,395	\$11,335	\$88,625	\$9,842	\$44,386	\$131,518	\$82,123	2.66
AC	Area 3A	direct expansion	install TES	ROF	82	Elect	Elect	\$49,395	\$11,335	\$88,625	\$9,842	\$44,386	\$131,518	\$82,123	2.66
AC	Area 6	chilled water	install TES	ROF	6	Elect	Elect	\$14,818	\$7,543	\$30,527	\$2,953	\$13,496	\$39,432	\$24,614	2.66
Heatpipes	PSL	AC/Boilers	Install Heatpipes	RI	4	Fuel Oil	Fuel Oil	\$69,400	\$184,574	na	na	na	\$184,574	\$115,174	2.66
Heatpipes	DELTA SPN BD	AC/Boilers	Install Heatpipes	RI	23	Fuel Oil	Fuel Oil	\$42,000	\$111,702	na	na	na	\$111,702	\$69,702	2.66
Heatpipes	OPTICS LAB	AC/Boilers	Install Heatpipes	RI	1	Fuel Oil	Fuel Oil	\$59,800	\$159,043	na	na	na	\$159,043	\$99,243	2.66
Heatpipes	CTL BD SP TS	AC/Boilers	Install Heatpipes	RI	24	Fuel Oil	Fuel Oil	\$20,300	\$53,989	na	na	na	\$53,989	\$33,689	2.66
Heatpipes	GPS PROP FAC	AC/Boilers	Install Heatpipes	RI	16	Fuel Oil	Fuel Oil	\$42,300	\$112,500	na	na	na	\$112,500	\$70,200	2.66
AC	Area 3A	direct expansion	install TES	ROF	73	Elect	Elect	\$27,167	\$13,828	\$55,965	\$5,413	\$23,564	\$71,115	\$43,947	2.62
AC	Area 3	direct expansion	install TES	ROF	83	Elect	Elect	\$62,237	\$14,282	\$111,668	\$12,401	\$52,552	\$162,338	\$100,101	2.61
Int light	DELTA RR	FL 2X4 4 34 STD	FL 2X4 3/40T12 ELC3	RI	7	Elect	Elect	\$233	\$344	\$190	\$72	na	\$606	\$373	2.60
Heatpipes	HANGER AF	AC/Boilers	Install Heatpipes	RI	21	Fuel Oil	Fuel Oil	\$167,300	\$432,035	na	na	na	\$432,035	\$264,735	2.58
Heatpipes	MIS CK BD AK	AC/Boilers	Install Heatpipes	RI	20	Fuel Oil	Fuel Oil	\$107,400	\$277,349	na	na	na	\$277,349	\$169,949	2.58
AC	Area 1W	Window AC	install efficient window units	ROF	5	Elect	Elect	\$1,350	\$1,974	\$132	\$21	\$1,350	\$3,476	\$2,127	2.58
AC	Area 2	Window AC	install efficient window units	ROF	8	Elect	Elect	\$2,700	\$3,947	\$263	\$43	\$2,700	\$6,953	\$4,253	2.58
AC	Area 3	Window AC	install efficient window units	ROF	11	Elect	Elect	\$4,050	\$5,921	\$395	\$64	\$4,050	\$10,429	\$6,380	2.58
Boilers	Navy	Boiler	High Eff Boiler	RI	3	Fuel Oil	Fuel Oil	\$42,675	\$89,295	\$0	\$0	\$18,235	\$107,529	\$64,854	2.52
AC	Area 7	Window AC	install efficient window units	ROF	19	Elect	Elect	\$6,679	\$9,210	\$614	\$100	\$6,679	\$16,603	\$9,924	2.49
AC	Area 5	Window AC	install efficient window units	ROF	15	Elect	Elect	\$29,578	\$40,788	\$2,720	\$441	\$29,578	\$73,528	\$43,950	2.49
AC	Area 1	Window AC	install efficient window units	ROF	2	Elect	Elect	\$954	\$1,316	\$88	\$14	\$954	\$2,372	\$1,418	2.49
AC	Other	Window AC	install efficient window units	ROF	24	Elect	Elect	\$954	\$1,316	\$88	\$14	\$954	\$2,372	\$1,418	2.49
AC	Area 6	Window AC	install efficient window units	ROF	17	Elect	Elect	\$10,496	\$14,473	\$965	\$157	\$10,496	\$26,091	\$15,595	2.49
AC	Area 1W	Window AC	install efficient window units	ROF	4	Elect	Elect	\$4,771	\$6,579	\$439	\$71	\$4,771	\$11,859	\$7,089	2.49
AC	Area 3	Window AC	install efficient window units	ROF	10	Elect	Elect	\$93,506	\$128,943	\$8,600	\$1,394	\$93,506	\$232,444	\$138,938	2.49
AC	Area 2	Window AC	install efficient window units	ROF	7	Elect	Elect	\$1,908	\$2,631	\$176	\$28	\$1,908	\$4,744	\$2,835	2.49
AC	Area 4	Window AC	install efficient window units	ROF	13	Elect	Elect	\$15,266	\$21,052	\$1,404	\$228	\$15,266	\$37,950	\$22,684	2.49
AC	Area IN	Window AC	install efficient window units	ROF	23	Elect	Elect	\$2,862	\$3,947	\$263	\$43	\$2,862	\$7,116	\$4,253	2.49
AC	Area 8	Window AC	install efficient window units	ROF	21	Elect	Elect	\$28,624	\$39,472	\$2,633	\$427	\$28,624	\$71,156	\$42,532	2.49
AC	Area 5	chilled water	install TES	ROF	8	Elect	Elect	\$17,288	\$8,800	\$35,614	\$3,445	\$12,619	\$42,878	\$25,590	2.48
AC	Area 2	chilled water	install TES	ROF	28	Elect	Elect	\$59,274	\$13,602	\$106,350	\$11,810	\$42,434	\$146,993	\$87,720	2.48
Boilers	USAF	Boiler	High Eff Boiler	RI	1	Fuel Oil	Fuel Oil	\$379,225	\$770,033	\$0	\$0	\$165,397	\$935,431	\$556,206	2.47
AC	Area 6	chilled water	install TES	ROF	9	Elect	Elect	\$19,758	\$10,057	\$40,702	\$3,937	\$14,099	\$48,681	\$28,923	2.46
AC	Area 1W	chilled water	install TES	ROF	10	Elect	Elect	\$19,758	\$10,057	\$40,702	\$3,937	\$14,099	\$48,681	\$28,923	2.46
Int light	MWK	FL 2X4 3 60 STD	MH 175 PEND	RI	20	Elect	Elect	\$11,006	\$6,960	\$1,761	\$17,354	na	\$26,075	\$15,069	2.37
Int light	SHOP WPN	FL 2X4 3 60 STD	MH 175 PEND	RI	51	Elect	Elect	\$7,228	\$4,571	\$1,156	\$11,397	na	\$17,124	\$9,896	2.37
Int light	SHOP ELEC	FL 2X4 3 60 STD	MH 175 PEND	RI	48	Elect	Elect	\$214,865	\$135,879	\$34,379	\$338,790	na	\$509,048	\$294,163	2.37
Int light	MTRIXOL	FL 2X4 3 60 STD	MH 175 PEND	RI	17	Elect	Elect	\$6,111	\$24,101	\$6,098	\$60,091	na	\$90,290	\$52,179	2.37
Int light	STOR-INT	FL 2X4 3 60 STD	MH 175 PEND	RI	54	Elect	Elect	\$43,367	\$27,425	\$6,939	\$68,380	na	\$102,744	\$59,376	2.37

Table 3.7
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Present Value of Installed	Present Value of Energy	Present Value of Demand	Present Value of O&M	Present Value of Replacement	Present Value of Total	Net Present	Savings to
								Cost (1993 \$)	Savings (1993 \$)	Savings (1993 \$)	Savings (1993 \$)	Cost Savings (1993 \$)	Savings (1993 \$)	Value (1993 \$)	Value (1993 \$)
Int light	SHOP	11 2X4 3 60 STD	MHI 175 PEND	RI	45	Elect	Elect	\$122 053	\$77 185	\$19 529	\$192 447	na	\$289 161	\$167 108	2 37
Int light	Ext Lights	INC 2-20 W	EXIT - LED	RI	62	Elect	Elect	\$1 317 146	\$1 517 755	\$383 856	\$1 154 456	na	\$3 056 067	\$1 738 921	2 32
AC	Area 3A	chilled water	install TES	ROF	11	Elect	Elect	\$27 167	\$13 828	\$55 965	\$5 413	\$15 466	\$63 016	\$35 849	2 32
AC	Area 8	chilled water	install TES	ROF	50	Elect	Elect	\$562 069	\$104 576	\$764 490	\$125 976	\$517 816	\$1 303 707	\$741 638	2 32
AC	Area 3	chilled water	install TES	ROF	16	Elect	Elect	\$34 576	\$17 599	\$71 229	\$6 889	\$19 600	\$80 118	\$45 542	2 32
AC	Area 3A	chilled water	install TES	ROF	17	Elect	Elect	\$34 576	\$17 599	\$71 229	\$6 889	\$19 600	\$80 118	\$45 542	2 32
Envelope	1748	Envelope	Double Paned Window	RI	18	na	na	\$11 079	\$24 014	\$1 513	\$0	\$0	\$25 527	\$14 448	2 30
Envelope	60600	Envelope	Double Paned Window	RI	23	na	na	\$8 895	\$19 281	\$1 215	\$0	\$0	\$20 496	\$11 601	2 30
Envelope	1724	Envelope	Double Paned Window	RI	17	na	na	\$9 490	\$20 569	\$1 296	\$0	\$0	\$21 866	\$12 376	2 30
Envelope	1645	Envelope	Double Paned Window	RI	14	na	na	\$21 096	\$45 726	\$2 882	\$0	\$0	\$48 608	\$27 512	2 30
Envelope	54915	Envelope	Double Paned Window	RI	21	na	na	\$16 183	\$35 077	\$2 210	\$0	\$0	\$37 287	\$21 104	2 30
Envelope	55005	Envelope	Double Paned Window	RI	22	na	na	\$12 374	\$26 820	\$1 690	\$0	\$0	\$28 510	\$16 137	2 30
Boilers	Navy	Boiler	Replace electric w/ high eff 1 o boiler	RI	8b	Electric	Fuel Oil	\$30 700	\$17 091	\$48 983	\$826	\$5 481	\$70 728	\$40 028	2 30
AC	Area IN	chilled water	install TES	ROF	19	Elect	Elect	\$37 046	\$8 501	\$86 469	\$7 381	\$19 953	\$85 302	\$48 256	2 30
AC	Area 1W	chilled water	install TES	ROF	34	Elect	Elect	\$88 910	\$20 403	\$159 526	\$17 715	\$45 919	\$202 757	\$113 847	2 28
AC	Area 3A	chilled water	install TES	ROF	20	Elect	Elect	\$39 516	\$9 068	\$70 900	\$7 874	\$20 306	\$90 012	\$50 496	2 28
AC	Area 6	chilled water	install TES	ROF	12	Elect	Elect	\$29 637	\$15 085	\$61 053	\$5 905	\$15 614	\$67 487	\$37 850	2 28
AC	Area 8	chilled water	install TES	ROF	13	Elect	Elect	\$29 637	\$15 085	\$61 053	\$5 905	\$15 614	\$67 487	\$37 850	2 28
AC	Area 1W	chilled water	install TES	ROF	14	Elect	Elect	\$29 637	\$15 085	\$61 053	\$5 905	\$15 614	\$67 487	\$37 850	2 28
AC	Area 3A	chilled water	install TES	ROF	38	Elect	Elect	\$105 388	\$20 649	\$122 108	\$23 621	\$113 630	\$238 707	\$133 319	2 27
AC	Area 7	chilled water	install TES	ROF	36	Elect	Elect	\$92 215	\$18 068	\$106 843	\$20 668	\$99 426	\$208 869	\$116 654	2 27
AC	Area 3A	chilled water	install TES	ROF	37	Elect	Elect	\$98 801	\$19 359	\$114 474	\$22 144	\$106 528	\$223 788	\$124 987	2 27
AC	Area 3A	chilled water	install TES	ROF	35	Elect	Elect	\$87 823	\$17 208	\$101 755	\$19 684	\$94 691	\$198 922	\$111 099	2 27
AC	Area 3A	chilled water	install TES	ROF	21	Elect	Elect	\$41 985	\$9 635	\$75 332	\$8 366	\$20 659	\$94 721	\$52 736	2 26
AC	Area 6	chilled water	install TES	ROF	22	Elect	Elect	\$44 455	\$10 202	\$79 763	\$8 858	\$21 012	\$99 431	\$54 976	2 24
AC	Area 1W	Window AC	install efficient window units	ROF	3	Elect	Elect	\$1 156	\$1 316	\$88	\$14	\$1 156	\$2 573	\$1 418	2 23
AC	Area 2	Window AC	install efficient window units	ROF	6	Elect	Elect	\$1 156	\$1 316	\$88	\$14	\$1 156	\$2 573	\$1 418	2 23
AC	Area IN	Window AC	install efficient window units	ROF	22	Elect	Elect	\$1 156	\$1 316	\$88	\$14	\$1 156	\$2 573	\$1 418	2 23
AC	Area 4	Window AC	install efficient window units	ROF	12	Elect	Elect	\$9 246	\$10 526	\$702	\$114	\$9 246	\$20 587	\$11 342	2 23
AC	Area 1	Window AC	install efficient window units	ROF	1	Elect	Elect	\$578	\$658	\$44	\$7	\$578	\$1 287	\$709	2 23
AC	Area 7	Window AC	install efficient window units	ROF	18	Elect	Elect	\$10 979	\$12 500	\$834	\$135	\$10 979	\$24 448	\$13 468	2 23
AC	Area 8	Window AC	install efficient window units	ROF	20	Elect	Elect	\$12 135	\$13 815	\$921	\$149	\$12 135	\$27 021	\$14 886	2 23
AC	Area 5	Window AC	install efficient window units	ROF	14	Elect	Elect	\$2 889	\$3 289	\$219	\$36	\$2 889	\$6 434	\$3 544	2 23
AC	Area 6	Window AC	install efficient window units	ROF	16	Elect	Elect	\$2 889	\$3 289	\$219	\$36	\$2 889	\$6 434	\$3 544	2 23
AC	Area 3	Window AC	install efficient window units	ROF	9	Elect	Elect	\$4 623	\$5 263	\$351	\$57	\$4 623	\$10 294	\$5 671	2 23
AC	Area 3A	chilled water	install TES	ROF	49	Elect	Elect	\$228 341	\$42 484	\$310 574	\$51 178	\$187 281	\$506 550	\$278 209	2 22
AC	Area 3A	chilled water	install TES	ROF	46	Elect	Elect	\$219 558	\$40 850	\$298 629	\$49 210	\$180 078	\$487 067	\$267 509	2 22
AC	Area 7	chilled water	install TES	ROF	25	Elect	Elect	\$51 864	\$11 902	\$93 057	\$10 334	\$23 250	\$114 739	\$62 874	2 21
AC	Area 3A	chilled water	install TES	ROF	26	Elect	Elect	\$54 334	\$12 469	\$97 488	\$10 826	\$24 064	\$119 909	\$65 575	2 21
AC	Area 3	chilled water	install TES	ROF	31	Elect	Elect	\$69 153	\$15 869	\$124 076	\$13 779	\$29 462	\$151 447	\$82 295	2 19
AC	Area 1W	chilled water	install TES	ROF	32	Elect	Elect	\$69 153	\$15 869	\$124 076	\$13 779	\$29 462	\$151 447	\$82 295	2 19
AC	Area 1W	chilled water	install TES	ROF	39	Elect	Elect	\$109 779	\$21 510	\$127 194	\$24 605	\$109 190	\$239 479	\$129 699	2 18
AC	Area 1W	chilled water	install TES	ROF	29	Elect	Elect	\$59 274	\$13 602	\$106 350	\$11 810	\$24 668	\$129 226	\$69 953	2 18
AC	Area 3A	chilled water	install TES	ROF	33	Elect	Elect	\$79 031	\$18 136	\$141 801	\$15 747	\$31 182	\$170 593	\$91 562	2 16
AC	Area 1W	chilled water	install TES	ROF	40	Elect	Elect	\$120 757	\$23 661	\$139 913	\$27 065	\$116 439	\$259 757	\$138 999	2 15
AC	Area 5	chilled water	install TES	ROF	42	Elect	Elect	\$131 735	\$25 812	\$152 633	\$29 526	\$123 660	\$280 007	\$148 272	2 13
AC	Area 1W	chilled water	install TES	ROF	43	Elect	Elect	\$131 735	\$25 812	\$152 633	\$29 526	\$123 660	\$280 007	\$148 272	2 13
AC	Area 5	chilled water	install TES	ROF	44	Elect	Elect	\$140 517	\$27 533	\$162 808	\$31 494	\$129 454	\$296 224	\$155 706	2 11
AC	Area 3A	chilled water	install TES	ROF	45	Elect	Elect	\$140 517	\$27 533	\$162 808	\$31 494	\$129 454	\$296 224	\$155 706	2 11
AC	Area 3A	chilled water	install TES	ROF	47	Elect	Elect	\$164 230	\$32 179	\$190 282	\$36 809	\$147 471	\$342 383	\$178 154	2 08
Envelope	49635	Envelope	Double Paned Window	RI	19	na	na	\$11 298	\$21 329	\$1 344	\$0	\$0	\$22 673	\$11 375	2 01
Envelope	1704	Envelope	Double Paned Window	RI	15	na	na	\$20 270	\$38 266	\$2 411	\$0	\$0	\$40 678	\$20 408	2 01
AC	Area 6	chilled water	install TES	ROF	46	Elect	Elect	\$158 182	\$30 974	\$183 159	\$35 431	\$129 573	\$317 189	\$159 107	2 01
Motors	R&D	Fan Motors	Install Energy Efficient Motor	RI	15	Elec	Elec	\$169 751	\$217 209	\$63 992	\$0	\$45 086	\$326 287	\$156 536	1 92
Motors	TRAINING	Fan Motors	Install Energy Efficient Motor	RI	22	Elec	Elec	\$761	\$974	\$287	\$0	\$202	\$1 464	\$702	1 92
Motors	WHIS	Fan Motors	Install Energy Efficient Motor	RI	23	Elec	Elec	\$53 496	\$68 452	\$20 167	\$0	\$14 208	\$102 827	\$49 331	1 92
Motors	NASOWN	Fan Motors	Install Energy Efficient Motor	RI	11	Elec	Elec	\$102 307	\$130 910	\$38 567	\$0	\$27 173	\$196 650	\$94 343	1 92
Motors	LAB MCD	Fan Motors	Install Energy Efficient Motor	RI	7	Elec	Elec	\$1 656	\$2 119	\$624	\$0	\$440	\$3 182	\$1 527	1 92
Motors	SECURITY	Fan Motors	Install Energy Efficient Motor	RI	17	Elec	Elec	\$5 152	\$6 593	\$1 942	\$0	\$1 368	\$9 903	\$4 751	1 92
Motors	DEFENSE	Fan Motors	Install Energy Efficient Motor	RI	4	Elec	Elec	\$718	\$928	\$278	\$0	\$58	\$418	\$201	1 92
Motors	SHOP WPN	Fan Motors	Install Energy Efficient Motor	RI	20	Elec	Elec	\$707	\$904	\$266	\$0	\$188	\$1 359	\$652	1 92
Motors	OTHER	Fan Motors	Install Energy Efficient Motor	RI	12	Elec	Elec	\$1 315	\$1 682	\$496	\$0	\$349	\$2 527	\$1 212	1 92
Motors	COMMCAIN	Fan Motors	Install Energy Efficient Motor	RI	3	Elec	Elec	\$30 163	\$38 596	\$11 371	\$0	\$8 011	\$57 977	\$27 815	1 92

Table 3.7
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio
Motors	SHOP-ELEC	Fan Motors	Install Energy Efficient Motor	RI	19	Elec	Elec	\$10 586	\$13 545	\$3 990	\$0	\$2 811	\$20 347	\$9 761	1.92
Motors	PLT-EQU	Fan Motors	Install Energy Efficient Motor	RI	14	Elec	Elec	\$9 411	\$12 042	\$3 548	\$0	\$2 499	\$18 089	\$8 678	1.92
Motors	MWR	Fan Motors	Install Energy Efficient Motor	RI	9	Elec	Elec	\$1 864	\$2 386	\$703	\$0	\$495	\$3 584	\$1 719	1.92
Motors	MINPOOL	Fan Motors	Install Energy Efficient Motor	RI	8	Elec	Elec	\$9 378	\$12 000	\$3 535	\$0	\$2 491	\$18 027	\$8 648	1.92
Motors	ADMIN	Fan Motors	Install Energy Efficient Motor	RI	1	Elec	Elec	\$43 489	\$55 648	\$16 354	\$0	\$11 551	\$83 593	\$40 104	1.92
Motors	HANGAR	Fan Motors	Install Energy Efficient Motor	RI	6	Elec	Elec	\$5 561	\$7 115	\$2 096	\$0	\$1 477	\$10 689	\$5 128	1.92
Motors	NASLEAS	Fan Motors	Install Energy Efficient Motor	RI	10	Elec	Elec	\$100 516	\$128 618	\$37 892	\$0	\$26 697	\$193 206	\$92 690	1.92
Motors	PLT BLD	Fan Motors	Install Energy Efficient Motor	RI	13	Elec	Elec	\$4 797	\$6 137	\$1 808	\$0	\$1 274	\$9 220	\$4 423	1.92
Motors	STOR UH	Fan Motors	Install Energy Efficient Motor	RI	21	Elec	Elec	\$21 348	\$27 316	\$8 048	\$0	\$5 670	\$41 034	\$19 686	1.92
Motors	FUELDSP	Fan Motors	Install Energy Efficient Motor	RI	5	Elec	Elec	\$329	\$421	\$124	\$0	\$87	\$633	\$304	1.92
Motors	RESTRNT	Fan Motors	Install Energy Efficient Motor	RI	16	Elec	Elec	\$2 257	\$2 888	\$851	\$0	\$599	\$4 338	\$2 081	1.92
Motors	SHOP	Fan Motors	Install Energy Efficient Motor	RI	18	Elec	Elec	\$30 069	\$38 475	\$11 335	\$0	\$7 986	\$57 797	\$27 728	1.92
Motors	BRK/ADM	Fan Motors	Install Energy Efficient Motor	RI	2	Elec	Elec	\$254	\$326	\$72	\$0	\$68	\$465	\$211	1.83
Int light	ADMIN	FL 2X4 2-34 STD	FL 2X4 2F40T12ES ELC2	RI	1	Elect	Elect	\$259 703	\$301 988	\$121 123	\$50 016	na	\$473 126	\$213 423	1.82
Heatpipes	HANGER R&D	AC/Boilers	Install Heatpipes	RI	3	Elec	Elec	\$92 100	\$165 086	na	na	na	\$165 086	\$72 986	1.79
Boilers	NASA	High Eff Boiler	High Eff Boiler	RI	5	Fuel Oil	Fuel Oil	\$7 000	\$9 382	\$0	\$0	\$2 796	\$12 177	\$5 177	1.74
Motors	Area 3	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	2C	Elec	Elec	\$1 796	\$1 784	\$0	\$0	\$1 336	\$3 120	\$1 325	1.74
Motors	Area 6	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	5C	Elec	Elec	\$5 345	\$5 311	\$0	\$0	\$3 976	\$9 287	\$3 942	1.74
Motors	Area 7	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	6C	Elec	Elec	\$4 190	\$4 184	\$0	\$0	\$3 117	\$7 281	\$3 091	1.74
Motors	Area 1N	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	10C	Elec	Elec	\$7 902	\$7 851	\$0	\$0	\$5 879	\$13 730	\$5 828	1.74
Motors	Area 5	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	4C	Elec	Elec	\$7 526	\$7 477	\$0	\$0	\$5 599	\$13 076	\$5 551	1.74
Motors	Area 3A	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	9C	Elec	Elec	\$34 532	\$34 311	\$0	\$0	\$25 690	\$60 002	\$25 470	1.74
Motors	Area 4	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	3C	Elec	Elec	\$214	\$212	\$0	\$0	\$159	\$371	\$158	1.74
Motors	Area 8	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	7C	Elec	Elec	\$11 459	\$11 386	\$0	\$0	\$8 525	\$19 911	\$8 452	1.74
Motors	Area 1W	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	8C	Elec	Elec	\$11 673	\$11 599	\$0	\$0	\$8 684	\$20 283	\$8 610	1.74
Motors	Area 2	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	1C	Elec	Elec	\$1 026	\$1 020	\$0	\$0	\$763	\$1 783	\$757	1.74
Boilers	USAF	Boiler	High Eff Boiler	RI	4	Fuel Oil	Fuel Oil	\$15 600	\$20 907	\$0	\$0	\$5 145	\$26 052	\$10 452	1.67
AC	Area 3	direct expansion	install TES	ROF	51	Elect	Elect	\$49 395	\$12 571	\$50 878	\$4 921	\$25 749	\$68 976	\$19 581	1.40
AC	Area 6	direct expansion	install TES	ROF	53	Elect	Elect	\$49 395	\$12 571	\$50 878	\$4 921	\$25 749	\$68 976	\$19 581	1.40
AC	Area 7	direct expansion	install TES	ROF	54	Elect	Elect	\$49 395	\$12 571	\$50 878	\$4 921	\$25 749	\$68 976	\$19 581	1.40
Int light	OTHER	FL 2X4 3-60 STD	MH 175 PEND	RI	26	Elect	Elect	\$19 877	\$7 001	\$3 180	\$16 408	na	\$26 589	\$6 712	1.34
Int light	TRAINING	FL 2X4 3-60 STD	MH 175 PEND	RI	57	Elect	Elect	\$22 341	\$7 869	\$3 575	\$18 442	na	\$29 885	\$7 544	1.34
AC	Area 7	direct expansion	install TES	ROF	59	Elect	Elect	\$59 274	\$15 085	\$61 053	\$5 905	\$26 354	\$78 227	\$18 954	1.32
AC	Area 8	direct expansion	install TES	ROF	60	Elect	Elect	\$59 274	\$15 085	\$61 053	\$5 905	\$26 354	\$78 227	\$18 954	1.32
AC	Area 1W	direct expansion	install TES	ROF	61	Elect	Elect	\$59 274	\$15 085	\$61 053	\$5 905	\$26 354	\$78 227	\$18 954	1.32
AC	Area 1W	direct expansion	install TES	ROF	74	Elect	Elect	\$118 547	\$30 170	\$122 106	\$11 810	\$51 930	\$155 676	\$37 128	1.31
AC	Area 7	direct expansion	install TES	ROF	63	Elect	Elect	\$69 153	\$17 599	\$71 229	\$6 869	\$28 024	\$88 542	\$19 390	1.28
AC	Area 1N	direct expansion	install TES	ROF	67	Elect	Elect	\$79 031	\$20 114	\$81 404	\$7 874	\$29 694	\$98 858	\$19 826	1.25
AC	Area 5	direct expansion	install TES	ROF	77	Elect	Elect	\$158 063	\$18 136	\$141 801	\$15 747	\$53 781	\$193 192	\$35 129	1.22
AC	Area 7	direct expansion	install TES	ROF	70	Elect	Elect	\$98 789	\$25 142	\$101 755	\$9 842	\$34 262	\$120 717	\$21 927	1.22
Int light	PLT BLD control boards	FL 2X4 3-60 STD	MH 175 PEND	RI	29	Elect	Elect	\$15 606	\$4 659	\$1 748	\$10 537	na	\$16 944	\$1 338	1.09
Int light	PLT BLD general	FL 2X4 3-60 STD	MH 175 PEND	RI	28	Elect	Elect	\$118 439	\$35 361	\$13 265	\$79 971	na	\$128 597	\$10 158	1.09
Int light	PLT EQU	FL 2X4 3-60 STD	MH 175 PEND	RI	31	Elect	Elect	\$138 315	\$41 295	\$15 491	\$93 392	na	\$150 178	\$11 863	1.09
AC	Area 3A	chilled water	Install Efficient Chillers	RI	30	Elec	Elec	\$123 250	\$60 334	\$12 104	\$0	\$56 716	\$129 153	\$5 903	1.05
AC	Area 3A	chilled water	Install Efficient Chillers	RI	27	Elec	Elec	\$114 500	\$55 507	\$11 136	\$0	\$52 689	\$119 332	\$4 832	1.04
AC	Area 5	chilled water	Install Efficient Chillers	RI	23	Elec	Elec	\$102 000	\$48 267	\$9 683	\$0	\$46 937	\$104 887	\$2 887	1.03
AC	Area 3A	chilled water	Install Efficient Chillers	RI	24	Elec	Elec	\$102 000	\$48 267	\$9 683	\$0	\$46 937	\$104 887	\$2 887	1.03
Int light	WHIS	FL 2X4 3-60 STD	MH 175 PEND	RI	59	Elect	Elect	\$108 582	\$28 577	\$17 373	\$64 022	na	\$109 973	\$1 390	1.01
Total								\$16 589 658	\$25 557 604	\$17 924 377	\$649 066	\$4 815 864	\$48 946 911	\$32 357 253	2.95

Table 3.6
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Annualized Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Annualized Installed Cost (1993 \$)	Annualized Energy Savings (1993 \$)	Annualized Demand Savings (1993 \$)	Annualized O&M Savings (1993 \$)	Annualized Replacement Cost Savings (1993 \$)	Annualized Total Savings (1993 \$)	Annualized Net Savings (1993 \$)	Savings to Investment Ratio
Boilers	NASA	Boiler	Replace electric w/ high eff 1 o bo	RI	7b	Electric	Fuel Oil	\$2 567	\$8 361	\$23 968	\$53	\$561	\$32 837	\$30 270	12.79
Boilers	USAF	Boiler	Replace electric w/ high eff 1 o bo	RI	9b	Electric	Fuel Oil	\$6 216	\$17 259	\$49 479	\$53	\$1 748	\$68 433	\$62 218	11.01
Heatpipes	SSA LAB	AC/Boilers	Install Heatpipes	RI	13	Elec	Elec	\$4 225	\$33 739	\$0	\$0	\$0	\$33 739	\$29 515	7.99
Boilers	USAF	Boiler	Replace electric w/ high eff 1 o bo	RI	6b	Electric	Fuel Oil	\$10 368	\$18 668	\$53 520	\$132	\$2 254	\$74 309	\$63 940	7.17
Envelope	Other	Envelope	Weatherization Package	RI	37	na	na	\$719	\$2 698	\$1 727	\$0	\$0	\$4 425	\$3 706	6.15
Heatpipes	RCT STOR BLD	AC/Boilers	Install Heatpipes	RI	12	Fuel Oil	Fuel Oil	\$826	\$4 564	\$0	\$0	\$0	\$4 564	\$3 738	5.53
Heatpipes	HANGER N	AC/Boilers	Install Heatpipes	RI	6	Fuel Oil	Fuel Oil	\$4 801	\$26 449	\$0	\$0	\$0	\$26 449	\$21 648	5.51
Heatpipes	CX 41	AC/Boilers	Install Heatpipes	RI	9	Fuel Oil	Fuel Oil	\$1 824	\$9 704	\$0	\$0	\$0	\$9 704	\$7 880	5.32
Heatpipes	COMIM CTL FAC	AC/Boilers	Install Heatpipes	RI	27	Fuel Oil	Fuel Oil	\$1 997	\$10 623	\$0	\$0	\$0	\$10 623	\$8 626	5.32
Heatpipes	TGSH	AC/Boilers	Install Heatpipes	RI	10	Fuel Oil	Fuel Oil	\$3 618	\$19 244	\$0	\$0	\$0	\$19 244	\$15 626	5.32
Heatpipes	MANJEX	AC/Boilers	Install Heatpipes	RI	14	Fuel Oil	Fuel Oil	\$3 073	\$16 343	\$0	\$0	\$0	\$16 343	\$13 271	5.32
Heatpipes	NK VI CK BLD	AC/Boilers	Install Heatpipes	RI	22	Fuel Oil	Fuel Oil	\$800	\$4 256	\$0	\$0	\$0	\$4 256	\$3 456	5.32
Heatpipes	HANGER L	AC/Boilers	Install Heatpipes	RI	7	Elec	Elec	\$1 792	\$9 323	\$0	\$0	\$0	\$9 323	\$7 531	5.20
Generator	Titan Substation	Generator	DGEN 2	RI	2	na	Diesel	\$2 948	\$11 289	\$30 591	\$3 966	\$0	\$15 336	\$12 387	5.20
Heatpipes	CTL COMP COM	AC/Boilers	Install Heatpipes	RI	11	Fuel Oil	Fuel Oil	\$4 814	\$24 940	\$0	\$0	\$0	\$24 940	\$20 126	5.18
Heatpipes	CX 30 BLKISE	AC/Boilers	Install Heatpipes	RI	17	Fuel Oil	Fuel Oil	\$2 560	\$13 224	\$0	\$0	\$0	\$13 224	\$10 664	5.16
Heatpipes	WASKIB BD AC	AC/Boilers	Install Heatpipes	RI	15	Fuel Oil	Fuel Oil	\$11 522	\$59 509	\$0	\$0	\$0	\$59 509	\$47 987	5.16
Heatpipes	SMAB WEST	AC/Boilers	Install Heatpipes	RI	25	Fuel Oil	Fuel Oil	\$11 445	\$59 113	\$0	\$0	\$0	\$59 113	\$47 667	5.16
Heatpipes	HANGER AE	AC/Boilers	Install Heatpipes	RI	19	Fuel Oil	Fuel Oil	\$10 325	\$53 327	\$0	\$0	\$0	\$53 327	\$43 002	5.16
Int light	FUELDSP	INC 60 CEIL	CFL 13 + BLST UNIT	RI	10	Elect	Elect	\$67	\$355	\$90	\$106	\$0	\$339	\$272	5.04
Int light	SECURITY other	INC 60 CEIL	CFL 13 + BLST UNIT	RI	44	Elect	Elect	\$267	\$1 409	\$357	\$422	\$0	\$1 344	\$1 077	5.04
Int light	SHOP WPN	INC 60 CEIL	CFL 13 + BLST UNIT	RI	53	Elect	Elect	\$365	\$1 930	\$488	\$578	\$0	\$1 840	\$1 475	5.04
Int light	HANGAR	INC 60 CEIL	CFL 13 + BLST UNIT	RI	13	Elect	Elect	\$1 140	\$6 017	\$1 522	\$1 801	\$0	\$5 739	\$4 599	5.04
Int light	MTRPOOL	INC 60 CEIL	CFL 13 + BLST UNIT	RI	19	Elect	Elect	\$1 940	\$10 245	\$2 592	\$3 667	\$0	\$9 770	\$7 830	5.04
Int light	STOR-UH	INC 60 CEIL	CFL 13 + BLST UNIT	RI	56	Elect	Elect	\$2 207	\$11 654	\$2 949	\$3 488	\$0	\$11 114	\$8 907	5.04
Int light	SECURITY record	INC 60 CEIL	CFL 13 + BLST UNIT	RI	43	Elect	Elect	\$2 664	\$14 066	\$3 559	\$4 210	\$0	\$13 414	\$10 751	5.04
Int light	SHOP	INC 60 CEIL	CFL 13 + BLST UNIT	RI	47	Elect	Elect	\$6 220	\$32 842	\$8 309	\$9 831	\$0	\$31 321	\$25 101	5.04
Int light	MWR	INC 60 CEIL	CFL 13 + BLST UNIT	RI	21	Elect	Elect	\$385	\$2 031	\$514	\$608	\$0	\$1 937	\$1 552	5.04
Int light	SHOP-ELEC	INC 60 CEIL	CFL 13 + BLST UNIT	RI	50	Elect	Elect	\$10 947	\$57 800	\$14 624	\$17 301	\$0	\$55 123	\$44 176	5.04
Heatpipes	HANGER S	AC/Boilers	Install Heatpipes	RI	5	Fuel Oil	Fuel Oil	\$8 962	\$43 494	\$0	\$0	\$0	\$43 494	\$34 533	4.85
Heatpipes	HANGER AO-AM	AC/Boilers	Install Heatpipes	RI	18	Fuel Oil	Fuel Oil	\$8 328	\$39 686	\$0	\$0	\$0	\$39 686	\$31 358	4.77
Heatpipes	VIB	AC/Boilers	Install Heatpipes	RI	26	Fuel Oil	Fuel Oil	\$11 791	\$55 971	\$0	\$0	\$0	\$55 971	\$44 180	4.75
Heatpipes	RCC MECH BLD	AC/Boilers	Install Heatpipes	RI	2	Fuel Oil	Fuel Oil	\$8 322	\$39 286	\$0	\$0	\$0	\$39 286	\$30 965	4.72
Generator	N Substation	Generator	DGEN 7	RI	7	na	Diesel	\$14 404	\$54 295	\$152 957	\$35 194	\$0	\$63 469	\$49 064	4.41
Int light	HANGAR	FL 2X4 4 40 STD	FL 2X4 3F32T8 ELC3 REF	RI	11	Elect	Elect	\$3 075	\$10 707	\$2 709	\$3	\$0	\$13 413	\$10 338	4.36
Int light	FUELDSP	FL 2X4 4 40 STD	FL 2X4 3F32T8 ELC3 REF	RI	9	Elect	Elect	\$113	\$392	\$99	\$0	\$0	\$491	\$378	4.36
Int light	LAB MED	INC 60 CEIL	CFL 13 + BLST UNIT	RI	16	Elect	Elect	\$341	\$1 392	\$456	\$395	\$0	\$1 453	\$1 112	4.26
Int light	RESTINT cashier	INC 60 CEIL	CFL 13 + BLST UNIT	RI	38	Elect	Elect	\$46	\$182	\$61	\$51	\$0	\$192	\$146	4.20
Int light	RESTINT cleaning	INC 60 CEIL	CFL 13 + BLST UNIT	RI	39	Elect	Elect	\$46	\$182	\$61	\$51	\$0	\$192	\$146	4.20
Int light	RESTINT cleaning	INC 60 CEIL	CFL 13 + BLST UNIT	RI	40	Elect	Elect	\$82	\$326	\$109	\$92	\$0	\$343	\$262	4.20
Generator	S Substation	Generator	DGEN 4	RI	4	na	Diesel	\$6 539	\$22 349	\$61 183	\$11 938	\$0	\$26 895	\$20 356	4.11
Heatpipes	CX 41 AC SHIR	AC/Boilers	Install Heatpipes	RI	8	Elec	Elec	\$28 982	\$113 679	\$0	\$0	\$0	\$113 679	\$84 697	3.92
Int light	NASILEAS	INC 60 CEIL	CFL 13 + BLST UNIT	RI	23	Elect	Elect	\$20 790	\$69 246	\$27 774	\$18 850	\$0	\$78 169	\$57 379	3.76
Int light	ADMIN	INC 60 CEIL	CFL 13 + BLST UNIT	RI	2	Elect	Elect	\$22 487	\$74 900	\$30 041	\$20 390	\$0	\$84 552	\$62 064	3.76
Int light	NASOWN	INC 60 CEIL	CFL 13 + BLST UNIT	RI	25	Elect	Elect	\$21 160	\$70 479	\$28 268	\$19 186	\$0	\$79 562	\$58 401	3.76
Int light	LAB MED	FL 2X4 4 40 STD	FL 2X4 3F32T8 ELC3 REF	RI	14	Elect	Elect	\$1 894	\$5 091	\$1 668	\$87	\$0	\$6 847	\$4 953	3.62
Int light	BRK/ADM	INC 60 CEIL	CFL 18 GLOBE UNIT	RI	4	Elect	Elect	\$43	\$166	\$62	\$74	\$0	\$154	\$111	3.55
Int light	RESTINT cashier	FL 2X4 4 34 STD	FL 2X4 3F40T12 ELC3	RI	35	Elect	Elect	\$50	\$121	\$41	\$14	\$0	\$176	\$126	3.54
Int light	RESTINT cleaning	FL 2X4 4 34 STD	FL 2X4 3F40T12 ELC3	RI	36	Elect	Elect	\$50	\$121	\$41	\$14	\$0	\$176	\$126	3.54
Int light	RESTINT cleaning	FL 2X4 4 34 STD	FL 2X4 3F40T12 ELC3	RI	37	Elect	Elect	\$89	\$218	\$73	\$26	\$0	\$317	\$227	3.54
Int light	TRAINING	INC 60 CEIL	CFL 13 + BLST UNIT	RI	58	Elect	Elect	\$786	\$2 312	\$1 050	\$605	\$0	\$2 757	\$1 971	3.51
Int light	OTHER	INC 60 CEIL	CFL 13 + BLST UNIT	RI	27	Elect	Elect	\$700	\$2 058	\$935	\$538	\$0	\$2 454	\$1 754	3.51
Int light	COMCATN	INC 60 CEIL	CFL 13 + BLST UNIT	RI	6	Elect	Elect	\$15 597	\$45 868	\$20 836	\$12 001	\$0	\$54 703	\$39 106	3.51
Int light	R&D	INC 60 CEIL	CFL 13 + BLST UNIT	RI	34	Elect	Elect	\$16 811	\$49 438	\$22 458	\$12 935	\$0	\$58 961	\$42 150	3.51
AC	Area 1W	heat pump	install TES	ROF	84	Elect	Elect	\$3 162	\$1 796	\$630	\$0	\$4 780	\$10 941	\$7 779	3.46
Int light	DET RR	INC 60 CEIL	CFL 13 + BLST UNIT	RI	8	Elect	Elect	\$75	\$180	\$100	\$45	\$0	\$235	\$161	3.15
Int light	NASOWN	FL 2X4 4 34 STD	FL 2X4 3F40T12 ELC3	RI	24	Elect	Elect	\$23 402	\$47 566	\$19 078	\$7 013	\$0	\$73 658	\$50 256	3.15
Int light	NASILEAS	FL 2X4 4 34 STD	FL 2X4 3F40T12 ELC3	RI	22	Elect	Elect	\$22 990	\$46 728	\$18 742	\$6 840	\$0	\$72 359	\$49 370	3.15
AC	Area 5	direct expansion	install TES	ROF	52	Elect	Elect	\$790	\$402	\$1 628	\$157	\$1 014	\$2 397	\$1 607	3.03
AC	Area 8	direct expansion	install TES	ROF	55	Elect	Elect	\$790	\$402	\$1 628	\$157	\$1 014	\$2 397	\$1 607	3.03
Int light	WHS	INC 60 CEIL	CFL 13 + BLST UNIT	RI	61	Elect	Elect	\$5 532	\$12 157	\$7 391	\$2 899	\$0	\$16 648	\$11 116	3.01
Int light	COMCATN	FL 2X4 4 34 STD	FL 2X4 3F40T12 ELC3	RI	5	Elect	Elect	\$17 247	\$30 952	\$14 060	\$9 238	\$0	\$50 251	\$33 004	2.91
Int light	R&D	FL 2X4 4 34 STD	FL 2X4 3F40T12 ELC3	RI	33	Elect	Elect	\$24 789	\$44 488	\$29 209	\$7 527	\$0	\$72 226	\$47 436	2.91
AC	Area 4	chilled water	install TES	ROF	1	Elect	Elect	\$790	\$402	\$1 628	\$157	\$901	\$2 285	\$1 494	2.89
AC	Area 5	chilled water	install TES	ROF	2	Elect	Elect	\$790	\$402	\$1 628	\$157	\$901	\$2 285	\$1 494	2.89
AC	Area 6	chilled water	install TES	ROF	3	Elect	Elect	\$790	\$402	\$1 628	\$157	\$901	\$2 285	\$1 494	2.89
AC	Area 3A	chilled water	install TES	ROF	5	Elect	Elect	\$790	\$402	\$1 628	\$157	\$901	\$2 285	\$1 494	2.89

Table 3.8
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Annualized Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Annualized Installed Cost (1993 \$)	Annualized Energy Savings (1993 \$)	Annualized Demand Savings (1993 \$)	Annualized O&M Savings (1993 \$)	Annualized Replacement Cost Savings (1993 \$)	Annualized Total Savings (1993 \$)	Annualized Net Savings (1993 \$)	Savings to Investment Ratio
AC	Area 5	direct expansion	install TES	ROF	58	Elect	Elect	\$949	-\$483	\$1,954	\$189	\$1,071	\$2,731	\$1,783	2.88
AC	Area 7	chilled water	install TES	ROF	4	Elect	Elect	\$790	-\$402	\$1,628	\$157	\$890	\$2,274	\$1,483	2.88
AC	Area 3A	direct expansion	install TES	ROF	75	Elect	Elect	\$1,897	-\$966	\$3,908	\$378	\$2,117	\$5,438	\$3,541	2.87
Int light	SECURITY records	FL 2X4 4 34 STD	FL 2X4 3F32T8 ELC3 REF	RI	41	Elect	Elect	\$5,560	\$12,547	\$3,174	\$142	\$0	\$15,864	\$10,304	2.85
Int light	SECURITY other	FL 2X4 4 34 STD	FL 2X4 3F32T8 ELC3 REF	RI	42	Elect	Elect	\$553	\$1,248	\$316	\$14	\$0	\$1,578	\$1,025	2.85
Int light	PLT-BLD	INC 60 CEIL	CFL 13 + BLST UNIT	RI	30	Elect	Elect	\$4,167	\$10,387	\$3,896	\$2,565	\$0	\$11,718	\$7,552	2.81
Int light	PLT EQU	INC 60 CEIL	CFL 13 + BLST UNIT	RI	32	Elect	Elect	\$4,866	\$12,131	\$4,551	\$2,996	\$0	\$13,686	\$8,820	2.81
AC	Area 3A	direct expansion	install TES	ROF	64	Elect	Elect	\$1,107	-\$563	\$2,280	\$220	\$1,163	\$3,099	\$1,993	2.80
AC	Area 5	direct expansion	install TES	ROF	65	Elect	Elect	\$1,265	-\$644	\$2,605	\$252	\$1,254	\$3,468	\$2,203	2.74
Envelope		60740 Envelope	Double Paned Window	RI	24	na	na	\$360	\$917	\$58	\$0	\$0	\$974	\$614	2.70
Envelope		49750 Envelope	Double Paned Window	RI	20	na	na	\$442	\$1,125	\$71	\$0	\$0	\$1,196	\$754	2.70
Envelope		1641 Envelope	Double Paned Window	RI	13	na	na	\$1,029	\$2,619	\$165	\$0	\$0	\$2,784	\$1,754	2.70
Envelope		1722 Envelope	Double Paned Window	RI	16	na	na	\$479	\$1,220	\$77	\$0	\$0	\$1,297	\$817	2.70
AC	Area 3A	direct expansion	install TES	ROF	78	Elect	Elect	\$2,529	-\$580	\$4,538	\$504	\$2,328	\$6,790	\$4,261	2.68
AC	Area 1	direct expansion	install TES	ROF	68	Elect	Elect	\$1,581	-\$805	\$3,257	\$315	\$1,476	\$4,243	\$2,662	2.68
AC	Area 6	direct expansion	install TES	ROF	69	Elect	Elect	\$1,581	-\$805	\$3,257	\$315	\$1,476	\$4,243	\$2,662	2.68
AC	Area 3A	direct expansion	install TES	ROF	72	Elect	Elect	\$1,581	-\$805	\$3,257	\$315	\$1,476	\$4,243	\$2,662	2.68
AC	Area 1N	direct expansion	install TES	ROF	76	Elect	Elect	\$1,897	-\$966	\$3,908	\$378	\$1,760	\$5,081	\$3,184	2.68
Boilers	NASA	Boiler	High Eff Boiler	RI	2	Fuel Oil	Fuel Oil	\$9,639	\$21,335	\$0	\$0	\$4,343	\$25,678	\$16,039	2.66
AC	Area 2	direct expansion	install TES	ROF	79	Elect	Elect	\$3,162	-\$726	\$5,673	\$630	\$2,841	\$8,419	\$5,257	2.66
AC	Area 4	direct expansion	install TES	ROF	80	Elect	Elect	\$3,162	-\$726	\$5,673	\$630	\$2,841	\$8,419	\$5,257	2.66
AC	Area 1W	direct expansion	install TES	ROF	81	Elect	Elect	\$3,162	-\$726	\$5,673	\$630	\$2,841	\$8,419	\$5,257	2.66
AC	Area 3A	direct expansion	install TES	ROF	82	Elect	Elect	\$3,162	-\$726	\$5,673	\$630	\$2,841	\$8,419	\$5,257	2.66
AC	Area 6	chilled water	install TES	ROF	6	Elect	Elect	\$949	-\$483	\$1,954	\$189	\$864	\$2,524	\$1,576	2.66
Heatpipes	PSL	AC/Boilers	Install Heatpipes	RI	4	Fuel Oil	Fuel Oil	\$4,442	\$11,815	\$0	\$0	\$0	\$11,815	\$7,373	2.66
Heatpipes	DELTA SPN BD	AC/Boilers	Install Heatpipes	RI	23	Fuel Oil	Fuel Oil	\$2,689	\$7,150	\$0	\$0	\$0	\$7,150	\$4,462	2.66
Heatpipes	OPTICS LAB	AC/Boilers	Install Heatpipes	RI	1	Fuel Oil	Fuel Oil	\$3,828	\$10,181	\$0	\$0	\$0	\$10,181	\$6,353	2.66
Heatpipes	CTL BD SP TS	AC/Boilers	Install Heatpipes	RI	24	Fuel Oil	Fuel Oil	\$1,299	\$3,456	\$0	\$0	\$0	\$3,456	\$2,157	2.66
Heatpipes	GPS PROP FAC	AC/Boilers	Install Heatpipes	RI	16	Fuel Oil	Fuel Oil	\$2,708	\$7,201	\$0	\$0	\$0	\$7,201	\$4,494	2.66
AC	Area 3A	direct expansion	install TES	ROF	73	Elect	Elect	\$1,739	-\$885	\$3,582	\$346	\$1,508	\$4,552	\$2,813	2.62
AC	Area 3	direct expansion	install TES	ROF	83	Elect	Elect	\$3,984	-\$914	\$7,148	\$794	\$3,364	\$10,392	\$6,403	2.61
Int light	DET RR	FL 2X4 4 34 STD	FL 2X4 3F40T12 ELC3	RI	7	Elect	Elect	\$15	\$22	\$12	\$5	\$0	\$39	\$24	2.60
Heatpipes	HANGER AF	AC/Boilers	Install Heatpipes	RI	21	Fuel Oil	Fuel Oil	\$10,709	\$27,655	\$0	\$0	\$0	\$27,655	\$16,946	2.58
Heatpipes	MIS CK BD AK	AC/Boilers	Install Heatpipes	RI	20	Fuel Oil	Fuel Oil	\$6,875	\$17,754	\$0	\$0	\$0	\$17,754	\$10,879	2.58
AC	Area 1W	Window AC	install efficient window units	ROF	5	Elect	Elect	\$86	\$126	\$8	\$1	\$86	\$223	\$136	2.58
AC	Area 2	Window AC	install efficient window units	ROF	8	Elect	Elect	\$173	\$253	\$17	\$3	\$173	\$445	\$272	2.58
AC	Area 3	Window AC	install efficient window units	ROF	11	Elect	Elect	\$259	\$379	\$25	\$4	\$259	\$668	\$408	2.58
Boilers	Navy	Boiler	High Eff Boiler	RI	3	Fuel Oil	Fuel Oil	\$2,732	\$5,716	\$0	\$0	\$1,167	\$6,883	\$4,151	2.52
AC	Area 7	Window AC	install efficient window units	ROF	19	Elect	Elect	\$428	\$590	\$39	\$6	\$428	\$1,063	\$635	2.49
AC	Area 5	Window AC	install efficient window units	ROF	15	Elect	Elect	\$1,893	\$2,611	\$174	\$28	\$1,893	\$4,707	\$2,813	2.49
AC	Area 1	Window AC	install efficient window units	ROF	2	Elect	Elect	\$61	\$84	\$6	\$1	\$61	\$152	\$91	2.49
AC	Other	Window AC	install efficient window units	ROF	24	Elect	Elect	\$61	\$84	\$6	\$1	\$61	\$152	\$91	2.49
AC	Area 6	Window AC	install efficient window units	ROF	17	Elect	Elect	\$672	\$926	\$62	\$10	\$672	\$1,670	\$998	2.49
AC	Area 1W	Window AC	install efficient window units	ROF	4	Elect	Elect	\$305	\$421	\$28	\$5	\$305	\$759	\$454	2.49
AC	Area 3	Window AC	install efficient window units	ROF	10	Elect	Elect	\$5,985	\$8,254	\$551	\$89	\$5,985	\$14,879	\$8,894	2.49
AC	Area 2	Window AC	install efficient window units	ROF	7	Elect	Elect	\$122	\$168	\$11	\$2	\$122	\$304	\$182	2.49
AC	Area 4	Window AC	install efficient window units	ROF	13	Elect	Elect	\$977	\$1,348	\$90	\$15	\$977	\$2,429	\$1,452	2.49
AC	Area 1N	Window AC	install efficient window units	ROF	23	Elect	Elect	\$183	\$253	\$17	\$3	\$183	\$455	\$272	2.49
AC	Area 8	Window AC	install efficient window units	ROF	21	Elect	Elect	\$1,832	\$2,527	\$169	\$27	\$1,832	\$4,555	\$2,723	2.49
AC	Area 5	chilled water	install TES	ROF	8	Elect	Elect	\$1,107	-\$563	\$2,280	\$220	\$808	\$2,745	\$1,638	2.48
AC	Area 2	chilled water	install TES	ROF	28	Elect	Elect	\$3,794	-\$871	\$6,808	\$756	\$2,716	\$9,409	\$5,615	2.48
Boilers	USAF	Boiler	High Eff Boiler	RI	1	Fuel Oil	Fuel Oil	\$24,275	\$49,291	\$0	\$0	\$10,587	\$59,879	\$35,604	2.47
AC	Area 6	chilled water	install TES	ROF	9	Elect	Elect	\$1,265	-\$644	\$2,605	\$252	\$903	\$3,116	\$1,851	2.46
AC	Area 1W	chilled water	install TES	ROF	10	Elect	Elect	\$1,265	-\$644	\$2,605	\$252	\$903	\$3,116	\$1,851	2.46
Int light	MWK	FL 2X4 3 60 STD	MH 175 PEND	RI	20	Elect	Elect	\$705	\$446	\$113	\$1,111	\$0	\$1,669	\$965	2.37
Int light	SHOP WPN	FL 2X4 3 60 STD	MH 175 PEND	RI	51	Elect	Elect	\$463	\$293	\$74	\$730	\$0	\$1,096	\$633	2.37
Int light	SHOP ELEC	FL 2X4 3 60 STD	MH 175 PEND	RI	48	Elect	Elect	\$13,754	\$8,698	\$2,201	\$21,687	\$0	\$32,585	\$18,831	2.37
Int light	MTRPOOL	FL 2X4 3 60 STD	MH 175 PEND	RI	17	Elect	Elect	\$2,440	\$1,543	\$390	\$3,847	\$0	\$5,780	\$3,340	2.37
Int light	STOR-UH	FL 2X4 3 60 STD	MH 175 PEND	RI	54	Elect	Elect	\$2,776	\$1,756	\$444	\$4,377	\$0	\$6,577	\$3,801	2.37
Int light	SHOP	FL 2X4 3 60 STD	MH 175 PEND	RI	45	Elect	Elect	\$7,813	\$4,941	\$1,250	\$12,319	\$0	\$18,510	\$10,697	2.37
Int light	Exit Lights	INC 2 20 W	EXIT - LED	RI	62	Elect	Elect	\$84,313	\$97,154	\$24,571	\$73,699	\$0	\$195,625	\$111,312	2.32
AC	Area 3A	chilled water	install TES	ROF	11	Elect	Elect	\$1,739	-\$885	\$3,582	\$346	\$990	\$4,034	\$2,295	2.32
AC	Area 8	chilled water	install TES	ROF	50	Elect	Elect	\$35,979	-\$6,694	\$48,937	\$8,064	\$33,146	\$83,453	\$47,474	2.32
AC	Area 3	chilled water	install TES	ROF	16	Elect	Elect	\$2,213	\$1,127	\$4,559	\$441	\$1,255	\$5,129	\$2,915	2.32
AC	Area 3A	chilled water	install TES	ROF	17	Elect	Elect	\$2,213	\$1,127	\$4,559	\$441	\$1,255	\$5,129	\$2,915	2.32
Envelope		1748 Envelope	Double Paned Window	RI	18	na	na	\$709	\$1,537	\$97	\$0	\$0	\$1,634	\$925	2.30
Envelope		60600 Envelope	Double Paned Window	RI	23	na	na	\$509	\$1,234	\$78	\$0	\$0	\$1,312	\$743	2.30

Table 3.8
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource. Annualized Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Annualized Installed Cost (1993 \$)	Annualized Energy Savings (1993 \$)	Annualized Demand Savings (1993 \$)	Annualized O&M Savings (1993 \$)	Annualized Replacement Cost Savings (1993 \$)	Annualized Total Savings (1993 \$)	Annualized Net Savings (1993 \$)	Savings to Investment Ratio
Envelope		1724 Envelope	Double Paned Window	RI	17	na	na	\$607	\$1,317	\$83	\$0	\$0	\$1,400	\$792	2.30
Envelope		1645 Envelope	Double Paned Window	RI	14	na	na	\$1,350	\$2,927	\$184	\$0	\$0	\$3,111	\$1,761	2.30
Envelope		54915 Envelope	Double Paned Window	RI	21	na	na	\$1,036	\$2,245	\$141	\$0	\$0	\$2,387	\$1,351	2.30
Envelope		55005 Envelope	Double Paned Window	RI	22	na	na	\$792	\$1,717	\$108	\$0	\$0	\$1,825	\$1,033	2.30
Boilers	Navy	Boiler	Replace electric w/ high eff. oil boiler	RI	8b	Electric	Fuel Oil	\$1,965	\$1,094	\$3,135	-\$53	\$351	\$4,527	\$2,562	2.30
AC	Area 1N	chilled water	install TES	ROF	19	Elect	Elect	\$2,371	-\$544	\$4,255	\$473	\$1,277	\$5,460	\$3,089	2.30
AC	Area 1W	chilled water	install TES	ROF	34	Elect	Elect	\$5,691	-\$1,306	\$10,212	\$1,134	\$2,939	\$12,979	\$7,288	2.28
AC	Area 3A	chilled water	install TES	ROF	20	Elect	Elect	\$2,529	-\$580	\$4,538	\$504	\$1,300	\$5,762	\$3,232	2.28
AC	Area 6	chilled water	install TES	ROF	12	Elect	Elect	\$1,897	-\$966	\$3,908	\$378	\$999	\$4,320	\$2,423	2.28
AC	Area 8	chilled water	install TES	ROF	13	Elect	Elect	\$1,897	-\$966	\$3,908	\$378	\$999	\$4,320	\$2,423	2.28
AC	Area 1W	chilled water	install TES	ROF	14	Elect	Elect	\$1,897	-\$966	\$3,908	\$378	\$999	\$4,320	\$2,423	2.28
AC	Area 3A	chilled water	install TES	ROF	38	Elect	Elect	\$6,746	-\$1,322	\$7,616	\$1,512	\$7,274	\$15,280	\$8,534	2.27
AC	Area 7	chilled water	install TES	ROF	36	Elect	Elect	\$5,903	-\$1,157	\$6,839	\$1,323	\$6,364	\$13,370	\$7,467	2.27
AC	Area 3A	chilled water	install TES	ROF	37	Elect	Elect	\$6,324	-\$1,239	\$7,328	\$1,417	\$6,819	\$14,325	\$8,001	2.27
AC	Area 3A	chilled water	install TES	ROF	35	Elect	Elect	\$5,622	-\$1,102	\$6,514	\$1,260	\$6,061	\$12,733	\$7,112	2.27
AC	Area 3A	chilled water	install TES	ROF	21	Elect	Elect	\$2,688	-\$617	\$4,822	\$536	\$1,322	\$6,063	\$3,376	2.26
AC	Area 6	chilled water	install TES	ROF	22	Elect	Elect	\$2,846	-\$653	\$5,106	\$567	\$1,345	\$6,365	\$3,519	2.24
AC	Area 1W	Window AC	install efficient window units	ROF	3	Elect	Elect	\$74	\$84	\$6	\$1	\$74	\$165	\$91	2.23
AC	Area 2	Window AC	install efficient window units	ROF	6	Elect	Elect	\$74	\$84	\$6	\$1	\$74	\$165	\$91	2.23
AC	Area 1N	Window AC	install efficient window units	ROF	22	Elect	Elect	\$74	\$84	\$6	\$1	\$74	\$165	\$91	2.23
AC	Area 4	Window AC	install efficient window units	ROF	12	Elect	Elect	\$592	\$674	\$45	\$7	\$592	\$1,318	\$726	2.23
AC	Area 1	Window AC	install efficient window units	ROF	1	Elect	Elect	\$37	\$42	\$3	\$0	\$37	\$82	\$45	2.23
AC	Area 7	Window AC	install efficient window units	ROF	18	Elect	Elect	\$703	\$800	\$53	\$9	\$703	\$1,565	\$862	2.23
AC	Area 8	Window AC	install efficient window units	ROF	20	Elect	Elect	\$777	\$884	\$59	\$10	\$777	\$1,730	\$953	2.23
AC	Area 5	Window AC	install efficient window units	ROF	14	Elect	Elect	\$185	\$211	\$14	\$2	\$185	\$412	\$227	2.23
AC	Area 6	Window AC	install efficient window units	ROF	16	Elect	Elect	\$185	\$211	\$14	\$2	\$185	\$412	\$227	2.23
AC	Area 3	Window AC	install efficient window units	ROF	9	Elect	Elect	\$296	\$337	\$22	\$4	\$296	\$659	\$363	2.23
AC	Area 3A	chilled water	install TES	ROF	49	Elect	Elect	\$14,617	-\$2,719	\$19,880	\$3,276	\$11,988	\$32,425	\$17,809	2.22
AC	Area 3A	chilled water	install TES	ROF	48	Elect	Elect	\$14,054	-\$2,615	\$19,116	\$3,150	\$11,527	\$31,178	\$17,124	2.22
AC	Area 7	chilled water	install TES	ROF	25	Elect	Elect	\$3,320	-\$762	\$6,957	\$662	\$1,488	\$7,345	\$4,025	2.21
AC	Area 3A	chilled water	install TES	ROF	26	Elect	Elect	\$3,478	-\$798	\$6,240	\$693	\$1,540	\$7,676	\$4,196	2.21
AC	Area 3	chilled water	install TES	ROF	31	Elect	Elect	\$4,427	-\$1,016	\$7,942	\$882	\$1,886	\$9,694	\$5,268	2.19
AC	Area 1W	chilled water	install TES	ROF	32	Elect	Elect	\$4,427	-\$1,016	\$7,942	\$882	\$1,886	\$9,694	\$5,268	2.19
AC	Area 1W	chilled water	install TES	ROF	39	Elect	Elect	\$7,027	-\$1,377	\$8,142	\$1,575	\$6,989	\$15,329	\$8,302	2.18
AC	Area 1W	chilled water	install TES	ROF	29	Elect	Elect	\$3,794	-\$871	\$6,808	\$756	\$1,579	\$8,272	\$4,478	2.18
AC	Area 3A	chilled water	install TES	ROF	33	Elect	Elect	\$5,059	-\$1,161	\$9,077	\$1,008	\$1,996	\$10,920	\$5,861	2.16
AC	Area 1W	chilled water	install TES	ROF	40	Elect	Elect	\$7,730	-\$1,515	\$8,956	\$1,732	\$7,453	\$16,628	\$8,898	2.15
AC	Area 5	chilled water	install TES	ROF	42	Elect	Elect	\$8,433	-\$1,652	\$9,770	\$1,890	\$7,916	\$17,924	\$9,491	2.13
AC	Area 1W	chilled water	install TES	ROF	43	Elect	Elect	\$8,433	-\$1,652	\$9,770	\$1,890	\$7,916	\$17,924	\$9,491	2.13
AC	Area 5	chilled water	install TES	ROF	44	Elect	Elect	\$8,995	-\$1,762	\$10,422	\$2,016	\$8,287	\$18,962	\$9,967	2.11
AC	Area 3A	chilled water	install TES	ROF	45	Elect	Elect	\$8,995	-\$1,762	\$10,422	\$2,016	\$8,287	\$18,962	\$9,967	2.11
AC	Area 3A	chilled water	install TES	ROF	47	Elect	Elect	\$10,513	-\$2,060	\$12,180	\$2,356	\$9,440	\$21,917	\$11,404	2.08
Envelope		49635 Envelope	Double Paned Window	RI	19	na	na	\$723	\$1,365	\$86	\$0	\$0	\$1,451	\$728	2.01
Envelope		1704 Envelope	Double Paned Window	RI	15	na	na	\$1,298	\$2,450	\$154	\$0	\$0	\$2,604	\$1,306	2.01
AC	Area 6	chilled water	install TES	ROF	46	Elect	Elect	\$10,119	-\$1,983	\$11,724	\$2,268	\$8,294	\$20,304	\$10,185	2.01
Motors	R&D	Fan Motors	Install Energy Efficient Motor	RI	15	Elec	Elec	\$10,866	\$13,904	\$4,096	\$0	\$2,886	\$20,886	\$10,020	1.92
Motors	TRAIN	Fan Motors	Install Energy Efficient Motor	RI	22	Elec	Elec	\$49	\$62	\$18	\$0	\$13	\$94	\$45	1.92
Motors	WHS	Fan Motors	Install Energy Efficient Motor	RI	23	Elec	Elec	\$3,424	\$4,382	\$1,291	\$0	\$910	\$6,582	\$3,158	1.92
Motors	NASOWN	Fan Motors	Install Energy Efficient Motor	RI	11	Elec	Elec	\$6,549	\$8,380	\$2,469	\$0	\$1,739	\$12,588	\$6,039	1.92
Motors	LAB-MED	Fan Motors	Install Energy Efficient Motor	RI	7	Elec	Elec	\$106	\$136	\$40	\$0	\$28	\$204	\$98	1.92
Motors	SECURITY	Fan Motors	Install Energy Efficient Motor	RI	17	Elec	Elec	\$330	\$422	\$124	\$0	\$88	\$634	\$304	1.92
Motors	DET-RR	Fan Motors	Install Energy Efficient Motor	RI	4	Elec	Elec	\$14	\$18	\$5	\$0	\$4	\$27	\$13	1.92
Motors	SHOP-WPH	Fan Motors	Install Energy Efficient Motor	RI	20	Elec	Elec	\$45	\$58	\$17	\$0	\$12	\$87	\$42	1.92
Motors	OTHER	Fan Motors	Install Energy Efficient Motor	RI	12	Elec	Elec	\$84	\$108	\$32	\$0	\$22	\$162	\$78	1.92
Motors	CONCATN	Fan Motors	Install Energy Efficient Motor	RI	3	Elec	Elec	\$1,931	\$2,471	\$728	\$0	\$513	\$3,711	\$1,780	1.92
Motors	SHOP-ELEC	Fan Motors	Install Energy Efficient Motor	RI	19	Elec	Elec	\$678	\$867	\$255	\$0	\$180	\$1,302	\$625	1.92
Motors	PLT-EQU	Fan Motors	Install Energy Efficient Motor	RI	14	Elec	Elec	\$602	\$771	\$227	\$0	\$160	\$1,158	\$555	1.92
Motors	MWR	Fan Motors	Install Energy Efficient Motor	RI	9	Elec	Elec	\$119	\$153	\$45	\$0	\$42	\$229	\$110	1.92
Motors	MTRPOOL	Fan Motors	Install Energy Efficient Motor	RI	8	Elec	Elec	\$600	\$768	\$226	\$0	\$159	\$1,154	\$554	1.92
Motors	ADMIN	Fan Motors	Install Energy Efficient Motor	RI	1	Elec	Elec	\$2,784	\$3,562	\$1,049	\$0	\$739	\$5,351	\$2,567	1.92
Motors	HANGAR	Fan Motors	Install Energy Efficient Motor	RI	6	Elec	Elec	\$356	\$455	\$134	\$0	\$95	\$684	\$328	1.92
Motors	NASIEAS	Fan Motors	Install Energy Efficient Motor	RI	10	Elec	Elec	\$6,434	\$8,233	\$2,426	\$0	\$1,709	\$12,368	\$5,933	1.92
Motors	PLT-BLD	Fan Motors	Install Energy Efficient Motor	RI	13	Elec	Elec	\$307	\$393	\$116	\$0	\$82	\$590	\$283	1.92
Motors	STOR-UH	Fan Motors	Install Energy Efficient Motor	RI	21	Elec	Elec	\$1,367	\$1,749	\$515	\$0	\$363	\$2,627	\$1,260	1.92
Motors	FUELDSP	Fan Motors	Install Energy Efficient Motor	RI	5	Elec	Elec	\$21	\$27	\$8	\$0	\$6	\$41	\$19	1.92
Motors	RESTRIH	Fan Motors	Install Energy Efficient Motor	RI	16	Elec	Elec	\$144	\$185	\$54	\$0	\$38	\$278	\$133	1.92
Motors	SHOP	Fan Motors	Install Energy Efficient Motor	RI	18	Elec	Elec	\$1,925	\$2,463	\$726	\$0	\$511	\$3,700	\$1,775	1.92

Table 3.8
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Annualized Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	Rt or ROF	ID	Existing Fuel	Resulting Fuel	Annualized Installed Cost (1993 \$)	Annualized Energy Savings (1993 \$)	Annualized Demand Savings (1993 \$)	Annualized O&M Savings (1993 \$)	Annualized Replacement Cost Savings (1993 \$)	Annualized Total Savings (1993 \$)	Annualized Net Savings (1993 \$)	Savings to Investment Ratio
Motors	BRK/ADM	Fan Motors	Install Energy Efficient Motor	Rt	2	Elec	Elec	\$16	\$21	\$5	\$0	\$4	\$30	\$13	1.83
Int light	ADMIN	FL 2X4 2 34 STD	FL 2X4 2F40T12ES ELC2	Rt	1	Elect	Elect	\$16 624	\$19 331	\$7 753	\$3 202	\$0	\$30 286	\$13 662	1.82
Heatpipes	HANGER R&D	AC/Boilers	Install Heatpipes	Rt	3	Elec	Elec	\$5 896	\$10 567	\$0	\$0	\$0	\$10 567	\$4 672	1.79
Boilers	NASA	Boiler	High Eff Boiler	Rt	5	Fuel Oil	Fuel Oil	\$448	\$601	\$0	\$0	\$179	\$780	\$331	1.74
Motors	Area 3	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	2C	Elec	Elec	\$115	\$114	\$0	\$0	\$86	\$200	\$85	1.74
Motors	Area 6	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	5C	Elec	Elec	\$342	\$340	\$0	\$0	\$255	\$594	\$252	1.74
Motors	Area 7	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	6C	Elec	Elec	\$268	\$267	\$0	\$0	\$200	\$466	\$198	1.74
Motors	Area IN	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	10C	Elec	Elec	\$506	\$503	\$0	\$0	\$376	\$879	\$373	1.74
Motors	Area 5	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	4C	Elec	Elec	\$482	\$479	\$0	\$0	\$358	\$837	\$355	1.74
Motors	Area 3A	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	9C	Elec	Elec	\$2 210	\$2 196	\$0	\$0	\$1 644	\$3 841	\$1 630	1.74
Motors	Area 4	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	3C	Elec	Elec	\$14	\$14	\$0	\$0	\$10	\$24	\$10	1.74
Motors	Area 8	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	7C	Elec	Elec	\$734	\$729	\$0	\$0	\$546	\$1 275	\$541	1.74
Motors	Area 1W	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	8C	Elec	Elec	\$747	\$742	\$0	\$0	\$556	\$1 298	\$551	1.74
Motors	Area 2	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	1C	Elec	Elec	\$66	\$65	\$0	\$0	\$49	\$114	\$48	1.74
Boilers	USAF	Boiler	High Eff Boiler	Rt	4	Fuel Oil	Fuel Oil	\$999	\$1 338	\$0	\$0	\$329	\$1 668	\$669	1.67
AC	Area 3	direct expansion	install TES	ROF	51	Elect	Elect	\$3 162	-\$805	\$3 257	\$315	\$1 648	\$4 415	\$1 253	1.40
AC	Area 6	direct expansion	install TES	ROF	53	Elect	Elect	\$3 162	-\$805	\$3 257	\$315	\$1 648	\$4 415	\$1 253	1.40
AC	Area 7	direct expansion	install TES	ROF	54	Elect	Elect	\$3 162	-\$805	\$3 257	\$315	\$1 648	\$4 415	\$1 253	1.40
Int light	OTHER	FL 2X4 3 60 STD	MH 175 PEND	Rt	26	Elect	Elect	\$1 272	\$448	\$204	\$1 050	\$0	\$1 702	\$430	1.34
Int light	TRAINING	FL 2X4 3 60 STD	MH 175 PEND	Rt	57	Elect	Elect	\$1 430	\$504	\$229	\$1 180	\$0	\$1 913	\$483	1.34
AC	Area 7	direct expansion	install TES	ROF	59	Elect	Elect	\$3 794	-\$966	\$3 908	\$378	\$1 687	\$5 007	\$1 213	1.32
AC	Area 8	direct expansion	install TES	ROF	60	Elect	Elect	\$3 794	-\$966	\$3 908	\$378	\$1 687	\$5 007	\$1 213	1.32
AC	Area 1W	direct expansion	install TES	ROF	61	Elect	Elect	\$3 794	-\$966	\$3 908	\$378	\$1 687	\$5 007	\$1 213	1.32
AC	Area 1W	direct expansion	install TES	ROF	74	Elect	Elect	\$7 588	-\$1 931	\$7 816	\$756	\$3 324	\$9 965	\$2 377	1.31
AC	Area 7	direct expansion	install TES	ROF	63	Elect	Elect	\$4 427	-\$1 127	\$4 559	\$441	\$1 794	\$5 668	\$1 241	1.28
AC	Area IN	direct expansion	install TES	ROF	67	Elect	Elect	\$5 059	-\$1 288	\$5 211	\$504	\$1 901	\$6 328	\$1 269	1.25
AC	Area 5	direct expansion	install TES	ROF	77	Elect	Elect	\$10 118	-\$1 161	\$9 077	\$1 008	\$3 443	\$12 367	\$2 249	1.22
AC	Area 7	direct expansion	install TES	ROF	70	Elect	Elect	\$6 324	-\$1 609	\$6 514	\$630	\$2 193	\$7 727	\$1 404	1.22
Int light	PLT BLD control boards	FL 2X4 3 60 STD	MH 175 PEND	Rt	29	Elect	Elect	\$999	\$298	\$112	\$675	\$0	\$1 085	\$86	1.09
Int light	PLT BLD general	FL 2X4 3 60 STD	MH 175 PEND	Rt	28	Elect	Elect	\$7 581	\$2 264	\$849	\$5 119	\$0	\$8 232	\$650	1.09
Int light	PLT EQU	FL 2X4 3 60 STD	MH 175 PEND	Rt	31	Elect	Elect	\$8 854	\$2 643	\$992	\$5 978	\$0	\$9 613	\$759	1.09
AC	Area 3A	chilled water	Install Efficient Chillers	Rt	30	Elec	Elec	\$7 889	\$3 862	\$775	\$0	\$3 630	\$8 267	\$378	1.05
AC	Area 3A	chilled water	Install Efficient Chillers	Rt	27	Elec	Elec	\$7 329	\$3 553	\$713	\$0	\$3 373	\$7 639	\$309	1.04
AC	Area 5	chilled water	Install Efficient Chillers	Rt	23	Elec	Elec	\$6 529	\$3 090	\$620	\$0	\$3 005	\$6 714	\$185	1.03
AC	Area 3A	chilled water	Install Efficient Chillers	Rt	24	Elec	Elec	\$6 529	\$3 090	\$620	\$0	\$3 005	\$6 714	\$185	1.03
Int light	WHS	FL 2X4 3 60 STD	MH 175 PEND	Rt	59	Elect	Elect	\$6 951	\$1 829	\$1 112	\$4 096	\$0	\$7 040	\$89	1.01
Total								\$1 061 937	\$1 635 992	\$1 147 375	\$41 548	\$308 273	\$3 133 188	\$2 071 251	2.95

Table 3.8
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Cumulative Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	Rt or ROF	ID	Existing Fuel	Resulting Fuel	Cumulative First-Year Energy Savings (MBtu)	Cumulative First-Year Demand Savings (kW-mo)	Cumulative Fuel Implement Energy Savings (MBtu)	Cumulative Fuel Implement Demand Savings (kW-mo)	Cumulative Net Present Value (1993 \$)	Cumulative Savings to Investment Ratio	Individual ERO Savings to Investment Ratio
Boilers	NASA	Boiler	Replace electric w/ high eff 1 o boll	Rt	7b	Electric	Fuel Oil	-1,710	3,761	-1,710	3,761	\$472,886	12.79	12.79
Boilers	USAF	Boiler	Replace electric w/ high eff 1 o boll	Rt	9b	Electric	Fuel Oil	-5,242	11,525	-5,242	11,525	\$1,444,855	11.53	11.01
Heatpipes	S&A LAB	AC/Boilers	Install Heatpipes	Rt	13	Elec	Elec	-2,618	11,525	-2,618	11,525	\$1,905,933	10.38	7.99
Boilers	USAF	Boiler	Replace electric w/ high eff 1 o boll	Rt	6b	Electric	Fuel Oil	-6,438	19,923	-6,438	19,923	\$2,904,813	8.95	7.17
Envelope	Other	Envelope	Weatherization Package	Rt	37	na	na	-6,174	20,194	-6,174	20,194	\$2,962,709	8.87	8.15
Heatpipes	RCT STOR BLD	AC/Boilers	Install Heatpipes	Rt	12	Fuel Oil	Fuel Oil	-5,724	20,194	-5,724	20,194	\$3,021,110	8.76	5.53
Heatpipes	HANGER N	AC/Boilers	Install Heatpipes	Rt	6	Fuel Oil	Fuel Oil	-3,112	20,194	-3,112	20,194	\$3,359,294	8.24	5.51
Heatpipes	CX 41	AC/Boilers	Install Heatpipes	Rt	9	Fuel Oil	Fuel Oil	-2,153	20,194	-2,153	20,194	\$3,482,390	8.07	5.32
Heatpipes	COMM CTL FAC	AC/Boilers	Install Heatpipes	Rt	27	Fuel Oil	Fuel Oil	-1,103	20,194	-1,103	20,194	\$3,617,147	7.90	5.32
Heatpipes	TGSF	AC/Boilers	Install Heatpipes	Rt	10	Fuel Oil	Fuel Oil	798	20,194	798	20,194	\$3,861,265	7.65	5.32
Heatpipes	M ANNEX	AC/Boilers	Install Heatpipes	Rt	14	Fuel Oil	Fuel Oil	2,413	20,194	2,413	20,194	\$4,068,584	7.47	5.32
Heatpipes	MK VI CK BLD	AC/Boilers	Install Heatpipes	Rt	22	Fuel Oil	Fuel Oil	2,833	20,194	2,833	20,194	\$4,122,574	7.43	5.32
Heatpipes	HANGER L	AC/Boilers	Install Heatpipes	Rt	7	Elec	Elec	3,755	20,194	3,755	20,194	\$4,240,225	7.34	5.20
Generator	Titan Substation	Generator	DGEN-2	Rt	2	na	Diesel	1,566	24,994	1,566	24,994	\$4,433,738	7.20	5.20
Heatpipes	CTL COMP COM	AC/Boilers	Install Heatpipes	Rt	11	Fuel Oil	Fuel Oil	4,031	24,994	4,031	24,994	\$4,748,152	7.01	5.18
Heatpipes	CX 30 BL KHSE	AC/Boilers	Install Heatpipes	Rt	17	Fuel Oil	Fuel Oil	5,338	24,994	5,338	24,994	\$4,914,743	6.92	5.18
Heatpipes	WASMB BD-AC	AC/Boilers	Install Heatpipes	Rt	15	Fuel Oil	Fuel Oil	11,220	24,994	11,220	24,994	\$5,664,405	6.81	5.18
Heatpipes	SMAB WEST	AC/Boilers	Install Heatpipes	Rt	25	Fuel Oil	Fuel Oil	17,063	24,994	17,063	24,994	\$6,409,069	6.39	5.18
Heatpipes	HANGER AE	AC/Boilers	Install Heatpipes	Rt	19	Fuel Oil	Fuel Oil	22,333	24,994	22,333	24,994	\$7,080,850	6.24	5.18
Int light	FUELDSP	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	10	Elect	Elect	22,369	25,008	22,369	25,008	\$7,085,094	6.24	5.04
Int light	SECURITY other	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	44	Elect	Elect	22,508	25,064	22,508	25,064	\$7,101,919	6.24	5.04
Int light	SHOP-WPN	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	53	Elect	Elect	22,699	25,141	22,699	25,141	\$7,124,958	6.23	5.04
Int light	HANGER	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	13	Elect	Elect	23,294	25,380	23,294	25,380	\$7,196,805	6.22	5.04
Int light	MTRPOOL	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	19	Elect	Elect	24,307	25,786	24,307	25,786	\$7,319,126	6.19	5.04
Int light	STOR-UH	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	56	Elect	Elect	25,459	26,249	25,459	26,249	\$7,458,273	6.17	5.04
Int light	SECURITY record	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	43	Elect	Elect	26,850	26,807	26,850	26,807	\$7,626,218	6.13	5.04
Int light	SHOP	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	47	Elect	Elect	30,098	28,111	30,098	28,111	\$8,018,344	6.07	5.04
Int light	MWR	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	21	Elect	Elect	30,299	28,192	30,299	28,192	\$8,042,596	6.06	5.04
Int light	SHOP-ELEC	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	50	Elect	Elect	36,015	30,487	36,015	30,487	\$8,732,719	5.96	5.04
Heatpipes	HANGER S	AC/Boilers	Install Heatpipes	Rt	5	Fuel Oil	Fuel Oil	40,318	30,487	40,318	30,487	\$9,272,190	5.88	4.85
Heatpipes	HANGER AO-AM	AC/Boilers	Install Heatpipes	Rt	18	Fuel Oil	Fuel Oil	44,245	30,487	44,245	30,487	\$9,762,071	5.81	4.77
Heatpipes	VIB	AC/Boilers	Install Heatpipes	Rt	26	Fuel Oil	Fuel Oil	49,784	30,487	49,784	30,487	\$10,452,250	5.72	4.75
Heatpipes	RCC MECH BLD	AC/Boilers	Install Heatpipes	Rt	2	Fuel Oil	Fuel Oil	53,672	30,487	53,672	30,487	\$10,935,981	5.67	4.72
Generator	N Substation	Generator	DGEN-7	Rt	7	na	Diesel	43,146	54,487	43,146	54,487	\$11,702,466	5.55	4.41
Int light	HANGER	FL 2X4 4-40 STD	FL 2X4 3F32T8 ELC3 REF	Rt	11	Elect	Elect	44,204	54,912	44,204	54,912	\$11,863,964	5.53	4.36
Int light	FUELDSP	FL 2X4 4-40 STD	FL 2X4 3F32T8 ELC3 REF	Rt	9	Elect	Elect	44,243	54,927	44,243	54,927	\$11,869,873	5.53	4.36
Int light	LAB-MED	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	16	Elect	Elect	44,380	54,999	44,380	54,999	\$11,887,241	5.53	4.28
Int light	RESTRNT cashier	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	38	Elect	Elect	44,398	55,008	44,398	55,008	\$11,889,525	5.53	4.20
Int light	RESTRNT cleaning	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	39	Elect	Elect	44,416	55,018	44,416	55,018	\$11,891,808	5.53	4.20
Int light	RESTRNT dining	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	40	Elect	Elect	44,448	55,035	44,448	55,035	\$11,895,894	5.53	4.20
Generator	S Substation	Generator	DGEN-4	Rt	4	na	Diesel	40,115	64,635	40,115	64,635	\$12,213,902	5.48	4.11
Heatpipes	CX 41 AC SHR	AC/Boilers	Install Heatpipes	Rt	8	Elec	Elec	48,795	64,635	48,795	64,635	\$13,537,051	5.25	3.92
Int light	NASLEAS	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	23	Elect	Elect	55,623	68,993	55,623	68,993	\$14,433,438	5.12	3.76
Int light	ADMIN	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	2	Elect	Elect	63,008	73,707	63,008	73,707	\$15,403,012	4.99	3.76
Int light	NASOWN	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	25	Elect	Elect	69,957	78,143	69,957	78,143	\$16,315,363	4.90	3.76
Int light	LAB-MED	FL 2X4 4-40 STD	FL 2X4 3F32T8 ELC3 REF	Rt	14	Elect	Elect	70,457	78,405	70,457	78,405	\$16,392,735	4.89	3.62
Int light	BRK/ADM	INC 60 CEIL	CFL 18 GLOBE UNIT	Rt	4	Elect	Elect	70,473	78,414	70,473	78,414	\$16,394,469	4.89	3.55
Int light	RESTRNT cashier	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	Rt	35	Elect	Elect	70,485	78,421	70,485	78,421	\$16,396,440	4.89	3.54
Int light	RESTRNT cleaning	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	Rt	36	Elect	Elect	70,497	78,427	70,497	78,427	\$16,398,412	4.89	3.54
Int light	RESTRNT dining	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	Rt	37	Elect	Elect	70,518	78,438	70,518	78,438	\$16,401,960	4.89	3.54
Int light	TRAINING	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	58	Elect	Elect	70,746	78,603	70,746	78,603	\$16,432,756	4.88	3.51
Int light	OTHER	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	27	Elect	Elect	70,949	78,750	70,949	78,750	\$16,460,161	4.88	3.51
Int light	COMCATN	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	6	Elect	Elect	75,466	82,019	75,466	82,019	\$17,071,078	4.80	3.51
Int light	R&D	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	34	Elect	Elect	80,336	85,543	80,336	85,543	\$17,729,554	4.73	3.51
AC	Area 1W	heat pump	install TES	ROF	84	Elect	Elect	80,336	85,543	80,002	86,693	\$17,851,081	4.72	3.46
Int light	DEI-RR	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	8	Elect	Elect	80,353	85,559	80,019	86,709	\$17,853,589	4.72	3.15
Int light	NASOWN	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	Rt	24	Elect	Elect	85,043	88,553	84,709	89,702	\$18,638,690	4.61	3.15
Int light	NASLEAS	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	Rt	22	Elect	Elect	89,651	91,493	89,317	92,643	\$19,409,947	4.51	3.15
AC	Area 5	direct expansion	install TES	ROF	52	Elect	Elect	89,651	91,493	89,242	92,899	\$19,435,051	4.51	3.03
AC	Area 8	direct expansion	install TES	ROF	55	Elect	Elect	89,651	91,493	89,167	93,154	\$19,460,154	4.51	3.03
Int light	WIIS	INC 60 CEIL	CFL 13 + BLST UNIT	Rt	61	Elect	Elect	90,854	92,653	90,371	94,314	\$19,633,806	4.48	3.01
Int light	COMCATN	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	Rt	5	Elect	Elect	93,903	94,859	93,419	96,520	\$20,149,396	4.41	2.91
Int light	R&D	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	Rt	33	Elect	Elect	98,284	98,031	97,801	99,691	\$20,890,451	4.32	2.91
AC	Area 4	chilled water	install TES	ROF	1	Elect	Elect	98,284	98,031	97,720	99,947	\$20,913,798	4.32	2.89

Table 3.9
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Cumulative Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Cumulative First-Year Energy Savings (MBtu)	Cumulative First-Year Demand Savings (kW-mo)	Cumulative Full Implement Energy Savings (MBtu)	Cumulative Full Implement Demand Savings (kW-mo)	Cumulative Net Present Value (1993 \$)	Cumulative Savings to Investment Ratio	Individual ERO Savings to Investment Ratio
AC	Area 5	chilled water	Install TES	ROF	2	Elect	Elect	98,284	98,031	97,652	100,202	\$20,937,144	4.31	2.89
AC	Area 6	chilled water	Install TES	ROF	3	Elect	Elect	98,284	98,031	97,577	100,458	\$20,980,491	4.31	2.89
AC	Area 3A	chilled water	Install TES	ROF	5	Elect	Elect	98,284	98,031	97,502	100,714	\$20,983,838	4.31	2.89
AC	Area 5	direct expansion	Install TES	ROF	58	Elect	Elect	98,284	98,031	97,412	101,020	\$21,011,889	4.30	2.88
AC	Area 7	chilled water	Install TES	ROF	4	Elect	Elect	98,284	98,031	97,338	101,276	\$21,034,863	4.30	2.88
AC	Area 3A	direct expansion	Install TES	ROF	75	Elect	Elect	98,284	98,031	97,158	101,889	\$21,080,178	4.30	2.87
Int light	SECURITY records	FL 2X4 4-34 STD	FL 2X4 3F32T8 ELC3 REF	RI	41	Elect	Elect	99,525	98,529	98,399	102,387	\$21,251,143	4.28	2.85
Int light	SECURITY other	FL 2X4 4-34 STD	FL 2X4 3F32T8 ELC3 REF	RI	42	Elect	Elect	99,649	98,578	98,522	102,437	\$21,267,158	4.27	2.85
Int light	PLT-BLD	INC 60 CEIL	CFL 13 + BLST UNIT	RI	30	Elect	Elect	100,664	99,180	99,538	103,048	\$21,385,129	4.26	2.81
Int light	PLT-EQU	INC 60 CEIL	CFL 13 + BLST UNIT	RI	32	Elect	Elect	101,850	99,904	100,724	103,762	\$21,522,909	4.24	2.81
AC	Area 3A	direct expansion	Install TES	ROF	84	Elect	Elect	101,850	99,904	100,619	104,120	\$21,554,041	4.24	2.80
AC	Area 5	direct expansion	Install TES	ROF	85	Elect	Elect	101,850	99,904	100,499	104,529	\$21,588,454	4.23	2.74
Envelope		60740 Envelope	Double Paned Window	RI	24	na	na	101,939	99,913	100,589	104,538	\$21,598,048	4.23	2.70
Envelope		49750 Envelope	Double Paned Window	RI	20	na	na	102,049	99,924	100,698	104,549	\$21,609,823	4.23	2.70
Envelope		1641 Envelope	Double Paned Window	RI	13	na	na	102,304	99,950	100,954	104,575	\$21,637,231	4.23	2.70
Envelope		1722 Envelope	Double Paned Window	RI	16	na	na	102,423	99,982	101,073	104,587	\$21,650,000	4.23	2.70
AC	Area 3A	direct expansion	Install TES	ROF	78	Elect	Elect	102,423	99,982	100,952	105,299	\$21,716,564	4.22	2.88
AC	Area 1	direct expansion	Install TES	ROF	68	Elect	Elect	102,423	99,982	100,803	105,810	\$21,758,152	4.21	2.88
AC	Area 6	direct expansion	Install TES	ROF	69	Elect	Elect	102,423	99,982	100,653	106,321	\$21,799,741	4.21	2.88
AC	Area 3A	direct expansion	Install TES	ROF	72	Elect	Elect	102,423	99,982	100,504	106,832	\$21,841,329	4.20	2.88
AC	Area IN	direct expansion	Install TES	ROF	78	Elect	Elect	102,423	99,982	100,324	107,445	\$21,891,062	4.19	2.88
Boilers	NASA	Boiler	High Eff Boiler	RI	2	Fuel Oil	Fuel Oil	104,539	99,982	102,440	107,445	\$22,141,630	4.16	2.86
AC	Area 2	direct expansion	Install TES	ROF	79	Elect	Elect	104,539	99,982	102,289	108,335	\$22,223,753	4.15	2.86
AC	Area 4	direct expansion	Install TES	ROF	80	Elect	Elect	104,539	99,982	102,139	109,226	\$22,305,877	4.14	2.86
AC	Area 1W	direct expansion	Install TES	ROF	81	Elect	Elect	104,539	99,982	101,988	110,116	\$22,388,000	4.13	2.86
AC	Area 3A	direct expansion	Install TES	ROF	82	Elect	Elect	104,539	99,982	101,837	111,006	\$22,470,123	4.12	2.86
AC	Area 6	chilled water	Install TES	ROF	6	Elect	Elect	104,539	99,982	101,747	111,313	\$22,494,737	4.12	2.86
Heatpipes	PSL	AC/Boilers	Install Heatpipes	RI	4	Fuel Oil	Fuel Oil	105,707	99,982	102,915	111,313	\$22,609,912	4.10	2.86
Heatpipes	DELTA SPN BD	AC/Boilers	Install Heatpipes	RI	23	Fuel Oil	Fuel Oil	106,413	99,982	103,621	111,313	\$22,679,614	4.09	2.86
Heatpipes	OPTICS LAB	AC/Boilers	Install Heatpipes	RI	1	Fuel Oil	Fuel Oil	107,419	99,982	104,627	111,313	\$22,778,856	4.08	2.86
Heatpipes	CTL BD SP TS	AC/Boilers	Install Heatpipes	RI	24	Fuel Oil	Fuel Oil	107,760	99,982	104,968	111,313	\$22,812,546	4.08	2.86
Heatpipes	GPS PROP FAC	AC/Boilers	Install Heatpipes	RI	18	Fuel Oil	Fuel Oil	108,472	99,982	105,680	111,313	\$22,882,746	4.07	2.86
AC	Area 3A	direct expansion	Install TES	ROF	73	Elect	Elect	108,472	99,982	105,515	111,875	\$22,926,683	4.07	2.82
AC	Area 3	direct expansion	Install TES	ROF	83	Elect	Elect	108,472	99,982	105,325	112,996	\$23,026,794	4.05	2.81
Int light	DET-RR	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	7	Elect	Elect	108,472	99,984	105,327	112,998	\$23,027,167	4.05	2.80
Heatpipes	HANGER AF	AC/Boilers	Install Heatpipes	RI	21	Fuel Oil	Fuel Oil	111,207	99,984	108,051	112,998	\$23,291,902	4.02	2.58
Heatpipes	MIS CK BD-AK	C/Boilers	Install Heatpipes	RI	20	Fuel Oil	Fuel Oil	112,962	99,984	109,816	112,998	\$23,461,851	4.00	2.58
AC	Area 1W	Window AC	install efficient window units	ROF	5	Elect	Elect	112,962	99,984	109,830	113,000	\$23,463,977	4.00	2.58
AC	Area 2	Window AC	install efficient window units	ROF	8	Elect	Elect	112,962	99,984	109,858	113,003	\$23,468,231	4.00	2.58
AC	Area 3	Window AC	install efficient window units	ROF	11	Elect	Elect	112,962	99,984	109,900	113,007	\$23,474,611	4.00	2.58
Boilers	Navy	Boiler	High Eff Boiler	RI	3	Fuel Oil	Fuel Oil	113,529	99,984	110,467	113,007	\$23,539,465	3.99	2.52
AC	Area 7	Window AC	install efficient window units	ROF	19	Elect	Elect	113,529	99,984	110,532	113,014	\$23,549,389	3.99	2.49
AC	Area 5	Window AC	install efficient window units	ROF	15	Elect	Elect	113,529	99,984	110,821	113,045	\$23,593,339	3.99	2.49
AC	Area 1	Window AC	install efficient window units	ROF	2	Elect	Elect	113,529	99,984	110,830	113,046	\$23,594,757	3.99	2.49
AC	Other	Window AC	install efficient window units	ROF	24	Elect	Elect	113,529	99,984	110,840	113,047	\$23,596,174	3.99	2.49
AC	Area 6	Window AC	install efficient window units	ROF	17	Elect	Elect	113,529	99,984	110,942	113,058	\$23,611,769	3.98	2.49
AC	Area 1W	Window AC	install efficient window units	ROF	4	Elect	Elect	113,529	99,984	110,989	113,063	\$23,618,858	3.98	2.49
AC	Area 3	Window AC	install efficient window units	ROF	10	Elect	Elect	113,529	99,984	111,903	113,161	\$23,757,796	3.97	2.49
AC	Area 2	Window AC	install efficient window units	ROF	7	Elect	Elect	113,529	99,984	111,921	113,163	\$23,760,632	3.96	2.49
AC	Area 4	Window AC	install efficient window units	ROF	13	Elect	Elect	113,529	99,984	112,071	113,179	\$23,783,315	3.96	2.49
AC	Area IN	Window AC	install efficient window units	ROF	23	Elect	Elect	113,529	99,984	112,099	113,182	\$23,787,569	3.96	2.49
AC	Area 8	Window AC	install efficient window units	ROF	21	Elect	Elect	113,529	99,984	112,378	113,212	\$23,830,101	3.96	2.49
AC	Area 5	chilled water	Install TES	ROF	8	Elect	Elect	113,529	99,984	112,274	113,570	\$23,855,691	3.95	2.48
AC	Area 2	chilled water	Install TES	ROF	28	Elect	Elect	113,529	99,984	112,093	114,638	\$23,943,410	3.94	2.48
Boilers	USAF	Boiler	High Eff Boiler	RI	1	Fuel Oil	Fuel Oil	118,418	99,984	116,982	114,638	\$24,499,616	3.88	2.47
AC	Area 6	chilled water	Install TES	ROF	9	Elect	Elect	118,418	99,984	116,802	115,047	\$24,526,539	3.87	2.46
AC	Area 1W	chilled water	Install TES	ROF	10	Elect	Elect	118,418	99,984	116,742	115,456	\$24,557,463	3.87	2.46
Int light	MWR	FL 2X4 3-60 STD	MH 175 PEND	RI	20	Elect	Elect	118,462	99,981	116,787	115,474	\$24,572,532	3.87	2.37
Int light	SHOP WPN	FL 2X4 3-60 STD	MH 175 PEND	RI	51	Elect	Elect	118,491	99,993	116,815	115,485	\$24,582,428	3.87	2.37
Int light	SHOP ELEC	FL 2X4 3-60 STD	MH 175 PEND	RI	48	Elect	Elect	119,351	100,338	117,676	115,830	\$24,876,610	3.83	2.37
Int light	MTRPOOL	FL 2X4 3-60 STD	MH 175 PEND	RI	17	Elect	Elect	119,504	100,400	117,828	115,892	\$24,928,790	3.82	2.37
Int light	STOR UH	FL 2X4 3-60 STD	MH 175 PEND	RI	54	Elect	Elect	119,678	100,469	118,002	115,901	\$24,988,166	3.82	2.37
Int light	SHOP	FL 2X4 3-60 STD	MH 175 PEND	RI	45	Elect	Elect	120,166	100,665	118,499	116,158	\$25,155,274	3.80	2.37
Int light	Exit Lights	INC 2-20 W	EXIT - LED	RI	62	Elect	Elect	129,770	104,521	128,094	120,013	\$26,894,195	3.61	2.32

Table 3.9
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Cumulative Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	Rt or ROF	ID	Existing Fuel	Resulting Fuel	Cumulative First-Year Energy Savings (MBtu)	Cumulative First-Year Demand Savings (kW-mo)	Cumulative Full Implement Energy Savings (MBtu)	Cumulative Full Implement Demand Savings (kW-mo)	Cumulative Net Present Value (1993 \$)	Cumulative Savings to Investment Ratio	Individual ERO Savings to Investment Ratio
AC	Area 3A	chilled water	install TES	ROF	11	Elect	Elect	129,770	104,521	127,530	120,575	\$26,930,044	3.61	2.32
AC	Area 8	chilled water	install TES	ROF	50	Elect	Elect	129,770	104,521	126,264	128,254	\$27,671,882	3.54	2.32
AC	Area 3	chilled water	install TES	ROF	16	Elect	Elect	129,770	104,521	126,055	128,970	\$27,717,224	3.53	2.32
AC	Area 3A	chilled water	install TES	ROF	17	Elect	Elect	129,770	104,521	125,846	129,685	\$27,762,767	3.53	2.32
Envelope		1748 Envelope	Double Paned Window	Rt	18	na	na	129,920	104,536	125,996	129,700	\$27,777,215	3.53	2.30
Envelope		60600 Envelope	Double Paned Window	Rt	23	na	na	130,040	104,548	126,116	129,712	\$27,788,816	3.53	2.30
Envelope		1724 Envelope	Double Paned Window	Rt	17	na	na	130,169	104,562	126,245	129,725	\$27,801,191	3.53	2.30
Envelope		1645 Envelope	Double Paned Window	Rt	14	na	na	130,454	104,580	126,530	129,754	\$27,828,703	3.53	2.30
Envelope		54915 Envelope	Double Paned Window	Rt	21	na	na	130,673	104,613	126,749	129,777	\$27,849,807	3.52	2.30
Envelope		55005 Envelope	Double Paned Window	Rt	22	na	na	130,841	104,630	126,916	129,794	\$27,865,944	3.52	2.30
Boilers	Navy	Boiler	Replace electric w/ high eff. f.o. boiler	Rt	8b	Electric	Fuel Oil	130,617	105,122	126,693	130,286	\$27,905,972	3.52	2.30
AC	Area 1N	chilled water	install TES	ROF	19	Elect	Elect	130,617	105,122	126,580	130,953	\$27,954,229	3.51	2.30
AC	Area 1W	chilled water	install TES	ROF	34	Elect	Elect	130,617	105,122	126,308	132,556	\$28,068,075	3.51	2.28
AC	Area 3A	chilled water	install TES	ROF	20	Elect	Elect	130,617	105,122	126,187	133,268	\$28,118,571	3.50	2.28
AC	Area 6	chilled water	install TES	ROF	12	Elect	Elect	130,617	105,122	126,008	133,881	\$28,156,421	3.50	2.28
AC	Area 8	chilled water	install TES	ROF	13	Elect	Elect	130,617	105,122	125,829	134,494	\$28,194,272	3.49	2.28
AC	Area 1W	chilled water	install TES	ROF	14	Elect	Elect	130,617	105,122	125,649	135,107	\$28,232,122	3.49	2.28
AC	Area 3A	chilled water	install TES	ROF	38	Elect	Elect	130,617	105,122	125,331	136,334	\$28,365,441	3.48	2.27
AC	Area 7	chilled water	install TES	ROF	36	Elect	Elect	130,617	105,122	125,053	137,007	\$28,402,085	3.47	2.27
AC	Area 3A	chilled water	install TES	ROF	37	Elect	Elect	130,617	105,122	124,755	138,557	\$28,607,081	3.46	2.27
AC	Area 3A	chilled water	install TES	ROF	35	Elect	Elect	130,617	105,122	124,490	139,579	\$28,718,180	3.45	2.27
AC	Area 3A	chilled water	install TES	ROF	21	Elect	Elect	130,617	105,122	124,362	140,336	\$28,770,916	3.45	2.26
AC	Area 6	chilled water	install TES	ROF	22	Elect	Elect	130,617	105,122	124,226	141,137	\$28,825,892	3.44	2.24
AC	Area 1W	Window AC	install efficient window units	ROF	3	Elect	Elect	130,617	105,122	124,235	141,138	\$28,827,310	3.44	2.23
AC	Area 2	Window AC	install efficient window units	ROF	8	Elect	Elect	130,617	105,122	124,245	141,139	\$28,828,727	3.44	2.23
AC	Area 1N	Window AC	install efficient window units	ROF	22	Elect	Elect	130,617	105,122	124,254	141,140	\$28,830,145	3.44	2.23
AC	Area 4	Window AC	install efficient window units	ROF	12	Elect	Elect	130,617	105,122	124,328	141,148	\$28,841,487	3.44	2.23
AC	Area 1	Window AC	install efficient window units	ROF	1	Elect	Elect	130,617	105,122	124,333	141,148	\$28,842,196	3.44	2.23
AC	Area 7	Window AC	install efficient window units	ROF	18	Elect	Elect	130,617	105,122	124,422	141,158	\$28,855,664	3.44	2.23
AC	Area 8	Window AC	install efficient window units	ROF	20	Elect	Elect	130,617	105,122	124,520	141,168	\$28,870,551	3.44	2.23
AC	Area 5	Window AC	install efficient window units	ROF	14	Elect	Elect	130,617	105,122	124,543	141,171	\$28,874,095	3.44	2.23
AC	Area 6	Window AC	install efficient window units	ROF	16	Elect	Elect	130,617	105,122	124,566	141,173	\$28,877,639	3.44	2.23
AC	Area 3	Window AC	install efficient window units	ROF	9	Elect	Elect	130,617	105,122	124,604	141,177	\$28,883,310	3.44	2.23
AC	Area 3A	chilled water	install TES	ROF	49	Elect	Elect	130,617	105,122	123,927	144,297	\$29,161,519	3.41	2.22
AC	Area 3A	chilled water	install TES	ROF	48	Elect	Elect	130,617	105,122	123,776	147,296	\$29,429,028	3.39	2.22
AC	Area 7	chilled water	install TES	ROF	25	Elect	Elect	130,617	105,122	123,118	148,231	\$29,491,902	3.39	2.21
AC	Area 3A	chilled water	install TES	ROF	26	Elect	Elect	130,617	105,122	122,952	149,210	\$29,557,477	3.38	2.21
AC	Area 3	chilled water	install TES	ROF	31	Elect	Elect	130,617	105,122	122,741	150,457	\$29,639,772	3.38	2.19
AC	Area 1W	chilled water	install TES	ROF	32	Elect	Elect	130,617	105,122	122,530	151,703	\$29,722,067	3.37	2.19
AC	Area 1W	chilled water	install TES	ROF	39	Elect	Elect	130,617	105,122	122,198	152,980	\$29,851,766	3.36	2.18
AC	Area 1W	chilled water	install TES	ROF	29	Elect	Elect	130,617	105,122	122,017	154,049	\$29,921,719	3.35	2.18
AC	Area 3A	chilled water	install TES	ROF	33	Elect	Elect	130,617	105,122	121,776	155,473	\$30,013,280	3.35	2.16
AC	Area 1W	chilled water	install TES	ROF	40	Elect	Elect	130,617	105,122	121,411	156,878	\$30,152,280	3.34	2.15
AC	Area 5	chilled water	install TES	ROF	42	Elect	Elect	130,617	105,122	121,014	158,411	\$30,300,552	3.32	2.13
AC	Area 1W	chilled water	install TES	ROF	43	Elect	Elect	130,617	105,122	120,616	159,944	\$30,448,824	3.31	2.13
AC	Area 5	chilled water	install TES	ROF	44	Elect	Elect	130,617	105,122	120,192	161,580	\$30,604,530	3.30	2.11
AC	Area 3A	chilled water	install TES	ROF	45	Elect	Elect	130,617	105,122	119,768	163,215	\$30,760,237	3.29	2.11
AC	Area 3A	chilled water	install TES	ROF	47	Elect	Elect	130,617	105,122	119,273	165,126	\$30,938,390	3.27	2.08
Envelope		49635 Envelope	Double Paned Window	Rt	19	na	na	130,750	105,135	119,406	165,140	\$30,949,765	3.27	2.01
Envelope		1704 Envelope	Double Paned Window	Rt	15	na	na	130,989	105,159	119,645	165,164	\$30,970,173	3.27	2.01
AC	Area 6	chilled water	install TES	ROF	46	Elect	Elect	130,989	105,159	119,168	167,004	\$31,129,280	3.25	2.01
Motors	R&D	Fan Motors	Install Energy Efficient Motor	Rt	15	Elec	Elec	132,358	105,802	120,537	167,647	\$31,285,816	3.24	1.92
Motors	TRAINING	Fan Motors	Install Energy Efficient Motor	Rt	22	Elec	Elec	132,364	105,805	120,543	167,649	\$31,286,518	3.24	1.92
Motors	WHS	Fan Motors	Install Energy Efficient Motor	Rt	23	Elec	Elec	132,796	106,008	120,975	167,852	\$31,335,849	3.23	1.92
Motors	NASOWN	Fan Motors	Install Energy Efficient Motor	Rt	11	Elec	Elec	133,621	106,365	121,800	168,239	\$31,430,192	3.22	1.92
Motors	LAB-MED	Fan Motors	Install Energy Efficient Motor	Rt	7	Elec	Elec	133,635	106,401	121,813	168,246	\$31,431,718	3.22	1.92
Motors	SECURITY	Fan Motors	Install Energy Efficient Motor	Rt	17	Elec	Elec	133,676	106,421	121,854	168,265	\$31,436,470	3.22	1.92
Motors	DET-RR	Fan Motors	Install Energy Efficient Motor	Rt	4	Elec	Elec	133,678	106,422	121,857	168,266	\$31,436,670	3.22	1.92
Motors	SHOP-WPN	Fan Motors	Install Energy Efficient Motor	Rt	20	Elec	Elec	133,684	106,424	121,862	168,269	\$31,437,322	3.22	1.92
Motors	OTHER	Fan Motors	Install Energy Efficient Motor	Rt	12	Elec	Elec	133,694	106,429	121,873	168,274	\$31,438,534	3.22	1.92
Motors	COMCATN	Fan Motors	Install Energy Efficient Motor	Rt	3	Elec	Elec	133,938	106,543	122,110	168,388	\$31,466,349	3.22	1.92
Motors	SHOP-EL-EC	Fan Motors	Install Energy Efficient Motor	Rt	19	Elec	Elec	134,023	106,584	122,202	168,428	\$31,476,110	3.22	1.92
Motors	PLI-EQU	Fan Motors	Install Energy Efficient Motor	Rt	14	Elec	Elec	134,099	106,619	122,270	168,464	\$31,484,788	3.22	1.92
Motors	MWR	Fan Motors	Install Energy Efficient Motor	Rt	9	Elec	Elec	134,114	106,626	122,293	168,471	\$31,486,507	3.22	1.92

Table 3.9
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Cumulative Annual Energy and Demand Reductions

ERO Category	Facility Type	Equipment	Description of ERO	Rt or ROF	ID	Existing Fuel	Resulting Fuel	Cumulative First-Year Energy Savings (\$/kW-yr)	Cumulative First-Year Demand Savings (\$/kW-yr)	Cumulative Full Implement Energy Savings (\$/kW-yr)	Cumulative Full Implement Demand Savings (\$/kW-yr)	Cumulative Net Present Value (\$1993 \$)	Cumulative Savings to Investment Ratio	Individual ERO Savings to Investment Ratio
Motors	MTRPOOL	Fan Motors	Install Energy Efficient Motor	Rt	8	Elec	Elec	134,190	106,662	122,368	168,506	\$31,495,156	3.22	1.92
Motors	ADMIN	Fan Motors	Install Energy Efficient Motor	Rt	1	Elec	Elec	134,540	106,626	122,719	168,671	\$31,535,259	3.21	1.92
Motors	HANGAR	Fan Motors	Install Energy Efficient Motor	Rt	6	Elec	Elec	134,585	106,647	122,764	168,692	\$31,540,387	3.21	1.92
Motors	NASLEAS	Fan Motors	Install Energy Efficient Motor	Rt	10	Elec	Elec	135,398	107,228	123,575	169,072	\$31,633,070	3.20	1.92
Motors	PLT-BLD	Fan Motors	Install Energy Efficient Motor	Rt	13	Elec	Elec	135,435	107,246	123,613	169,091	\$31,637,501	3.20	1.92
Motors	STOR-UH	Fan Motors	Install Energy Efficient Motor	Rt	21	Elec	Elec	135,607	107,327	123,786	169,171	\$31,657,187	3.20	1.92
Motors	FUELDSP	Fan Motors	Install Energy Efficient Motor	Rt	5	Elec	Elec	135,609	107,328	123,788	169,173	\$31,657,490	3.20	1.92
Motors	RESTRNT	Fan Motors	Install Energy Efficient Motor	Rt	16	Elec	Elec	135,828	107,337	123,806	169,181	\$31,659,571	3.20	1.92
Motors	SHOP	Fan Motors	Install Energy Efficient Motor	Rt	18	Elec	Elec	135,870	107,451	124,049	169,295	\$31,687,299	3.20	1.92
Motors	BRK/ADM	Fan Motors	Install Energy Efficient Motor	Rt	2	Elec	Elec	135,872	107,451	124,051	169,296	\$31,687,510	3.20	1.92
Int light	ADMIN	FL 2X4 2-34 STD	FL 2X4 2F40T12ES ELC2	Rt	1	Elect	Elect	137,778	108,668	125,957	170,512	\$31,900,933	3.17	1.92
Heatpipes	HANGER R&D	AC/Boilers	Install Heatpipes	Rt	3	Elec	Elec	138,613	108,668	126,792	170,512	\$31,973,919	3.17	1.79
Boilers	NASA	Boiler	High Eff Boiler	Rt	5	Fuel Oil	Fuel Oil	138,673	108,668	126,852	170,512	\$31,979,086	3.16	1.74
Motors	Area 3	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	2C	Elec	Elec	138,673	108,668	126,870	170,512	\$31,980,421	3.16	1.74
Motors	Area 6	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	5C	Elec	Elec	138,673	108,668	126,923	170,512	\$31,984,363	3.16	1.74
Motors	Area 7	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	6C	Elec	Elec	138,673	108,668	126,965	170,512	\$31,987,453	3.16	1.74
Motors	Area IN	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	10C	Elec	Elec	138,673	108,668	127,044	170,512	\$31,993,282	3.16	1.74
Motors	Area 5	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	4C	Elec	Elec	138,673	108,668	127,119	170,512	\$31,998,832	3.16	1.74
Motors	Area 3A	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	9C	Elec	Elec	138,673	108,668	127,465	170,512	\$32,024,302	3.16	1.74
Motors	Area 4	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	3C	Elec	Elec	138,673	108,668	127,467	170,512	\$32,024,480	3.16	1.74
Motors	Area 8	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	7C	Elec	Elec	138,673	108,668	127,582	170,512	\$32,032,912	3.16	1.74
Motors	Area 1W	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	8C	Elec	Elec	138,673	108,668	127,698	170,512	\$32,041,521	3.16	1.74
Motors	Area 2	Chilled Water Pump Motors	Install Energy Efficient Motor	ROF	1C	Elec	Elec	138,673	108,668	127,709	170,512	\$32,042,278	3.16	1.74
Boilers	USAF	Boiler	High Eff Boiler	Rt	4	Fuel Oil	Fuel Oil	138,806	108,668	127,842	170,512	\$32,052,730	3.15	1.67
AC	Area 3	direct expansion	Install TES	ROF	51	Elect	Elect	138,806	108,668	127,692	171,023	\$32,072,311	3.15	1.40
AC	Area 6	direct expansion	Install TES	ROF	53	Elect	Elect	138,806	108,668	127,543	171,535	\$32,091,893	3.14	1.40
AC	Area 7	direct expansion	Install TES	ROF	54	Elect	Elect	138,806	108,668	127,393	172,046	\$32,111,474	3.14	1.40
Int light	OTHER	FL 2X4 3-60 STD	MH 175 PEND	Rt	26	Elect	Elect	138,850	108,700	127,437	172,077	\$32,118,186	3.14	1.34
Int light	TRAINING	FL 2X4 3-60 STD	MH 175 PEND	Rt	57	Elect	Elect	138,900	108,736	127,487	172,113	\$32,125,731	3.13	1.34
AC	Area 7	direct expansion	Install TES	ROF	59	Elect	Elect	138,900	108,736	127,308	172,727	\$32,144,684	3.13	1.32
AC	Area 8	direct expansion	Install TES	ROF	60	Elect	Elect	138,900	108,736	127,128	173,340	\$32,163,638	3.12	1.32
AC	Area 1W	direct expansion	Install TES	ROF	61	Elect	Elect	138,900	108,736	126,949	173,953	\$32,182,591	3.11	1.32
AC	Area 1W	direct expansion	Install TES	ROF	74	Elect	Elect	138,900	108,736	126,590	175,180	\$32,219,720	3.10	1.31
AC	Area 7	direct expansion	Install TES	ROF	63	Elect	Elect	138,900	108,736	126,381	175,895	\$32,239,110	3.09	1.28
AC	Area IN	direct expansion	Install TES	ROF	67	Elect	Elect	138,900	108,736	126,142	176,713	\$32,258,936	3.08	1.25
AC	Area 5	direct expansion	Install TES	ROF	77	Elect	Elect	138,900	108,736	125,900	178,137	\$32,294,065	3.06	1.22
AC	Area 7	direct expansion	Install TES	ROF	70	Elect	Elect	138,900	108,736	125,601	179,159	\$32,315,993	3.05	1.22
Int light	PLT-BLD control boards	FL 2X4 3-60 STD	MH 175 PEND	Rt	29	Elect	Elect	138,929	108,753	125,630	179,177	\$32,317,331	3.05	1.09
Int light	PLT BLD general	FL 2X4 3-60 STD	MH 175 PEND	Rt	28	Elect	Elect	139,150	108,887	125,852	179,310	\$32,327,489	3.03	1.09
Int light	PLT EQU	FL 2X4 3-60 STD	MH 175 PEND	Rt	31	Elect	Elect	139,409	109,042	126,110	179,465	\$32,339,353	3.02	1.09
AC	Area 3A	chilled water	Install Efficient Chillers	Rt	30	Elec	Elec	140,414	109,367	127,116	179,790	\$32,345,256	3.00	1.05
AC	Area 3A	chilled water	Install Efficient Chillers	Rt	27	Elec	Elec	141,339	109,665	128,041	180,088	\$32,350,088	2.99	1.04
AC	Area 5	chilled water	Install Efficient Chillers	Rt	23	Elec	Elec	142,144	109,925	128,845	180,348	\$32,352,975	2.98	1.03
AC	Area 3A	chilled water	Install Efficient Chillers	Rt	24	Elec	Elec	142,948	110,184	129,650	180,607	\$32,355,863	2.96	1.03
Int light	WHS	FL 2X4 3-60 STD	MH 175 PEND	Rt	59	Elect	Elect	143,130	110,359	129,831	180,782	\$32,357,253	2.95	1.01

Table 3.18
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Cumulative Present Values of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Cumulative Present Value of Installed Cost (1993 \$)	Cumulative Present Value of Energy Savings (1993 \$)	Cumulative Present Value of Demand Savings (1993 \$)	Cumulative Present Value of O&M Savings (1993 \$)	Cumulative Present Value of Replacement Cost Savings (1993 \$)	Cumulative Present Value of Total Savings (1993 \$)	Cumulative Net Present Value (1993 \$)	Cumulative Savings to Investment Ratio	Individual ERO Savings to Investment Ratio
Boilers	NASA	Boiler	Replace electric w/ high eff. boiler	RI	76	Electric	Fuel Oil	\$40,100	\$130,812	\$374,438	-\$626	\$8,783	\$512,000	\$472,000	12.79	12.79
Boilers	USAF	Boiler	Replace electric w/ high eff. boiler	RI	86	Electric	Fuel Oil	\$137,200	\$480,228	\$1,147,488	-\$1,852	\$36,072	\$1,582,055	\$1,444,855	11.53	11.53
Heatpumps	S&A LAB	AC/Boilers	Install Heatpumps	RI	13	Elec	Elec	\$203,200	\$627,307	\$1,147,488	-\$1,852	\$36,072	\$2,100,133	\$1,985,833	10.38	7.89
Boilers	USAF	Boiler	Replace electric w/ high eff. boiler	RI	86	Electric	Fuel Oil	\$365,175	\$1,218,833	\$1,883,484	-\$3,718	\$71,278	\$3,286,886	\$2,994,813	8.65	7.17
Envelope	Other	Envelope	Weatherization Package	RI	37	na	na	\$378,407	\$1,261,888	\$2,810,488	-\$3,718	\$71,278	\$3,330,116	\$2,882,768	8.67	6.15
Heatpumps	RCT STOR BLD	AC/Boilers	Install Heatpumps	RI	12	Fuel Oil	Fuel Oil	\$389,307	\$1,332,387	\$2,810,488	-\$3,718	\$71,278	\$3,410,417	\$3,021,110	6.76	5.53
Heatpumps	HANGER N	AC/Boilers	Install Heatpumps	RI	6	Fuel Oil	Fuel Oil	\$464,307	\$1,745,571	\$2,810,488	-\$3,718	\$71,278	\$3,823,001	\$3,358,284	6.24	5.51
Heatpumps	CK 41	AC/Boilers	Install Heatpumps	RI	9	Fuel Oil	Fuel Oil	\$482,807	\$1,807,186	\$2,810,488	-\$3,718	\$71,278	\$3,875,137	\$3,482,389	6.67	5.32
Heatpumps	COMM CTL FAC	AC/Boilers	Install Heatpumps	RI	27	Fuel Oil	Fuel Oil	\$524,007	\$2,063,124	\$2,810,488	-\$3,718	\$71,278	\$4,141,154	\$3,617,147	7.80	5.32
Heatpumps	TGSE	AC/Boilers	Install Heatpumps	RI	10	Fuel Oil	Fuel Oil	\$580,527	\$2,383,782	\$2,810,488	-\$3,718	\$71,278	\$4,441,182	\$3,883,285	7.65	5.32
Heatpumps	M AHREX	AC/Boilers	Install Heatpumps	RI	14	Fuel Oil	Fuel Oil	\$628,527	\$2,610,881	\$2,810,488	-\$3,718	\$71,278	\$4,661,111	\$4,088,584	7.47	5.32
Heatpumps	MX VLCK BLD	AC/Boilers	Install Heatpumps	RI	22	Fuel Oil	Fuel Oil	\$641,027	\$2,885,578	\$2,810,488	-\$3,718	\$71,278	\$4,763,091	\$4,122,574	7.43	5.32
Heatpumps	HANGER L	AC/Boilers	Install Heatpumps	RI	7	Elec	Elec	\$660,027	\$2,831,222	\$2,810,488	-\$3,718	\$71,278	\$4,888,252	\$4,240,225	7.34	5.28
Generator	Titan Substation	Generator	DGEN-2	RI	2	na	Diesel	\$715,087	\$2,854,857	\$2,488,388	-\$85,880	\$71,278	\$5,148,825	\$4,430,738	7.28	5.28
Heatpumps	CTL COMP COM	AC/Boilers	Install Heatpumps	RI	11	Fuel Oil	Fuel Oil	\$760,287	\$3,044,471	\$2,488,388	-\$85,880	\$71,278	\$5,538,438	\$4,748,152	7.01	5.18
Heatpumps	CK 30 BLKHSE	AC/Boilers	Install Heatpumps	RI	17	Fuel Oil	Fuel Oil	\$830,287	\$3,251,883	\$2,488,388	-\$85,880	\$71,278	\$5,745,831	\$4,914,743	6.82	5.18
Heatpumps	MASMB BD-AC	AC/Boilers	Install Heatpumps	RI	15	Fuel Oil	Fuel Oil	\$1,010,287	\$4,180,724	\$2,488,388	-\$85,880	\$71,278	\$6,674,003	\$5,884,485	6.01	5.18
Heatpumps	SMAB WEST	AC/Boilers	Install Heatpumps	RI	25	Fuel Oil	Fuel Oil	\$1,189,087	\$5,184,188	\$2,488,388	-\$85,880	\$71,278	\$7,568,157	\$6,488,088	6.20	5.18
Heatpumps	HANGER AE	AC/Boilers	Install Heatpumps	RI	18	Fuel Oil	Fuel Oil	\$1,350,287	\$5,837,288	\$2,488,388	-\$85,880	\$71,278	\$8,431,237	\$7,088,850	6.38	5.18
Int light	FUELDSP	INC 60 CEIL	CFL 13 - BLST UNIT	RI	16	Elect	Elect	\$1,351,436	\$5,942,822	\$2,488,774	-\$87,342	\$71,278	\$8,438,533	\$7,085,884	6.24	5.04
Int light	SECURITY other	INC 60 CEIL	CFL 13 - BLST UNIT	RI	44	Elect	Elect	\$1,355,608	\$5,984,838	\$2,488,774	-\$87,342	\$71,278	\$8,482,578	\$7,101,918	6.24	5.04
Int light	SHOP-WPH	INC 60 CEIL	CFL 13 - BLST UNIT	RI	53	Elect	Elect	\$1,361,917	\$5,984,881	\$2,488,871	-\$87,342	\$71,278	\$8,486,278	\$7,124,858	6.23	5.04
Int light	HANGAR	INC 60 CEIL	CFL 13 - BLST UNIT	RI	13	Elect	Elect	\$1,379,121	\$6,088,885	\$2,488,774	-\$87,342	\$71,278	\$8,575,828	\$7,188,885	6.22	5.04
Int light	MTRPOOL	INC 60 CEIL	CFL 13 - BLST UNIT	RI	19	Elect	Elect	\$1,408,432	\$6,249,831	\$2,488,774	-\$87,342	\$71,278	\$8,728,558	\$7,318,128	6.18	5.04
Int light	STOR-UH	INC 60 CEIL	CFL 13 - BLST UNIT	RI	58	Elect	Elect	\$1,443,912	\$6,431,881	\$2,488,774	-\$87,342	\$71,278	\$8,902,184	\$7,458,272	6.17	5.04
Int light	SECURITY record	INC 60 CEIL	CFL 13 - BLST UNIT	RI	43	Elect	Elect	\$1,485,528	\$6,850,832	\$2,488,887	-\$87,342	\$71,278	\$9,111,747	\$7,628,218	6.13	5.04
Int light	SHOP	INC 60 CEIL	CFL 13 - BLST UNIT	RI	47	Elect	Elect	\$1,582,888	\$7,183,881	\$2,488,774	-\$87,342	\$71,278	\$9,801,848	\$8,018,344	6.07	5.04
Int light	MWR	INC 60 CEIL	CFL 13 - BLST UNIT	RI	21	Elect	Elect	\$1,586,788	\$7,185,823	\$2,488,774	-\$87,342	\$71,278	\$9,801,848	\$8,018,344	6.07	5.04
Int light	SHOP-ELEC	INC 60 CEIL	CFL 13 - BLST UNIT	RI	56	Elect	Elect	\$1,758,718	\$8,088,883	\$2,488,774	-\$87,342	\$71,278	\$10,482,435	\$8,732,718	5.86	5.04
Heatpumps	HANGER S	AC/Boilers	Install Heatpumps	RI	5	Fuel Oil	Fuel Oil	\$1,888,718	\$8,778,884	\$2,488,774	-\$87,342	\$71,278	\$11,171,888	\$9,272,881	5.88	4.85
Heatpumps	HANGER AD-AM	AC/Boilers	Install Heatpumps	RI	18	Fuel Oil	Fuel Oil	\$2,028,818	\$9,388,835	\$2,488,774	-\$87,342	\$71,278	\$11,781,888	\$9,782,881	5.81	4.77
Heatpumps	VIB	AC/Boilers	Install Heatpumps	RI	28	Fuel Oil	Fuel Oil	\$2,214,818	\$10,272,414	\$2,488,774	-\$87,342	\$71,278	\$12,664,288	\$10,482,258	5.72	4.75
Generator	RCC MECH BLD	AC/Boilers	Install Heatpumps	RI	2	Fuel Oil	Fuel Oil	\$2,344,818	\$10,886,145	\$2,488,774	-\$87,342	\$71,278	\$13,278,887	\$10,886,881	5.68	4.72
Generator	N Substation	Generator	DGEN-7	RI	7	na	Diesel	\$2,569,042	\$10,837,852	\$8,424,781	-\$1,282,424	\$71,278	\$14,041,481	\$11,762,488	5.58	4.41
Int light	HANGAR	FL 2X4 4-40 STD	FL 2X4 3F32T8 ELC3 REF	RI	11	Elect	Elect	\$2,618,842	\$10,285,222	\$6,467,822	-\$1,282,475	\$71,278	\$14,041,481	\$11,762,488	5.53	4.38
Int light	FUELDSP	FL 2X4 4-40 STD	FL 2X4 3F32T8 ELC3 REF	RI	9	Elect	Elect	\$2,618,842	\$10,285,222	\$6,467,822	-\$1,282,475	\$71,278	\$14,041,481	\$11,762,488	5.53	4.38
Int light	LAB-MED	INC 60 CEIL	CFL 13 - BLST UNIT	RI	16	Elect	Elect	\$2,624,175	\$10,233,888	\$6,478,885	-\$1,286,444	\$71,278	\$14,511,416	\$11,887,311	5.53	4.28
Int light	RESTRIIT casheer	INC 60 CEIL	CFL 13 - BLST UNIT	RI	38	Elect	Elect	\$2,624,888	\$10,235,834	\$6,478,885	-\$1,286,444	\$71,278	\$14,514,413	\$11,889,225	5.53	4.28
Int light	RESTRIIT clearing	INC 60 CEIL	CFL 13 - BLST UNIT	RI	39	Elect	Elect	\$2,625,802	\$10,236,782	\$6,477,882	-\$1,270,253	\$71,278	\$14,517,410	\$11,889,888	5.53	4.28
Int light	RESTRIIT dining	INC 60 CEIL	CFL 13 - BLST UNIT	RI	40	Elect	Elect	\$2,626,876	\$10,243,878	\$6,478,388	-\$1,271,882	\$71,278	\$14,522,773	\$11,888,884	5.53	4.28
Generator	S Substation	Generator	DGEN-4	RI	4	na	Diesel	\$2,729,828	\$9,884,738	\$6,438,188	-\$1,458,185	\$71,278	\$14,642,931	\$12,513,882	5.46	4.11
Heatpumps	CK 41 AC SHR	AC/Boilers	Install Heatpumps	RI	8	Elec	Elec	\$3,181,788	\$11,670,848	\$6,438,188	-\$1,458,185	\$71,278	\$16,718,848	\$13,537,851	5.25	3.82
Int light	NASI EAS	INC 60 CEIL	CFL 13 - BLST UNIT	RI	23	Elect	Elect	\$3,506,571	\$12,752,417	\$6,888,888	-\$1,752,678	\$71,278	\$17,848,888	\$14,433,438	5.12	3.78
Int light	ADMIN	INC 60 CEIL	CFL 13 - BLST UNIT	RI	2	Elect	Elect	\$3,857,888	\$13,822,508	\$7,338,288	-\$2,671,285	\$71,278	\$18,288,881	\$15,483,842	4.88	3.78
Int light	NASOWN	INC 60 CEIL	CFL 13 - BLST UNIT	RI	25	Elect	Elect	\$4,188,435	\$15,823,544	\$7,778,888	-\$2,370,833	\$71,278	\$20,503,788	\$16,315,383	4.88	3.78
Int light	LAB-MED	FL 2X4 4-40 STD	FL 2X4 3F32T8 ELC3 REF	RI	14	Elect	Elect	\$4,218,822	\$15,163,882	\$7,885,871	-\$2,369,578	\$71,278	\$20,618,758	\$16,382,735	4.88	3.62
Int light	BRK-ADM	INC 60 CEIL	CFL 18 GLOBE UNIT	RI	4	Elect	Elect	\$4,218,781	\$15,165,874	\$7,888,844	-\$2,370,728	\$71,278	\$20,613,178	\$16,384,488	4.88	3.65
Int light	RESTRIIT casheer	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	35	Elect	Elect	\$4,218,478	\$15,167,568	\$7,887,577	-\$2,370,504	\$71,278	\$20,615,918	\$16,386,448	4.88	3.54
Int light	RESTRIIT clearing	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	36	Elect	Elect	\$4,220,254	\$15,169,457	\$7,888,218	-\$2,370,281	\$71,278	\$20,618,688	\$16,388,412	4.88	3.54
Int light	RESTRIIT dining	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	37	Elect	Elect	\$4,221,852	\$15,172,882	\$7,888,358	-\$2,369,878	\$71,278	\$20,623,813	\$16,389,880	4.88	3.54
Int light	TRAIHNG	INC 60 CEIL	CFL 13 - BLST UNIT	RI	50	Elect	Elect	\$4,233,935	\$15,148,882	\$7,825,758	-\$2,370,328	\$71,278	\$20,688,688	\$16,432,758	4.88	3.51
Int light	OTHER	INC 60 CEIL	CFL 13 - BLST UNIT	RI	27	Elect	Elect	\$4,244,885	\$15,181,126	\$7,848,388	-\$2,387,740	\$71,278	\$20,705,825	\$16,488,181	4.88	3.51
Int light	COMCATN	INC 60 CEIL	CFL 13 - BLST UNIT	RI	8	Elect	Elect	\$4,488,518	\$15,887,875	\$8,188,888	-\$2,575,219	\$71,278	\$21,558,584	\$17,071,678	4.88	3.51
Int light	R&D	INC 60 CEIL	CFL 13 - BLST UNIT	RI	34	Elect	Elect	\$4,751,138	\$16,870,808	\$8,518,888	-\$2,777,294	\$71,278	\$22,480,888	\$17,728,584	4.73	3.51
AC	Area 1W	heat pump	install TES	ROF	84	Elect	Elect	\$4,800,530	\$16,841,842	\$8,631,173	-\$2,767,452	\$145,948	\$22,651,811	\$17,061,881	4.72	3.48
Int light	DET-RR	INC 60 CEIL	CFL 13 - BLST UNIT	RI	8	Elect	Elect	\$4,801,895	\$16,844,757	\$8,632,728	-\$2,768,150	\$145,948	\$22,655,284	\$17,063,588	4.72	3.15
Int light	NASOWN	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	24	Elect	Elect	\$5,167,288	\$17,387,844	\$8,838,778	-\$2,858,585	\$145,948	\$23,805,878	\$18,638,688	4.81	3.15
Int light	NASLEW	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	22	Elect	Elect	\$5,228,434	\$18,117,828	\$8,223,557	-\$2,550,953	\$145,948	\$24,636,381	\$18,688,947	4.81	3.15
AC	Area 5	direct expansion	install TES	ROF	52	Elect	Elect	\$5,538,782	\$18,111,543	\$8,248,988	-\$2,548,482	\$161,788	\$24,973,833	\$19,435,851	4.81	3.03
AC	Area 8	direct expansion	install TES	ROF	55	Elect	Elect	\$5,551,131	\$18,105,257	\$8,274,434	-\$2,548,832	\$177,624	\$25,011,284	\$19,488,154	4.81	3.03
Int light	WHIS	INC 60 CEIL	CFL 13 - BLST UNIT	RI	61	Elect	Elect	\$5,637,556	\$18,265,172	\$8,388,882	-\$2,561,324	\$177,624	\$25,211,384	\$19,633,888	4.88	3.01
Int light	COMCATN	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	5	Elect	Elect	\$5,906,984	\$18,778,712	\$8,888,548	-\$2,569,483	\$177,624	\$26,058,388	\$20,148,388	4.41	2.91
Int light	R&D	FL 2X4 4-34 STD	FL 2X4 3F40T12 ELC3	RI	33	Elect	Elect	\$6,294,258	\$19,473,706	\$8,825,254	-\$2,361,876	\$177,624	\$27,184,708	\$20,888,451	4.32	2.91
AC	Area 4	chilled water	install TES	ROF	1	Elect	Elect	\$6,306,885	\$19,467,420	\$8,858,882	-\$2,386,418	\$191,708	\$27,220,403	\$20,913,788	4.32	2.88
AC	Area 5	chilled water	install TES	ROF	2	Elect	Elect	\$6,318,954	\$19,481,135	\$8,878,131	-\$2,386,855	\$205,787	\$27,258,088	\$20,937,144	4.31	2.88
AC	Area 6	chilled water	install TES	ROF	3	Elect	Elect	\$6,331,302	\$19,494,849	\$8,891,578	-\$2,387,495	\$219,868	\$27,291,793	\$20,968,491	4.31	2.88
AC	Area 3A	chilled water	install TES	ROF	5	Elect	Elect	\$6,343,651	\$19,488,564	\$8,82						

Table 3.10
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Cumulative Present Value of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	Rt or RCF	ID	Existing Fuel	Resulting Fuel	Cumulative Present Value of Installed Cost (1983 \$)	Cumulative Present Value of Energy Savings (1983 \$)	Cumulative Present Value of Demand Savings (1983 \$)	Cumulative Present Value of O&M Savings (1983 \$)	Cumulative Present Value of Replacement Cost Savings (1983 \$)	Cumulative Present Value of Total Savings (1983 \$)	Cumulative Net Present Value (1983 \$)	Cumulative Savings to Investment Ratio	Individual ERO Savings to Investment Ratio
Int light	PLT-ECU	INC 60 CBL	CFL 13 • BLST UNIT	RI	32	Elect	Elect	\$8,637,066	\$18,988,827	\$18,238,514	\$2,455,136	\$297,876	\$28,156,975	\$21,522,888	4.24	2.81
AC	Area 3A	direct expansion	install TES	ROF	84	Elect	Elect	\$8,654,354	\$18,978,128	\$18,288,128	\$2,451,691	\$315,831	\$28,288,385	\$21,554,641	4.24	2.80
AC	Area 5	direct expansion	install TES	ROF	85	Elect	Elect	\$8,674,112	\$18,968,671	\$18,686,638	\$2,447,755	\$335,428	\$28,262,586	\$21,588,454	4.23	2.74
Envelope		68740 Envelope	Double Paned Window	RI	24	na	na	\$8,678,748	\$18,982,381	\$18,487,733	\$2,447,755	\$335,428	\$28,277,788	\$21,588,648	4.23	2.76
Envelope		48750 Envelope	Double Paned Window	RI	20	na	na	\$8,688,947	\$18,988,985	\$18,686,648	\$2,447,755	\$335,428	\$28,286,478	\$21,608,823	4.23	2.76
Envelope		1841 Envelope	Double Paned Window	RI	13	na	na	\$8,702,723	\$20,640,871	\$18,411,418	\$2,447,755	\$335,428	\$28,338,854	\$21,637,231	4.23	2.76
Envelope		1722 Envelope	Double Paned Window	RI	16	na	na	\$8,710,213	\$20,658,828	\$18,412,819	\$2,447,755	\$335,428	\$28,388,213	\$21,658,688	4.23	2.76
AC	Area 3A	direct expansion	install TES	ROF	78	Elect	Elect	\$8,748,728	\$20,658,881	\$18,483,518	\$2,438,681	\$371,784	\$28,486,283	\$21,716,584	4.22	2.88
AC	Area 1	direct expansion	install TES	ROF	86	Elect	Elect	\$8,774,428	\$20,638,288	\$18,534,387	\$2,434,988	\$384,852	\$28,532,578	\$21,758,152	4.21	2.88
AC	Area 8	direct expansion	install TES	ROF	88	Elect	Elect	\$8,788,124	\$20,625,718	\$18,588,274	\$2,438,681	\$417,818	\$28,588,664	\$21,788,741	4.21	2.88
AC	Area 3A	direct expansion	install TES	ROF	72	Elect	Elect	\$8,823,821	\$20,613,148	\$18,638,152	\$2,425,118	\$448,888	\$28,685,158	\$21,841,328	4.20	2.88
AC	Area IN	direct expansion	install TES	ROF	76	Elect	Elect	\$8,853,454	\$18,988,683	\$18,887,388	\$2,418,213	\$488,485	\$28,744,528	\$21,881,082	4.18	2.88
Boilers	NASA	Boiler	High Eff Boiler	RI	2	Fuel Oil	Fuel Oil	\$7,884,833	\$20,331,384	\$18,887,388	\$2,418,213	\$538,388	\$28,145,883	\$22,141,838	4.18	2.88
AC	Area 2	direct expansion	install TES	ROF	79	Elect	Elect	\$7,853,428	\$20,328,628	\$18,788,638	\$2,408,371	\$588,882	\$28,277,181	\$22,223,751	4.15	2.88
AC	Area 4	direct expansion	install TES	ROF	80	Elect	Elect	\$7,162,822	\$20,388,484	\$18,874,488	\$2,388,528	\$625,878	\$28,488,888	\$22,385,877	4.14	2.88
AC	Area 1W	direct expansion	install TES	ROF	81	Elect	Elect	\$7,152,217	\$20,287,358	\$18,883,881	\$2,388,687	\$688,484	\$28,548,217	\$22,388,688	4.13	2.88
AC	Area 3A	direct expansion	install TES	ROF	82	Elect	Elect	\$7,281,812	\$20,288,684	\$18,881,788	\$2,378,888	\$713,858	\$28,671,735	\$22,478,123	4.12	2.88
AC	Area 6	chilled water	install TES	ROF	8	Elect	Elect	\$7,718,438	\$20,278,482	\$18,882,233	\$2,378,683	\$727,348	\$28,711,187	\$22,494,737	4.12	2.88
Heatpumps	PSL	AC/Boilers	install Heatpumps	RI	4	Fuel Oil	Fuel Oil	\$7,285,838	\$20,483,858	\$18,882,233	\$2,378,683	\$727,348	\$28,885,742	\$22,888,812	4.10	2.88
Heatpumps	DELTA SPH BD	AC/Boilers	install Heatpumps	RI	23	Fuel Oil	Fuel Oil	\$7,327,838	\$20,574,758	\$18,882,233	\$2,378,683	\$727,348	\$28,887,444	\$22,878,812	4.08	2.88
Heatpumps	OPTICS LAB	AC/Boilers	install Heatpumps	RI	1	Fuel Oil	Fuel Oil	\$7,387,838	\$20,733,881	\$18,882,233	\$2,378,683	\$727,348	\$28,188,488	\$22,778,858	4.08	2.88
Heatpumps	CTL BD SP TS	AC/Boilers	install Heatpumps	RI	24	Fuel Oil	Fuel Oil	\$7,467,838	\$20,787,788	\$18,882,233	\$2,378,683	\$727,348	\$28,228,478	\$22,812,548	4.08	2.88
Heatpumps	GPS PROP FAC	AC/Boilers	install Heatpumps	RI	16	Fuel Oil	Fuel Oil	\$7,458,238	\$20,688,288	\$18,882,233	\$2,378,683	\$727,348	\$28,338,878	\$22,882,748	4.07	2.88
AC	Area 3A	direct expansion	install TES	ROF	73	Elect	Elect	\$7,477,387	\$20,688,482	\$18,138,188	\$2,371,688	\$758,818	\$28,484,888	\$22,838,688	4.07	2.82
AC	Area 3	direct expansion	install TES	ROF	83	Elect	Elect	\$7,538,834	\$20,672,188	\$18,288,888	\$2,358,878	\$803,482	\$28,588,428	\$22,828,788	4.05	2.81
Int light	HANGER AF	FL 2K4 J 34 STD	FL 2K4 J 34 STD ELC3	RI	7	Elect	Elect	\$7,538,887	\$20,672,524	\$18,288,888	\$2,358,887	\$803,482	\$28,588,428	\$22,828,788	4.05	2.81
Heatpumps	MIS CK BD AK	AC/Boilers	install Heatpumps	RI	21	Fuel Oil	Fuel Oil	\$7,787,187	\$21,384,558	\$18,258,888	\$2,358,887	\$803,482	\$28,388,888	\$22,388,888	4.02	2.58
AC	Area 1W	Window AC	install efficient window units	ROF	20	Fuel Oil	Fuel Oil	\$7,814,587	\$21,581,887	\$18,258,888	\$2,358,887	\$803,482	\$21,278,418	\$22,481,881	4.02	2.58
AC	Area 2	Window AC	install efficient window units	ROF	8	Elect	Elect	\$7,815,917	\$21,583,881	\$18,258,188	\$2,358,888	\$804,812	\$21,278,885	\$22,483,887	4.00	2.58
AC	Area 2	Window AC	install efficient window units	ROF	8	Elect	Elect	\$7,818,817	\$21,587,828	\$18,258,451	\$2,358,843	\$807,511	\$21,288,847	\$22,488,231	4.00	2.58
AC	Area 3	Window AC	install efficient window units	ROF	11	Elect	Elect	\$7,822,886	\$21,583,748	\$18,258,888	\$2,358,878	\$811,581	\$21,287,277	\$22,474,811	4.00	2.58
Boilers	Navy	Boiler	High Eff Boiler	RI	3	Fuel Oil	Fuel Oil	\$7,885,347	\$21,883,844	\$18,258,888	\$2,358,878	\$829,785	\$21,484,888	\$22,538,488	3.98	2.52
AC	Area 7	Window AC	install efficient window units	ROF	19	Elect	Elect	\$7,872,828	\$21,882,254	\$18,251,488	\$2,358,778	\$838,474	\$21,421,488	\$22,538,488	3.98	2.48
AC	Area 5	Window AC	install efficient window units	ROF	15	Elect	Elect	\$7,901,588	\$21,733,042	\$18,254,181	\$2,358,338	\$864,853	\$21,484,838	\$22,583,338	3.98	2.48
AC	Area 1	Window AC	install efficient window units	ROF	2	Elect	Elect	\$7,902,553	\$21,734,358	\$18,254,288	\$2,358,334	\$867,887	\$21,487,318	\$22,584,757	3.98	2.48
AC	Other	Window AC	install efficient window units	ROF	24	Elect	Elect	\$7,903,587	\$21,735,474	\$18,254,388	\$2,358,318	\$867,881	\$21,488,881	\$22,584,174	3.98	2.48
AC	Area 6	Window AC	install efficient window units	ROF	17	Elect	Elect	\$7,914,883	\$21,758,147	\$18,256,321	\$2,358,153	\$878,457	\$21,525,772	\$22,611,788	3.98	2.48
AC	Area 1W	Window AC	install efficient window units	ROF	4	Elect	Elect	\$7,918,773	\$21,758,728	\$18,255,788	\$2,358,882	\$883,227	\$21,537,831	\$22,618,858	3.98	2.48
AC	Area 3	Window AC	install efficient window units	ROF	10	Elect	Elect	\$8,012,278	\$21,885,688	\$18,284,388	\$2,358,888	\$878,733	\$21,778,875	\$22,757,788	3.97	2.48
AC	Area 2	Window AC	install efficient window units	ROF	7	Elect	Elect	\$8,014,188	\$21,888,381	\$18,284,338	\$2,358,658	\$878,642	\$21,774,818	\$22,788,632	3.98	2.48
AC	Area 4	Window AC	install efficient window units	ROF	13	Elect	Elect	\$8,028,454	\$21,908,353	\$18,288,948	\$2,358,431	\$883,888	\$21,812,768	\$22,783,777	3.98	2.48
AC	Area IN	Window AC	install efficient window units	ROF	23	Elect	Elect	\$8,032,318	\$21,913,388	\$18,288,283	\$2,358,388	\$888,778	\$21,818,885	\$22,788,588	3.98	2.48
AC	Area 8	Window AC	install efficient window units	ROF	21	Elect	Elect	\$8,060,848	\$21,952,773	\$18,288,838	\$2,358,882	\$1,025,365	\$21,881,841	\$22,838,181	3.98	2.48
AC	Area 5	chilled water	install TES	ROF	8	Elect	Elect	\$8,078,228	\$21,943,873	\$18,284,458	\$2,352,517	\$1,038,813	\$21,933,818	\$22,855,688	3.95	2.48
AC	Area 2	chilled water	install TES	ROF	28	Elect	Elect	\$8,137,582	\$21,938,371	\$18,418,881	\$2,348,787	\$1,088,448	\$22,088,912	\$23,043,418	3.84	2.48
Boilers	USAF	Boiler	High Eff Boiler	RI	1	Fuel Oil	Fuel Oil	\$8,518,727	\$22,708,484	\$18,418,881	\$2,348,787	\$1,245,845	\$23,018,343	\$24,488,688	3.88	2.47
AC	Area 6	chilled water	install TES	ROF	9	Elect	Elect	\$8,538,485	\$22,688,347	\$18,451,583	\$2,338,778	\$1,258,844	\$23,085,824	\$24,528,538	3.87	2.48
AC	Area 1W	chilled water	install TES	ROF	10	Elect	Elect	\$8,558,243	\$22,688,281	\$18,482,285	\$2,332,833	\$1,274,844	\$23,113,788	\$24,557,483	3.87	2.48
Int light	MWR	FL 2K4 J 80 STD	MH 175 PEND	RI	20	Elect	Elect	\$8,567,248	\$22,687,251	\$18,483,888	\$2,315,478	\$1,274,844	\$23,138,781	\$24,572,532	3.87	2.37
Int light	SHOP-WPH	FL 2K4 J 80 STD	MH 175 PEND	RI	51	Elect	Elect	\$8,574,477	\$22,681,822	\$18,485,122	\$2,304,883	\$1,274,844	\$23,158,885	\$24,582,428	3.87	2.37
Int light	SHOP-ELEC	FL 2K4 J 80 STD	MH 175 PEND	RI	48	Elect	Elect	\$8,788,342	\$22,827,781	\$18,528,501	\$1,985,282	\$1,274,844	\$23,085,853	\$24,878,618	3.83	2.37
Int light	MIRPOOL	FL 2K4 J 80 STD	MH 175 PEND	RI	17	Elect	Elect	\$8,827,453	\$22,851,881	\$18,538,588	\$1,985,281	\$1,274,844	\$23,756,242	\$24,828,788	3.82	2.37
Int light	STOR-UH	FL 2K4 J 80 STD	MH 175 PEND	RI	54	Elect	Elect	\$8,878,828	\$22,878,227	\$18,542,537	\$1,938,821	\$1,274,844	\$23,858,888	\$24,888,188	3.82	2.37
Int light	SHOP	FL 2K4 J 80 STD	MH 175 PEND	RI	45	Elect	Elect	\$8,982,873	\$22,958,412	\$18,582,888	\$1,844,374	\$1,274,844	\$24,148,147	\$25,155,274	3.80	2.37
Int light	Ext Lights	INC 2-20 W	EXIT - LED	RI	82	Elect	Elect	\$10,310,818	\$24,474,187	\$18,985,822	\$488,818	\$1,274,844	\$24,204,214	\$26,884,185	3.81	2.32
AC	Area 3A	chilled water	install TES	ROF	11	Elect	Elect	\$10,337,188	\$24,488,338	\$18,881,887	\$484,585	\$1,288,518	\$23,267,238	\$26,838,844	3.81	2.32
AC	Area 8	chilled water	install TES	ROF	50	Elect	Elect	\$10,888,255	\$24,355,783	\$18,788,377	\$458,528	\$1,887,328	\$28,578,838	\$27,671,682	3.54	2.32
AC	Area 3	chilled water	install TES	ROF	16	Elect	Elect	\$10,833,832	\$24,338,184	\$18,837,888	\$451,638	\$1,828,828	\$28,651,858	\$27,717,224	3.53	2.32
AC	Area 3A	chilled water	install TES	ROF	17	Elect	Elect	\$10,968,488	\$24,328,584	\$18,988,834	\$444,758	\$1,848,528	\$28,731,175	\$27,762,787	3.53	2.32
Envelope		1748 Envelope	Double Paned Window	RI	18	na	na	\$10,979,487	\$24,344,578	\$18,988,477	\$444,758	\$1,848,528	\$28,756,782	\$27,777,215	3.53	2.38
Envelope		80800 Envelope	Double Paned Window	RI	23	na	na	\$10,988,382	\$24,363,858	\$18,911,582	\$444,758	\$1,848,528	\$28,777,198	\$27,788,818	3.53	2.38
Envelope		1724 Envelope	Double Paned Window	RI	17	na	na	\$10,987,872	\$24,384,428	\$18,912,858	\$444,758	\$1,848,528	\$28,788,864	\$27,801,181	3.53	2.38
Envelope		1645 Envelope	Double Paned Window	RI	14	na	na	\$11,018,988	\$24,438,155	\$18,915,748	\$444,758	\$1,848,528	\$28,847,472	\$27,828,783	3.53	2.38
Envelope		54915 Envelope	Double Paned Window	RI	21	na	na	\$11,035,151	\$24,485,232	\$18,917,851	\$444,758	\$1,848,528	\$28,884,858	\$27,848,887	3.52	2.38
Envelope		55005 Envelope	Double Paned Window	RI	22	na	na	\$11,047,525	\$24,482,052	\$18,918,841	\$444,758	\$1,848,528	\$28,913,489	\$27,885,884	3.52	2.38
Boilers	Navy	Boiler	Replace electric w/ high eff f o boiler	RI	8b	Electric	Fuel Oil	\$11,078,225	\$24,508,143	\$18,988,823	\$445,578	\$1,852,887	\$28,984,187	\$27,985,872	3.52	2.38
AC	Area IN	chilled water	install TES	ROF	19	Elect	Elect	\$11,115,271	\$24,508,8							

Table 3.10
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Cumulative Present Value of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Cumulative Present Value of Installed Cost (\$1003 \$)	Cumulative Present Value of Energy Savings (\$1003 \$)	Cumulative Present Value of Demand Savings (\$1003 \$)	Cumulative Present Value of O&M Savings (\$1003 \$)	Cumulative Present Value of Replacement Cost Savings (\$1003 \$)	Cumulative Present Value of Total Savings (\$1003 \$)	Cumulative Net Present Value (\$1003 \$)	Cumulative Savings to Investment Ratio	Individual ERO Savings to Investment Ratio
AC	Area 7	chilled water	install TES	ROF	36	Elect	Elect	\$11,530,210	\$24,367,187	\$13,677,626	-\$250,601	\$2,198,063	\$40,612,365	\$28,462,665	3.47	2.27
AC	Area 3A	chilled water	install TES	ROF	37	Elect	Elect	\$11,629,011	\$24,367,639	\$13,762,161	-\$229,457	\$2,304,610	\$40,236,662	\$28,607,661	3.46	2.27
AC	Area 3A	chilled water	install TES	ROF	35	Elect	Elect	\$11,718,835	\$24,350,631	\$13,683,656	-\$268,773	\$2,306,362	\$40,435,615	\$28,716,160	3.45	2.27
AC	Area 3A	chilled water	install TES	ROF	21	Elect	Elect	\$11,758,620	\$24,340,064	\$13,680,167	-\$268,408	\$2,419,961	\$40,529,738	\$28,776,616	3.45	2.26
AC	Area 6	chilled water	install TES	ROF	22	Elect	Elect	\$11,803,275	\$24,330,784	\$14,048,860	-\$181,550	\$2,440,673	\$40,629,167	\$28,825,862	3.44	2.24
AC	Area 1W	Window AC	install efficient window units	ROF	3	Elect	Elect	\$11,804,431	\$24,332,110	\$14,048,838	-\$181,538	\$2,442,128	\$40,631,741	\$28,827,318	3.44	2.23
AC	Area 2	Window AC	install efficient window units	ROF	6	Elect	Elect	\$11,805,567	\$24,333,428	\$14,048,128	-\$181,522	\$2,443,284	\$40,634,314	\$28,828,727	3.44	2.23
AC	Area 1H	Window AC	install efficient window units	ROF	22	Elect	Elect	\$11,806,742	\$24,334,742	\$14,048,213	-\$181,507	\$2,444,440	\$40,636,887	\$28,830,145	3.44	2.23
AC	Area 4	Window AC	install efficient window units	ROF	12	Elect	Elect	\$11,815,988	\$24,345,288	\$14,048,815	-\$181,383	\$2,453,685	\$40,657,475	\$28,841,467	3.44	2.23
AC	Area 1	Window AC	install efficient window units	ROF	1	Elect	Elect	\$11,816,566	\$24,345,825	\$14,048,850	-\$181,384	\$2,454,263	\$40,658,762	\$28,842,196	3.44	2.23
AC	Area 7	Window AC	install efficient window units	ROF	18	Elect	Elect	\$11,827,545	\$24,356,425	\$14,056,783	-\$181,251	\$2,465,242	\$40,683,206	\$28,855,864	3.44	2.23
AC	Area 6	Window AC	install efficient window units	ROF	20	Elect	Elect	\$11,830,680	\$24,372,240	\$14,081,714	-\$181,162	\$2,477,377	\$40,710,239	\$28,870,551	3.44	2.23
AC	Area 5	Window AC	install efficient window units	ROF	14	Elect	Elect	\$11,842,569	\$24,375,530	\$14,081,634	-\$181,086	\$2,480,266	\$40,718,064	\$28,874,685	3.44	2.23
AC	Area 6	Window AC	install efficient window units	ROF	16	Elect	Elect	\$11,845,458	\$24,378,819	\$14,082,163	-\$181,031	\$2,483,156	\$40,723,087	\$28,877,638	3.44	2.23
AC	Area 3	Window AC	install efficient window units	ROF	9	Elect	Elect	\$11,850,061	\$24,384,062	\$14,082,594	-\$180,974	\$2,487,778	\$40,733,391	\$28,883,310	3.44	2.23
AC	Area 3A	chilled water	install TES	ROF	48	Elect	Elect	\$12,078,422	\$24,341,598	\$14,363,679	-\$129,796	\$2,675,060	\$41,230,641	\$29,161,519	3.41	2.22
AC	Area 3A	chilled water	install TES	ROF	48	Elect	Elect	\$12,297,980	\$24,300,748	\$14,681,767	-\$60,586	\$2,655,138	\$41,727,089	\$29,428,628	3.39	2.22
AC	Area 7	chilled water	install TES	ROF	25	Elect	Elect	\$12,349,844	\$24,288,847	\$14,754,764	-\$80,252	\$2,678,388	\$41,841,746	\$29,681,692	3.38	2.21
AC	Area 3A	chilled water	install TES	ROF	26	Elect	Elect	\$12,404,178	\$24,276,378	\$14,682,262	-\$80,428	\$2,602,452	\$41,981,656	\$29,567,477	3.38	2.21
AC	Area 3	chilled water	install TES	ROF	31	Elect	Elect	\$12,473,331	\$24,260,506	\$14,676,327	-\$85,647	\$2,631,914	\$42,113,103	\$29,636,772	3.38	2.19
AC	Area 1W	chilled water	install TES	ROF	32	Elect	Elect	\$12,542,483	\$24,244,840	\$15,169,483	-\$41,889	\$2,661,376	\$42,264,556	\$29,722,667	3.37	2.18
AC	Area 1W	chilled water	install TES	ROF	38	Elect	Elect	\$12,652,283	\$24,223,130	\$15,227,587	-\$17,264	\$3,070,568	\$42,504,628	\$29,851,766	3.35	2.18
AC	Area 1W	chilled water	install TES	ROF	28	Elect	Elect	\$12,711,538	\$24,209,528	\$15,333,947	-\$5,454	\$3,065,233	\$42,633,255	\$29,821,718	3.35	2.18
AC	Area 3A	chilled water	install TES	ROF	33	Elect	Elect	\$12,790,588	\$24,191,362	\$15,475,748	\$10,283	\$3,126,415	\$42,863,648	\$29,813,280	3.35	2.16
AC	Area 1W	chilled water	install TES	ROF	48	Elect	Elect	\$12,911,325	\$24,167,732	\$15,616,861	\$37,356	\$3,242,854	\$43,063,685	\$29,152,288	3.34	2.15
AC	Area 5	chilled water	install TES	ROF	42	Elect	Elect	\$13,043,080	\$24,141,820	\$15,788,283	\$66,864	\$3,368,514	\$43,343,612	\$29,389,552	3.32	2.13
AC	Area 1W	chilled water	install TES	ROF	43	Elect	Elect	\$13,174,795	\$24,116,108	\$15,828,828	\$86,410	\$3,490,174	\$43,623,618	\$29,448,824	3.31	2.13
AC	Area 5	chilled water	install TES	ROF	44	Elect	Elect	\$13,315,312	\$24,088,578	\$16,083,734	\$127,904	\$3,618,620	\$43,919,642	\$29,604,538	3.30	2.11
AC	Area 3A	chilled water	install TES	ROF	45	Elect	Elect	\$13,455,828	\$24,061,043	\$16,246,542	\$159,388	\$3,748,083	\$44,216,686	\$29,760,237	3.29	2.11
AC	Area 3A	chilled water	install TES	ROF	47	Elect	Elect	\$13,620,050	\$24,028,864	\$16,438,624	\$186,267	\$3,906,554	\$44,558,448	\$29,838,398	3.27	2.08
Envelope	Envelope	49635 Envelope	Double Paned Window	RI	19	na	na	\$13,631,357	\$24,050,194	\$16,438,168	\$186,267	\$3,906,554	\$44,561,123	\$29,840,765	3.27	2.01
Envelope	Envelope	1704 Envelope	Double Paned Window	RI	15	na	na	\$13,651,627	\$24,068,480	\$16,448,580	\$186,267	\$3,906,554	\$44,621,001	\$29,878,173	3.27	2.01
AC	Area 6	chilled water	install TES	ROF	48	Elect	Elect	\$13,808,700	\$24,057,488	\$16,623,730	\$221,638	\$4,028,127	\$44,838,990	\$31,129,280	3.25	2.01
Motors	RAD	Fan Motors	install Energy Efficient Motor	RI	15	Elect	Elect	\$13,979,461	\$24,274,885	\$16,687,731	\$221,638	\$4,071,213	\$45,265,277	\$31,285,616	3.25	1.62
Motors	TRAINING	Fan Motors	install Energy Efficient Motor	RI	22	Elect	Elect	\$13,980,222	\$24,275,870	\$16,688,618	\$221,638	\$4,071,415	\$45,268,740	\$31,286,518	3.24	1.62
Motors	WHS	Fan Motors	install Energy Efficient Motor	RI	23	Elect	Elect	\$14,033,718	\$24,344,122	\$16,788,184	\$221,638	\$4,085,623	\$45,369,567	\$31,335,948	3.23	1.62
Motors	NASOWN	Fan Motors	install Energy Efficient Motor	RI	11	Elect	Elect	\$14,136,025	\$24,475,032	\$16,748,751	\$221,638	\$4,112,786	\$45,566,217	\$31,439,162	3.22	1.62
Motors	LAB-MED	Fan Motors	install Energy Efficient Motor	RI	7	Elect	Elect	\$14,137,681	\$24,477,150	\$16,747,376	\$221,638	\$4,113,238	\$45,568,368	\$31,431,718	3.22	1.62
Motors	SECURITY	Fan Motors	install Energy Efficient Motor	RI	17	Elect	Elect	\$14,142,833	\$24,483,743	\$16,748,318	\$221,638	\$4,114,604	\$45,579,303	\$31,436,478	3.22	1.62
Motors	DET-RR	Fan Motors	install Energy Efficient Motor	RI	4	Elect	Elect	\$14,143,051	\$24,484,021	\$16,748,480	\$221,638	\$4,114,662	\$45,579,721	\$31,438,678	3.22	1.62
Motors	SHOP-WPH	Fan Motors	install Energy Efficient Motor	RI	20	Elect	Elect	\$14,143,758	\$24,484,826	\$16,748,886	\$221,638	\$4,114,850	\$45,581,679	\$31,437,322	3.22	1.62
Motors	OTHER	Fan Motors	install Energy Efficient Motor	RI	12	Elect	Elect	\$14,145,072	\$24,488,608	\$16,756,162	\$221,638	\$4,115,189	\$45,583,607	\$31,438,534	3.22	1.62
Motors	COMCATN	Fan Motors	install Energy Efficient Motor	RI	3	Elect	Elect	\$14,175,235	\$24,525,203	\$16,781,633	\$221,638	\$4,123,210	\$45,641,564	\$31,488,348	3.22	1.62
Motors	SHOP-ELEC	Fan Motors	install Energy Efficient Motor	RI	19	Elect	Elect	\$14,185,621	\$24,538,748	\$16,788,525	\$221,638	\$4,128,021	\$45,661,631	\$31,478,118	3.22	1.62
Motors	PLT-EQU	Fan Motors	install Energy Efficient Motor	RI	14	Elect	Elect	\$14,195,231	\$24,550,790	\$16,788,671	\$221,638	\$4,128,521	\$45,680,619	\$31,484,788	3.22	1.62
Motors	IMWR	Fan Motors	install Energy Efficient Motor	RI	9	Elect	Elect	\$14,197,086	\$24,553,178	\$16,788,773	\$221,638	\$4,128,616	\$45,683,603	\$31,485,567	3.22	1.62
Motors	MTRPOOL	Fan Motors	install Energy Efficient Motor	RI	8	Elect	Elect	\$14,206,474	\$24,565,176	\$16,773,388	\$221,638	\$4,131,507	\$45,701,630	\$31,485,156	3.22	1.62
Motors	ADMN	Fan Motors	install Energy Efficient Motor	RI	1	Elect	Elect	\$14,248,963	\$24,620,824	\$16,788,783	\$221,638	\$4,143,058	\$45,785,223	\$31,535,258	3.22	1.62
Motors	HANGAR	Fan Motors	install Energy Efficient Motor	RI	6	Elect	Elect	\$14,255,524	\$24,627,838	\$16,781,780	\$221,638	\$4,144,535	\$45,795,811	\$31,546,367	3.21	1.62
Motors	NASLEAS	Fan Motors	install Energy Efficient Motor	RI	10	Elect	Elect	\$14,256,040	\$24,756,557	\$16,828,881	\$221,638	\$4,171,231	\$45,889,118	\$31,633,678	3.20	1.62
Motors	PLT-BLD	Fan Motors	install Energy Efficient Motor	RI	13	Elect	Elect	\$14,360,837	\$24,762,605	\$16,831,580	\$221,638	\$4,172,505	\$45,898,337	\$31,637,501	3.20	1.62
Motors	STOR UH	Fan Motors	install Energy Efficient Motor	RI	21	Elect	Elect	\$14,382,185	\$24,780,011	\$16,838,547	\$221,638	\$4,178,175	\$46,039,371	\$31,667,167	3.20	1.62
Motors	FUELDSP	Fan Motors	install Energy Efficient Motor	RI	5	Elect	Elect	\$14,382,514	\$24,780,432	\$16,838,671	\$221,638	\$4,178,263	\$46,040,004	\$31,667,480	3.20	1.62
Motors	RESTRIIT	Fan Motors	install Energy Efficient Motor	RI	16	Elect	Elect	\$14,384,770	\$24,793,320	\$16,848,522	\$221,638	\$4,178,662	\$46,044,342	\$31,658,571	3.20	1.62
Motors	SHOP	Fan Motors	install Energy Efficient Motor	RI	18	Elect	Elect	\$14,414,839	\$24,831,785	\$16,851,657	\$221,638	\$4,186,848	\$46,102,138	\$31,687,288	3.20	1.62
Motors	BRK/ADM	Fan Motors	install Energy Efficient Motor	RI	2	Elect	Elect	\$14,415,064	\$24,832,121	\$16,851,620	\$221,638	\$4,186,916	\$46,102,604	\$31,687,516	3.20	1.63
Int light	ADMN	FL 2X4 2'x3' STD	FL 2X4 2'x4'12ES ELC2	RI	1	Elect	Elect	\$14,674,787	\$25,134,108	\$16,873,852	\$281,654	\$4,186,916	\$46,575,730	\$31,886,833	3.17	1.62
Heatpumps	HANGER RAD	AC/Batters	install Heatpumps	RI	3	Elect	Elect	\$14,768,687	\$25,299,194	\$16,873,852	\$281,654	\$4,186,916	\$46,740,616	\$31,873,919	3.17	1.76
Boilers	NASA	Boiler	High Eff Boiler	RI	5	Fuel Oil	Fuel Oil	\$14,773,887	\$25,300,575	\$16,873,852	\$281,654	\$4,189,712	\$46,752,983	\$31,879,886	3.16	1.74
Motors	Area 3	Chilled Water Pump Motors	install Energy Efficient Motor	ROF	2C	Elect	Elect	\$14,775,683	\$25,310,360	\$16,873,852	\$281,654	\$4,191,048	\$46,756,113	\$31,880,421	3.16	1.74
Motors	Area 6	Chilled Water Pump Motors	install Energy Efficient Motor	ROF	5C	Elect	Elect	\$14,781,038	\$25,315,870	\$16,873,852	\$281,654	\$4,195,024	\$46,765,400	\$31,884,363	3.16	1.74
Motors	Area 7	Chilled Water Pump Motors	install Energy Efficient Motor	ROF	6C	Elect	Elect	\$14,785,228	\$25,319,634	\$16,873,852	\$281,654	\$4,198,142	\$46,772,682	\$31,887,453	3.16	1.74
Motors	Area 1H	Chilled Water Pump Motors	install Energy Efficient Motor	ROF	10C	Elect	Elect	\$14,793,130	\$25,327,685	\$16,873,852	\$281,654	\$4,204,020	\$46,786,412	\$31,883,282	3.16	1.74
Motors	Area 5	Chilled Water Pump Motors	install Energy Efficient Motor	ROF	4C	Elect	Elect	\$14,800,658	\$25,335,183	\$16,873,852	\$281,654	\$4,205,619	\$46,799,488	\$31,888,632	3.16	1.74
Motors	Area 3A	Chilled Water Pump Motors	install Energy Efficient Motor	ROF	8C	Elect	Elect	\$14,835,188	\$25,369,474	\$16,873,852	\$281,654	\$4,235,309	\$46,859,490	\$32,024,302	3.16	1.74
Motors	Area 4	Chilled Water Pump Motors	install Energy Efficient Motor	ROF	3C	Elect	Elect	\$14,835,402	\$25,369,687	\$16,873,852	\$281,654	\$4,235,469	\$46,859,661	\$32,024,466	3.16	1.74
Motors	Area 6	Chilled Water Pump Motors	install Energy Efficient Motor	ROF	7C	Elect	Elect	\$14,848,861	\$25,381,673	\$16,873,852	\$281,654	\$4,243,984	\$46,879,772	\$32,032,8		

Table 3.10
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Cumulative Present Value of Costs and Savings

ERO Category	Facility Type	Equipment	Description of ERO	RI or ROF	ID	Existing Fuel	Resulting Fuel	Cumulative Present Value of Installed Cost (1993 \$)	Cumulative Present Value of Energy Savings (1993 \$)	Cumulative Present Value of Demand Savings (1993 \$)	Cumulative Present Value of O&M Savings (1993 \$)	Cumulative Present Value of Replacement Cost Savings (1993 \$)	Cumulative Present Value of Total Savings (1993 \$)	Cumulative Net Present Value (1993 \$)	Cumulative Savings to Investment Ratio	Individual ERO Savings to Investment Ratio
Int light	OTHER	FL 2X4 3-60 STD	MH 175 PEND	RI	26	Elect	Elect	\$15,043,221	\$25,363,886	\$17,128,885	\$312,824	\$4,335,832	\$47,161,487	\$32,118,188	3.14	1.34
Int light	TRAINING	FL 2X4 3-60 STD	MH 175 PEND	RI	57	Elect	Elect	\$15,065,562	\$25,301,755	\$17,132,448	\$331,286	\$4,335,832	\$47,191,282	\$32,125,731	3.13	1.34
AC	Area 7	direct expansion	install TES	ROF	68	Elect	Elect	\$15,124,835	\$25,378,670	\$17,183,483	\$337,171	\$4,362,187	\$47,268,520	\$32,144,684	3.13	1.32
AC	Area 8	direct expansion	install TES	ROF	60	Elect	Elect	\$15,184,109	\$25,381,584	\$17,254,546	\$343,078	\$4,386,541	\$47,347,747	\$32,163,838	3.12	1.32
AC	Area 1W	direct expansion	install TES	ROF	61	Elect	Elect	\$15,243,382	\$25,348,488	\$17,315,588	\$348,981	\$4,414,885	\$47,425,874	\$32,182,581	3.11	1.32
AC	Area 1W	direct expansion	install TES	ROF	74	Elect	Elect	\$15,361,930	\$25,318,329	\$17,437,705	\$360,781	\$4,466,825	\$47,581,649	\$32,218,728	3.10	1.31
AC	Area 7	direct expansion	install TES	ROF	63	Elect	Elect	\$15,431,882	\$25,298,729	\$17,508,835	\$367,621	\$4,464,848	\$47,670,182	\$32,238,118	3.08	1.28
AC	Area H-I	direct expansion	install TES	ROF	67	Elect	Elect	\$15,510,114	\$25,278,618	\$17,580,237	\$375,554	\$4,524,542	\$47,768,849	\$32,258,836	3.08	1.25
AC	Area 5	direct expansion	install TES	ROF	77	Elect	Elect	\$15,646,177	\$25,260,480	\$17,732,138	\$391,301	\$4,578,323	\$47,862,242	\$32,284,885	3.06	1.22
AC	Area 7	direct expansion	install TES	ROF	70	Elect	Elect	\$15,786,968	\$25,235,338	\$17,833,883	\$401,143	\$4,612,585	\$48,082,958	\$32,315,983	3.05	1.22
Int light	PLT-BLD control boards	FL 2X4 3-60 STD	MH 175 PEND	RI	29	Elect	Elect	\$15,782,572	\$25,230,087	\$17,835,841	\$411,680	\$4,612,585	\$48,088,903	\$32,317,331	3.05	1.08
Int light	PLT BLD general	FL 2X4 3-60 STD	MH 175 PEND	RI	28	Elect	Elect	\$15,901,810	\$25,275,358	\$17,848,808	\$491,851	\$4,612,585	\$48,228,580	\$32,327,488	3.03	1.08
Int light	PLT EQU	FL 2X4 3-60 STD	MH 175 PEND	RI	31	Elect	Elect	\$16,039,328	\$25,318,853	\$17,864,387	\$505,043	\$4,612,585	\$48,378,678	\$32,338,353	3.02	1.08
AC	Area 3A	chilled water	install Efficient Chillers	RI	30	Elec	Elec	\$16,182,578	\$25,378,087	\$17,878,501	\$505,043	\$4,669,301	\$48,507,832	\$32,345,256	3.00	1.05
AC	Area 3A	chilled water	install Efficient Chillers	RI	27	Elec	Elec	\$16,277,878	\$25,432,483	\$17,887,837	\$505,043	\$4,721,890	\$48,627,184	\$32,358,088	2.98	1.04
AC	Area 5	chilled water	install Efficient Chillers	RI	23	Elec	Elec	\$16,379,878	\$25,488,780	\$17,887,328	\$505,043	\$4,768,827	\$48,732,851	\$32,352,875	2.98	1.03
AC	Area 3A	chilled water	install Efficient Chillers	RI	24	Elec	Elec	\$16,481,878	\$25,529,027	\$17,887,804	\$505,043	\$4,815,884	\$48,838,838	\$32,355,883	2.98	1.03
Int light	WHS	FL 2X4 3-60 STD	MH 175 PEND	RI	58	Elect	Elect	\$16,589,858	\$25,557,804	\$17,824,377	\$648,066	\$4,815,884	\$48,948,811	\$32,357,253	2.85	1.01

Table 3.11
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Present Values Aggregated by Category

ERO Category	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW-mo)	Full Implement. Energy Savings (MBtu)	Full Implement. Demand Savings (kW-mo)	Present Value of Installed Cost (1993 \$)	Present Value of Energy Savings (1993 \$)	Present Value of Demand Savings (1993 \$)	Present Value of O&M Savings (1993 \$)	Present Value of Replacement Cost Savings (1993 \$)	Present Value of Total Savings (1993 \$)	Net Present Value (1993 \$)	Savings to Investment Ratio
AC	3,540	1,142	-10,615	71,565	\$5,631,801	-\$663,962	\$7,050,801	\$965,176	\$4,255,171	\$11,607,187	\$5,975,385	2.06
Boilers	-1,520	20,415	-1,520	20,415	\$924,950	\$1,931,863	\$2,032,477	-\$4,544	\$336,174	\$4,295,970	\$3,371,020	4.64
Envelope	2,279	475	2,279	475	\$158,018	\$365,095	\$47,326	\$0	\$0	\$412,421	\$254,403	2.61
Generators	-17,048	38,400	-17,048	38,400	\$373,236	-\$1,373,697	\$3,823,200	-\$798,261	\$0	\$1,651,242	\$1,278,006	4.42
Heatpipes	68,913	0	68,913	0	\$2,631,580	\$11,439,374	\$0	\$0	\$0	\$11,439,374	\$8,807,794	4.35
Lighting	82,082	47,634	82,082	47,634	\$6,179,025	\$12,999,180	\$4,742,382	\$486,694	\$0	\$18,228,257	\$12,049,232	2.95
Motors	4,883	2,292	5,740	2,292	\$691,048	\$859,750	\$228,191	\$0	\$224,519	\$1,312,459	\$621,411	1.90
Totals	143,130	110,359	129,831	180,782	\$16,589,658	\$25,557,604	\$17,924,377	\$649,066	\$4,815,864	\$48,946,911	\$32,357,253	2.95

Table 3.12
EROs Constituting the Minimum Life-Cycle Cost Efficiency Resource: Annualized Values Aggregated by Category

ERO Category	First-Year Energy Savings (MBtu)	First-Year Demand Savings (kW-mo)	Full Implement. Energy Savings (MBtu)	Full Implement. Demand Savings (kW-mo)	Annualized Value of Installed Cost (1993 \$)	Annualized Value of Energy Savings (1993 \$)	Annualized Value of Demand Savings (1993 \$)	Annualized Value of O&M Savings (1993 \$)	Annualized Value of Replacement Cost Savings (1993 \$)	Annualized Value of Total Savings (1993 \$)	Annualized Net Savings (1993 \$)	Savings to Investment Ratio
AC	3,540	1,142	-10,615	71,565	\$360,503	-\$42,501	\$451,336	\$61,783	\$272,382	\$742,999	\$382,496	2.06
Boilers	-1,520	20,415	-1,520	20,415	\$59,208	\$123,662	\$130,103	-\$291	\$21,519	\$274,993	\$215,786	4.64
Envelope	2,279	475	2,279	475	\$10,115	\$23,370	\$3,029	\$0	\$0	\$26,400	\$16,285	2.61
Generators	-17,048	38,400	-17,048	38,400	\$23,892	-\$87,933	\$244,731	-\$51,098	\$0	\$105,699	\$81,808	4.42
Heatpipes	68,913	0	68,913	0	\$168,453	\$732,257	\$0	\$0	\$0	\$732,257	\$563,804	4.35
Lighting	82,082	47,634	82,082	47,634	\$395,531	\$832,103	\$303,569	\$31,154	\$0	\$1,166,826	\$771,295	2.95
Motors	4,883	2,292	5,740	2,292	\$44,235	\$55,034	\$14,607	\$0	\$14,372	\$84,013	\$39,778	1.90
Totals	143,130	110,359	129,831	180,782	\$1,061,937	\$1,635,992	\$1,147,375	\$41,548	\$308,273	\$3,133,188	\$2,071,251	2.95

Table 3.13
Summary of Total Minimum Life-Cycle Cost Efficiency Resource

Summary of Energy and Demand Savings

First Year Energy Savings (MBtu)	143,130
First Year Demand Savings (kW-mo)	110,359
Full Implementation Energy Savings (MBtu)	129,831
Full Implementation Demand Savings (kW-mo)	180,782

Summary of Costs and Benefits

	Present Value (1993 \$)	Annualized Value (1993 \$)
Installed Cost	\$16,589,658	\$1,061,937
Value of Energy Savings	\$25,557,604	\$1,635,992
Value of Demand Savings	\$17,924,377	\$1,147,375
Value of O&M Savings	\$649,066	\$41,548
Value of Replacement Cost Savings	\$4,815,864	\$308,273
Value of Total Savings	\$48,946,911	\$3,133,188
Net Value of Savings	\$32,357,253	\$2,071,251
Savings to Investment Ratio	2.95	2.95

TABLE 3.14. Fuel Balance Table

	Existing		Conservation		New Load		Resulting		Net Conservation	
Fuel Type	1991 Existing Energy Use (MBtu)	Existing Demand (kW-mo)	Energy Use Reduction (MBtu)	Demand Reduction (kW-mo)	Increased Energy Use (MBtu)	Increased Demand (kW-mo)	Resulting Energy Use (MBtu)	Resulting Demand (kW-mo)	Net Energy Use Reduction (MBtu)	Net Demand Reduction (kW-mo)
Diesel	218,162	N/A	0	N/A	24,887	N/A	243,049	N/A	-24,887	N/A
Electricity	655,549	362,135	167,775	180,782	16,529	0	504,303	181,353	151,246	180,782
Fuel Oil	128,265	N/A	63,618	N/A	60,147	N/A	124,794	N/A	3,471	N/A
Totals	1,001,976	362,135	231,393	242,025	101,562	0	872,145	181,353	129,831	180,782

3.5 ADDITIONAL NOTES

To estimate energy cost savings as a percentage of total energy expenditures for a given fuel, the energy expenditures must be known. The Cape Canaveral AFS Integrated Resource Assessment Volume 2: Baseline Detail report gives total energy expenditures for 1991, using 1991 fuel prices (Wahlstrom et al. 1993). The LCC analysis, however, uses more current fuel prices in its development of the cost-effective resource (see Table 3.2). Because fuel prices for electricity and diesel fuel have declined significantly since 1991, using the figures from the Volume 2 report for baseline consumption will tend to understate the percentage savings. To avoid this problem, 1991 expenditures are multiplied by an adjustment factor, which is the ratio of 1991 fuel prices to fuel prices used in the LCC analysis. The adjusted price is the price that a given bundle of energy purchased in 1991 would cost at the prices used in the LCC analysis. Table 3.15 lists 1991 expenditures, the adjustment factor used for the conversion, and the adjusted expenditures for each fuel type.

Because there is no single price for electricity at Cape Canaveral AFS, the adjustment factor is based on average prices that incorporate on-peak and off-peak consumption and demand charges. The adjustment factor for diesel fuel is the simple ratio of the 1991 price to the current price. There has been no significant change in the price of fuel oil.

It is important to keep in mind that this adjustment process only yields an estimate of percentage energy savings. Although it incorporates current fuel prices, it is still based on 1991 energy consumption. To the extent that energy consumption has changed since 1991, some error will exist in the percentage savings figure.

TABLE 3.15. Summary of Expenditure Adjustment Process

<u>Fuel</u>	<u>1991 Expenditures</u>	<u>Adjustment Factor</u>	<u>Adjusted Expenditures</u>
Electricity	\$9,876,000	.04569/.0532	\$8,481,850
Fuel Oil No.2	\$952,000	1	\$952,000
Diesel	\$1,558,000	.69/1.03	\$1,043,709
Totals	\$12,386,000		\$10,477,559

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