PROGRAMMING DOCUMENTS

ENERGY ENGINEERING ANALYSIS PROGRAM

ENERGY SAVINGS OPPORTUNITY SURVEY

FORT HUACHUCA, ARIZONA 1994

VOLUME III

PREPARED FOR

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

PREPARED BY

KELLER & GANNON
ENGINEERS • ARCHITECTS
1453 MISSION STREET, SAN FRANCISCO, CA 94103

CONTRACT NO. DACA05-C-92-0155

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
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Work Request 1

Building Envelope Modifications

WORK REQUEST (IFS-M)

(For use of this form, see AR 420-17 and DA PAM 420-6; the proponent agency is USACE.)

PART A *(See Instructions)*	CUSTOMER ID CODE	DOCUMENT SERIAL NUMBER	FY	TYPE	SHORT JOB DESCRIPTION	DATE DA	DATE MON	DATE YR
	FEE		5	P	INSULATE WALL&ROOF+COAT ROOFS			

INSTALLATION ABBREVIATION OF FACILITIES	BUILDING / FACILITY NUMBERS									
	1	2	3	4	5	6	7	8	9	10
1 HUA	15544	20200	43083	51005	56301	91114				
2										
3										

REMARKS: **This Work Request is a result of the EEAP, ESOS conducted by Keller & Gannon under Contract No. DACA05-C-92-0155. Economic analysis results are: $30,025 energy cost saved per year for an Investment of $111,681; SIR = 3.45; Payback Period = 3.72 years.**

INSTALLATION NAME:	CUSTOMER NAME	POC NAME	POC PHONE NUMBER
FORT HUACHUCA, ARIZONA	**Directorate of Engineering and Housing**	**WILLIAM J STEIN**	**602 533-1861**

WORK DESCRIPTION (*Description of work requested*): **Refer to the attached information for details and specifics concerning the analyses.**

Building 15544: **Install 7,680 SF Blow-In Wall Insulation, 12,800 SF Fiberglass Batt Ceiling Insulation & Coat 12,800 SF Roof with LO/MIT-1 or approved equal.**

Building 20200: **Install 3,130 SF of R-30 Fiberglass Batt Ceiling Insulation between ceiling joists.**

Building 43083: **Install 29,982 SF of R-30 Rigid Polyisocyanurate 2 pound per cubic foot Board Roof Insulation.**

Building 51005: **Install 78,400 SF of reflective roof coating, LO/MIT-1 or approved equal.**

Building 56301: **Install 30,000 SF of reflective roof coating, LO/MIT-1 or approved equal.**

Building 91114: **Install 6,979 SF of reflective roof coating, LO/MIT-1 or approved equal.**

AUTHORIZED REQUESTOR (Type or Print) _____ *SIGNATURE* _____

PART B *(Approving Official Only)*			DATE DA	DATE MON	DATE YR
	APPROVAL ACTION CODE:	SPECIAL INTEREST CODE:			
	WORK REQUEST PRIORITY:	ESTIMATED WORK START DATE:			
	PROGRAM INDICATOR CODE:	ESTIMATED WORK COMPLETION DATE:			

ENVIRONMENTAL IMPACT

YES	NO	
☐	☐	ENVIRONMENTAL CONSIDERATION
☐	☐	EIS / EIA INITIATED
☐	☐	EIS / EIA COMPLETED

WORK TO BE PERFORMED

- ☐ IN-HOUSE
- ☐ SELF-HELP
- ☐ CONTRACT
- ☐ TROOP

WORKCLASS	APPROVAL AMOUNTS FUNDED	APPROVAL AMOUNTS UNFUNDED
☐	$	$
☐	$	$
☐	$	$
TOTAL	$	$

SOURCE OF FUNDS

- ☐ DIRECT
- ☐ AUTOMATIC REIMBURSEMENT
- ☐ FUNDED REIMBURSEMENT

OTHER FUND CITATION

DESIGN APPROVAL	DATE DA	DATE MON	DATE YR	APPROVAL AUTHORITY	APPROVAL ACTION	DATE DA	DATE MON	DATE YR
(Please type or print name)				*(Please type or print name)*	☐ APPROVED			
(Signature)				*(Signature)*	☐ DISAPPROVED			

EHSC FORM 4283-1 (On Microsoft Excel Version 5.0)

F:\PROJ\1640313\ENGR\PREFINAL\WORK-REQ.XLS Envelope

Insulation Retrofit Evaluations for Selected Buildings

Insulation is considered for selected buildings. Energy savings are evaluated using energy simulations employing the Carrier HAP program. Weather data is only available for large cities. El Paso, Texas was selected as the closest city with a somewhat similar climate; results are adjusted based on Fort Huachuca and El Paso meteorological data.

Buildings included in this analysis and insulation retrofits considered for each are:

Building 15544 Instruction Building
The 'Butler' type building is built on a concrete slab with metal wall panels insulated with 1-inch of fiberglass and gypsum board interior. The roof has the same construction, with suspended acoustical ceiling tiles.

HVAC is provided by a multizone air handling unit fitted with hot and chilled water coils. Chilled water is provided by a package air cooled reciprocating chiller; hot water is provided by a natural gas fired hot water boiler.

Insulation projects evaluated for this building include:

- Retrofit wall Insulation to achieve an insulating value of R-11,
  to be accomplished by installing blow-in insulation from the building interior.
- Retrofit roof Insulation to achieve an insulating value of R-30,
  to be accomplished by adding an R-30 layer of fiberglass insulation below the existing roof deck.
- Apply a coating of LO/MIT-1 to roof exterior surface.

Building 20200 Residential Duplex
The building is constructed on a concrete slab. Walls are wood stud with stucco exterior and gypsum board interior. Originally, walls were insulated with a loose mineral wool which has now settled, removing insulation from the top portions of the walls. Roof construction is on 2"x10" joists with R-11 Batt insulation between; built-up roofing above and gypsum board ceiling, both fixed directly to the joists. Roof insulation is deteriorated due to previous leakage; it is assumed that removal is required prior to the addition of new R-30 fiberglass batts.

Heating is provided by a warm air furnace and cooling is provided by a roof top evaporative cooler. Each of the two units has the same equipment.

Insulation projects evaluated for this building include:

- Retrofit wall Insulation to achieve an insulating value of R-11,
  to be accomplished by installing blow-in insulation from the building exterior, only about 1/2 the wall cavities need to be filled; cost estimates are adjusted accordingly.
- Retrofit roof Insulation to achieve an insulating value of R-30,
  to be accomplished by adding R-30 fiberglass batts between ceiling joists when the building requires re-roofing.
- Apply a coating of LO/MIT-1 to roof exterior surface.

Building 43083 Visitor's Quarters
The Visitor's Quarters is a three-floor, hotel-like building. Walls are constructed of concrete masonry units (CMU), floors are concrete decks and the roof/ceiling is composed of a built-up roof over concrete deck, air space and gypsum-board ceiling. Certain walls of one floor have been insulated on the interior surface with rigid boards on furring strips with a new surface covering.

HVAC is provided in each room via two-pipe fan-coil units on thermostatic controls. Either chilled or hot water is provided to the fan-coil units depending on the season. Hallways and central areas are provided HVAC via air handling units fitted with chilled and hot water coils. The building is split into two service areas, each handled by separate hot water boilers and air cooled reciprocating chillers.

Insulation projects evaluated for this building include:

- Retrofit wall Insulation to achieve an insulating value of R-11, to be accomplished by installing rigid fiberglass board insulation between furring strips on interior walls, with new gypsum board covering, prime and finish coatings.
- Retrofit roof Insulation to achieve an insulating value of R-30, to be accomplished by adding rigid insulation boards to roof surface when reroofing is required.
- Apply a coating of LO/MIT-1 to roof exterior surface.

Building 51005 Guest House

The Guest House is similar to the Visitor's Quarters in construction, three-floors with CMU walls, concrete decks and built-up roof. This study investigates only the proposed application of LO/MIT 1 to the roof, thus, only the top floor is used in computer simulations of annual energy use.

HVAC is provided to this building similarly to that of the Visitors Quarters described above. Rooms are fitted with individual, thermostatically controlled fan-coil units.

Insulation projects evaluated for this building include:

- Apply a coating of LO/MIT-1 to roof exterior surface.

Building 56301 Communications Equipment Facility

Building 56301 is a communications equipment facility. The 30,000 square foot, single floor, building heating, ventilating and air conditioning (HVAC) system is comprised of three rooftop-mounted multi-zone air handling units. Each unit is fitted with both hot and chilled water coils. Hot water is supplied by a hot water boiler and chilled water is provided by an air cooled reciprocating chiller.

Insulation projects evaluated for this building include:

- Apply a coating of LO/MIT-1 to roof exterior surface.

Building 91114 Aircraft Hangar, Shops and Offices

The Aircraft hangar is constructed on a concrete slab. The central portion of the building is occupied by the high-bay hangar. The hangar is flanked on each side by two-floor office/shop wings. Construction consists of CMU walls with structural steel framing. Wall panels on the exterior office/shop wings have about a 2-inch thick layer of fiberglass insulation which has deteriorated. Roof construction is built-up roofing over a thin layer of rigid insulation. The upper floors of the office/shop wings have suspended ceilings.

The hangar is heated by natural gas fired radiant heaters and is not cooled. Office/shop wings are heated with a combination of fan-coil units fitted with steam heating coils and by steam convectors. Cooling is provided to selected areas of the two-floor office/shop wings by evaporative coolers. The Avionics shop located on the second floor of the East office/shop wing is cooled by a package rooftop air conditioner.

Insulation projects evaluated for this building include:

- Retrofit wall Insulation to achieve an insulating value of R-11, to be accomplished by installing rigid fiberglass board insulation between furring strips on interior walls, with new gypsum board covering, prime and finish coatings.
- Retrofit roof Insulation to achieve an insulating value of R-30, to be accomplished by adding rigid insulation boards to roof surface when reroofing is required.
- Apply a coating of LO/MIT-1 to roof exterior surface.

Summary of Building Envelope Retrofit Evaluations

Building Number	Insulation Retrofit			Energy Savings		Energy Cost Savings					
	Lo-E Roof	Roof Insul	Wall Insul	Electric (kWH/Year)	Gas (Million BTU/Yr)	Electric ($/Year)	Gas ($/Year)	LCC Savings ($)	Investment ($)	Payback (Years)	SIR
15544	•	•	•	27,827	442	$1,750	$1,556	$43,080	$24,210	7.32	1.78
20200	-	•	-	4,029	64	$253	$226	$6,245	$4,147	8.65	1.51
43083	•	•	-	124,909	1,228	$7,857	$4,318	$155,623	$58,567	4.81	2.66
51005	•	-	-	(14,401)	928	($906)	$3,264	$35,364	$16,822	7.13	2.10
56301	•	-	-	149,852	567	$9,426	$1,994	$141,556	$6,437	0.56	21.99
91114	•	-	-	5,460	(16)	$343	($57)	$3,321	$1,498	5.23	2.22
Totals	•	•	•	**297,676**	**3,214**	**$18,724**	**$11,301**	**$385,191**	**$111,681**	**3.72**	**3.45**

Note that only those insulation projects are listed above for which Life Cycle Cost Analyses resulted in an SIR above 1.0. Insulation retrofits recommended for each building are indicated by "·" symbols, above.

Baseline HVAC Energy Use

Building Number	Building (SF)	Electric kWH/Year	Gas Therms/Yr	SF Wall Insulation	SF Roof Insulation	LO/MIT-1 Coating SF
15544	12,800	340,893	9,636	7,680	12,800	12,800
20200	1,565	5,509	411	1,193	3,130	3,130
43083	89,946	778,117	66,982	32,546	29,982	29,982
51005	78,400	1,069,343	67,096	Not Considered		78,400
56301	30,000	415,473	32,087	Not Considered		30,000
91114	21,758	163,200	9,596	6,466	6,979	6,979

Energy Costs and Adjustment Factors

Electric Usage Cost & Taxes, **including demand charges:**

$0.0629 per kWH 12.02 Uniform Present Worth, N=15

Natural Gas Cost, Rate CG-40 for Air Conditioning Service, incl Taxes:

$3.5163 per Mil BTU's 14.17 Uniform Present Worth, N=15

Adjustment for Tuscon vs. Fort Huachuca Energy Use:

Location	Heating DD/Year	Cooling DD/Year
Simulations @ El Paso, Texas	2,678	2,098
Actual Site Fort Huachuca	2,551	1,595
Adjustment Factors:	0.953	0.760

HVAC Energy Use with Low-E Roof Coating Only

Adjusted Values (See above)

Building Number	Building (SF)	Electric kWH/Year	Gas Therms/Yr	Savings kWH/Year	Savings Therms/Yr	Elec Saved ($/Year)	Gas Saved ($/Year)	Constr. Cost ($)	Invest-ment ($)	LCCA Saved ($)	SIR
15544	12,800	313,786	7,988	20,608	1,570	$1,296	$552	$2,452	$2,747	$23,403	8.52
20200	1,565	5,509	468	0	(109)	$0	($38)	Not Evaluated because no energy is saved			
43083	89,946	674,041	62,533	79,124	4,238	$4,977	$1,490	$5,744	$6,433	$80,938	12.58
51005	78,400	1,088,286	57,351	(14,401)	9,283	($906)	$3,264	$15,020	$16,822	$35,364	2.10
56301	30,000	218,364	26,133	149,852	5,672	$9,426	$1,994	$5,747	$6,437	$141,556	21.99
91114	21,758	156,018	9,766	5,460	(162)	$343	($57)	$1,337	$1,498	$3,321	2.22

HVAC Energy Use with Added Roof Insulation Only

Adjusted Values (See above)

Building Number	Building (SF)	Electric kWH/Year	Gas Therms/Yr	Savings kWH/Year	Savings Therms/Yr	Elec Saved ($/Year)	Gas Saved ($/Year)	Constr. Cost ($)	Invest-ment ($)	LCCA Saved ($)	SIR
15544	12,800	322,156	7,268	14,245	2,256	$896	$793	$10,676	$11,957	$22,009	1.84
20200	1,565	2,859	74	4,029	642	$253	$226	$3,703	$4,147	$6,245	1.51
43083	89,946	627,107	54,947	114,805	11,464	$7,221	$4,031	$46,548	$52,134	$143,921	2.76
91114	21,758	158,508	9,318	3,567	265	$224	$93	$7,712	$8,638	$4,016	0.46

HVAC Energy Use with Added Wall Insulation Only — Adjusted Values (See above)

Building Number	Building (SF)	Electric kWH/Year	Gas Therms/Yr	Savings kWH/Year	Savings Therms/Yr	Elec Saved ($/Year)	Gas Saved ($/Year)	Constr. Cost ($)	Invest-ment ($)	LCCA Saved ($)	SIR
15544	12,800	330,180	8,024	8,145	1,536	$512	$540	$8,488	$9,506	$13,809	1.45
20200	1,565	5,158	319	534	175	$34	$62	$1,053	$1,180	$1,277	1.08
43083	89,946	663,705	56,680	86,981	9,813	$5,471	$3,451	$126,835	$142,055	$114,659	0.81
91114	21,758	148,436	8,602	11,224	947	$706	$333	$25,199	$28,223	$13,204	0.47

HVAC Energy Use with Added Roof Insulation and Low-E Roof Coating Only — Adjusted Values (See above)

Building Number	Building (SF)	Electric kWH/Year	Gas Therms/Yr	Savings kWH/Year	Savings Therms/Yr	Elec Saved ($/Year)	Gas Saved ($/Year)	Constr. Cost ($)	Invest-ment ($)	LCCA Saved ($)	SIR
43083	89,946	613,816	54,091	124,909	12,280	$7,857	$4,318	$52,292	$58,567	$155,623	2.66

HVAC Energy Use with Added Wall & Roof Insulation and Low-E Roof Coating — Adjusted Values (See above)

Building Number	Building (SF)	Electric kWH/Year	Gas Therms/Yr	Savings kWH/Year	Savings Therms/Yr	Elec Saved ($/Year)	Gas Saved ($/Year)	Constr. Cost ($)	Invest-ment ($)	LCCA Saved ($)	SIR
15544	12,800	304,291	4,992	27,827	4,424	$1,750	$1,556	$21,616	$24,210	$43,080	1.78

HVAC Energy Use with Added Wall & Roof Insulation — Adjusted Values (See above)

Building Number	Building (SF)	Electric kWH/Year	Gas Therms/Yr	Savings kWH/Year	Savings Therms/Yr	Elec Saved ($/Year)	Gas Saved ($/Year)	Constr. Cost ($)	Invest-ment ($)	LCCA Saved ($)	SIR
20200	1,565	2,508	48	2,282	345	$144	$121	$4,756	$5,327	$3,446	0.65

Note: Analysis shows that while roof and wall insulation retrofits are economically justified when evaluated separately, that when evaluated together, they are not economically justified. Recommend roof insulation only because it has the higher SIR.

CONSTRUCTION COST ESTIMATE

Date Prepared: January 1995 | Sheet 1 Of 6

Project: ECIP Facility Energy Improvements | Project No. | Basis for Estimate: Code A (no design competed)

Location: Fort Huachuca, Arizona

Engineer-Architect: Keller & Gannon

Drawing No.: Building 15544 Insulation Retrofits | Estimator: BIH | Checked By: RCL

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor & Equipment Per Unit	Labor & Equipment Total	Material Per Unit	Material Total	Total Cost
Wall Insulation: Blow-In Insulation to Achieve R-11 (Costs based on April 1994 Insulation project by DEH, Fort Huachuca)							
Blow-In Wall Insulation, drilling & patching, fiberglass to R-11	7,680	SF	$0.74	$5,683	$0.05	$384	$6,067
Subtotal				$5,683		$384	$6,067
Arizona Transaction Privilege Tax	3.75%	%		-		$14	$14
Subtotal							$6,082
Contractor OH & Profit	25.0%	%					$1,520
Subtotal							$7,602
Bond	1.5%	%					$114
Subtotal							$7,716
Estimating Contingency	10.0%	%					$772
Total Probable Construction Cost							$8,488
Roof Insulation: Fiberglass Batts to Underside of Roof to Achieve R-30 (Costs based on April 1994 Insulation project by DEH, Fort Huachuca and on Means 1994)							
Fiberglass Batt Insulation, R-30 Batts above drop-ceiling	12,800	SF	$0.11	$1,408	$0.47	$6,016	$7,424
Subtotal				$1,408		$6,016	$7,424
Arizona Transaction Privilege Tax	3.75%	%		-		$226	$226
Subtotal							$7,650
Contractor OH & Profit	25.0%	%					$1,912
Subtotal							$9,562
Bond	1.5%	%					$143
Subtotal							$9,705
Estimating Contingency	10.0%	%					$971
Total Probable Construction Cost							$10,676
LO/MIT 1 Roof Coating: Apply to Top of Roof (Costs based on 600 SF/Gal coverage, 25% contractor discount from $50/Gal and Means 1994 labor costs for spray painting, adjusted for the location.)							
Apply LO/MIT 1 Coating to Roof Surface	12,800	SF	$0.05	$634	$0.06	$800	$1,434
Subtotal				$634		$800	$1,434
Arizona Transaction Privilege Tax	3.75%	%		-		$30	$30
Subtotal							$1,464
Contractor OH & Profit	25.0%	%					$366
Subtotal							$1,830
Bond	1.5%	%					$27
Subtotal							$1,858
Estimating Contingency	10.0%	%					$186
Total Probable Construction Cost							$2,044
Subtotal							$2,229
Estimating Contingency	10.0%	%					$223
Total Probable Construction Cost							$2,452

CONSTRUCTION COST ESTIMATE	Date Prepared January 1995	Sheet 2 Of 6

Project	Project No.	Basis for Estimate
ECIP Facility Energy Improvements		Code A (no design competed)
Location: Fort Huachuca, Arizona		
Engineer-Architect: Keller & Gannon		

Drawing No.	Estimator	Checked By
Building 20200 Insulation Retrofits	BIH	RCL

Line Item	Quantity		Labor		Material		
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Total Cost
Wall Insulation: Blow-In Insulation to Achieve R-11							
(Costs are based on April 1994 Insulation Project by DEH, Fort Huachuca, assumes 1/2 material cost & 2/3 installation cost due to settling of existing mineral wool type insulation; for both duplex units)							
Blow-In Wall Insulation, drilling & patching, fiberglass to R-11	1,193	SF	$0.61	$724	$0.025	$30	$753
Subtotal				$724		$30	$753
Arizona Transaction Privilege Tax	3.75%	%		-		$1	$1
Subtotal							$755
Contractor OH & Profit	25.0%	%					$189
Subtotal							$943
Bond	1.5%	%					$14
Subtotal							$957
Estimating Contingency	10.0%	%					$96
Total Probable Construction Cost							$1,053
Roof Insulation: Fiberglass Batts in Ceiling Joist Spaces to Achieve R-30							
(Costs based on April 1994 Insulation project by DEH, Fort Huachuca and on Means 1994, assumes work is performed when re-roofing is required, quanties adjusted for both duplex units in building)							
Fiberglass Batt Insulation, R-30 Batts above drop-ceiling	3,130	SF	$0.11	$344	$0.47	$1,471	$1,815
Remove existing deteriorated fiberglass batt insulation during reroofing	3,130	SF	$0.25	$783	$0.00	$0	$783
Subtotal				$1,127		$1,471	$2,598
Arizona Transaction Privilege Tax	3.75%	%		-		$55	$55
Subtotal							$2,653
Contractor OH & Profit	25.0%	%					$663
Subtotal							$3,316
Bond	1.5%	%					$50
Subtotal							$3,366
Estimating Contingency	10.0%	%					$337
Total Probable Construction Cost							$3,703

CONSTRUCTION COST ESTIMATE

Date Prepared: January 1995 | Sheet 3 Of 6

Project: ECIP Facility Energy Improvements | Project No. | Basis for Estimate: Code A (no design competed)

Location: Fort Huachuca, Arizona

Engineer-Architect: Keller & Gannon

Drawing No.: Building 43083 Insulation Retrofits | Estimator: BIH | Checked By: RCL

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Wall Insulation: Interior Rigid Fiberglass Board & New Surface to Achieve R-11 (Costs based on Means 1994, adjusted for Fort Huachuca's location)							
Rigid Fiberglass Board for R-11	32,546	SF	$0.20	$6,406	$1.50	$48,975	$55,381
Furring Strips 1"x2", 16" O.C.	24,410	LF	$0.32	$7,780	$0.16	$3,801	$11,581
Gypsum Board, Taped & Finished, 1/2"	32,546	SF	$0.34	$10,943	$0.19	$6,158	$17,100
Paint, Spray, Base plus Finish Coats	32,546	SF	$0.08	$2,688	$0.06	$1,851	$4,539
Subtotal				$27,816		$60,785	$88,601
Arizona Transaction Privilege Tax	3.75%	%		-		$2,279	$2,279
Subtotal							$90,881
Contractor OH & Profit	25.0%	%					$22,720
Subtotal							$113,601
Bond	1.5%	%					$1,704
Subtotal							$115,305
Estimating Contingency	10.0%	%					$11,530
Total Probable Construction Cost							$126,835
Roof Insulation: Rigid Board Insulation to Roof Surface to Achieve R-30 (Costs based on Means 1994, adjusted for Fort Huachuca's location, performed as part or reroofing)							
Rigid Polyisocyanurate 2#/CF, 3-1/2" R-25	29,982	SF	$0.14	$4,275	$0.93	$28,027	$32,302
Subtotal				$4,275		$28,027	$32,302
Arizona Transaction Privilege Tax	3.75%	%		-		$1,051	$1,051
Subtotal							$33,353
Contractor OH & Profit	25.0%	%					$8,338
Subtotal							$41,691
Bond	1.5%	%					$625
Subtotal							$42,316
Estimating Contingency	10.0%	%					$4,232
Total Probable Construction Cost							$46,548
LO/MIT 1 Roof Coating: Apply to Top of Roof (Costs based on 600 SF/Gal coverage, 25% contractor discount from $50/Gal and Means 1994 labor costs for spray painting, adjusted for the location.)							
Apply LO/MIT 1 Coating to Roof Surface	29,982	SF	$0.05	$1,486	$0.06	$1,874	$3,359
Subtotal				$1,486		$1,874	$3,359
Arizona Transaction Privilege Tax	3.75%	%		-		$70	$70
Subtotal							$3,430
Contractor OH & Profit	25.0%	%					$857
Subtotal							$4,287
Bond	1.5%	%					$64
Subtotal							$4,352
Estimating Contingency	10.0%	%					$435
Total Probable Construction Cost							$4,787
Subtotal							$5,222
Estimating Contingency	10.0%	%					$522
Total Probable Construction Cost							$5,744

CONSTRUCTION COST ESTIMATE	Date Prepared	Sheet	Of
	January 1995	4	6

Project	Project No.	Basis for Estimate
ECIP Facility Energy Improvements		
Location: Fort Huachuca, Arizona		**Code A (no design competed)**
Engineer-Architect: Keller & Gannon		

Drawing No.	Estimator	Checked By
Building 51005 Insulation Retrofits	**BIH**	**RCL**

Line Item	Quantity		Labor		Material		
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Total Cost
LO/MIT 1 Roof Coating: Apply to Top of Roof (Costs based on 600 SF/Gal coverage, 25% contractor discount from $50/Gal and Means 1994 labor costs for spray painting, adjusted for the locati							
Apply LO/MIT 1 Coating to Roof Surface	78,400	SF	$0.05	$3,885	$0.06	$4,900	$8,785
Subtotal				$3,885		$4,900	$8,785
Arizona Transaction Privilege Tax	3.75%	%		-		$184	$184
Subtotal							$8,969
Contractor OH & Profit	25.0%	%					$2,242
Subtotal							$11,211
Bond	1.5%	%					$168
Subtotal							$11,379
Estimating Contingency	10.0%	%					$1,138
Total Probable Construction Cost							$12,517
Subtotal							$13,655
Estimating Contingency	10.0%	%					$1,365
Total Probable Construction Cost							$15,020

CONSTRUCTION COST ESTIMATE	Date Prepared January 1995	Sheet 5 Of 6

Project	Project No.	Basis for Estimate
ECIP Facility Energy Improvements		Code A (no design competed)
Location: Fort Huachuca, Arizona		
Engineer-Architect: Keller & Gannon		

Drawing No.	Estimator	Checked By
Building 56301 Low-E Roof Coating	BIH	RCL

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
LO/MIT 1 Roof Coating: Apply to Top of Roof (Costs based on 600 SF/Gal coverage, 25% contractor discount from $50/Gal and Means 1994 labor costs for spray painting, adjusted for the location.)							
Apply LO/MIT 1 Coating to Roof Surface	30,000	SF	$0.05	$1,487	$0.06	$1,875	$3,362
Subtotal				$1,487		$1,875	$3,362
Arizona Transaction Privilege Tax	3.75%	%		-		$70	$70
Subtotal							$3,432
Contractor OH & Profit	25.0%	%					$858
Subtotal							$4,290
Bond	1.5%	%					$64
Subtotal							$4,354
Estimating Contingency	10.0%	%					$435
Total Probable Construction Cost							$4,790
Subtotal							$5,225
Estimating Contingency	10.0%	%					$522
Total Probable Construction Cost							$5,747

CONSTRUCTION COST ESTIMATE			Date Prepared: January 1995		Sheet: 6 Of: 6	
Project: ECIP Facility Energy Improvements			Project No.		Basis for Estimate: Code A (no design competed)	
Location: Fort Huachuca, Arizona						
Engineer-Architect: Keller & Gannon						
Drawing No.: Building 91114 Insulation Retrofits		Estimator: BIH		Checked By: RCL		
Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Wall Insulation: Interior Rigid Fiberglass Board & New Surface to Achieve R-11 (Costs based on Means 1994, adjusted for Fort Huachuca's location)							
Rigid Fiberglass Board for R-11	6,466	SF	$0.20	$1,273	$1.50	$9,730	$11,003
Furring Strips 1"x2", 16" O.C.	4,850	LF	$0.32	$1,546	$0.16	$755	$2,301
Gypsum Board, Taped & Finished, 1/2"	6,466	SF	$0.34	$2,174	$0.19	$1,223	$3,397
Paint, Spray, Base plus Finish Coats	6,466	SF	$0.08	$534	$0.06	$368	$902
Subtotal				$5,526		$12,076	$17,603
Arizona Transaction Privilege Tax	3.75%	%		-		$453	$453
Subtotal							$18,055
Contractor OH & Profit	25.0%	%					$4,514
Subtotal							$22,569
Bond	1.5%	%					$339
Subtotal							$22,908
Estimating Contingency	10.0%	%					$2,291
Total Probable Construction Cost							$25,199
Roof Insulation: Rigid Board Insulation to Roof Surface to Achieve R-30 (Costs based on Means 1994, adjusted for Fort Huachuca's location, performed as part or reroofing)							
Rigid Polyisocyanurate 2#/CF, 2-1/2" R-17	6,979	SF	$0.09	$656	$0.67	$4,694	$5,350
Subtotal				$656		$4,694	$5,350
Arizona Transaction Privilege Tax	3.75%	%		-		$176	$176
Subtotal							$5,526
Contractor OH & Profit	25.0%	%					$1,382
Subtotal							$6,908
Bond	1.5%	%					$104
Subtotal							$7,011
Estimating Contingency	10.0%	%					$701
Total Probable Construction Cost							$7,712
LO/MIT 1 Roof Coating: Apply to Top of Roof (Costs based on 600 SF/Gal coverage, 25% contractor discount from $50/Gal and Means 1994 labor costs for spray painting, adjusted for the location.)							
Apply LO/MIT 1 Coating to Roof Surface	6,979	SF	$0.05	$346	$0.06	$436	$782
Subtotal				$346		$436	$782
Arizona Transaction Privilege Tax	3.75%	%		-		$16	$16
Subtotal							$798
Contractor OH & Profit	25.0%	%					$200
Subtotal							$998
Bond	1.5%	%					$15
Subtotal							$1,013
Estimating Contingency	10.0%	%					$101
Total Probable Construction Cost							$1,114
Subtotal							$1,216
Estimating Contingency	10.0%	%					$122
Total Probable Construction Cost							$1,337

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Huachuca, Arizona Region No. 4 Project No.
Project Title: ECIP Facility Energy Improvements Fiscal Year FY96
Discrete Portion: Building **15544**: Roof & Wall Insulation, plus Low-E Roof Coating Preparer: KELLER & GANNON
Analysis Date January 1995 Economic Life: 15 Years

1. Investment Costs			
A. Construction Costs	$21,616		
B. SIOH	$1,297		
C. Design Cost	$1,297		
D. Total Cost (1A + 1B + 1C)	$24,210		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
Investment (1D-1E-1F)			$24,210

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.43	95.0	$1,750	12.02	$21,039
B. Dist		0	$0		$0
C. LPG		0	$0		$0
D. Natural Gas	$3.52	442.4	$1,556	14.17	$22,042
E. Demand Saved	Included above		$0	12.02	$0
F. Total		537.3	$3,306		$43,081

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		10.74	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2 + 3Bd4)	$0	
4. First Year Dollar Savings (2F3 + 3A + (3Bd1/Years Economic Li	$3,306	
5. Simple Payback (1G/4):	7.32	Years
6. Total Net Discounted Savings (2F5 + 3C):	$43,081	
7. Savings to Investment Ratio (SIR) 6/1G:	1.78	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Huachuca, Arizona | Region No. 4 | Project No.
Project Title: ECIP Facility Energy Improvements | Fiscal Year FY96
Discrete Portion: Building **20200**: Roof Insulation | Preparer: KELLER & GANNON
Analysis Date: January 1995 | Economic Life: 15 Years

1. Investment Costs			
A. Construction Costs	$3,703		
B. SIOH	$222		
C. Design Cost	$222		
D. Total Cost (1A + 1B + 1C)	$4,147		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$4,147

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.43	13.8		$253	12.02	$3,046
B. Dist		0		$0		$0
C. LPG		0		$0		$0
D. Natural Gas	$3.52	64.2		$226	14.17	$3,199
E. Demand Saved	Included above		kW	$0	12.02	$0
F. Total		78.0		$479		$6,245

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		10.74	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2 + 3Bd4)	$0	
4. First Year Dollar Savings (2F3 + 3A + (3Bd1/Years Economic Life))	$479	
5. Simple Payback (1G/4):	8.65	Years
6. Total Net Discounted Savings (2F5 + 3C):	$6,245	
7. Savings to Investment Ratio (SIR) 6/1G:	1.51	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Huachuca, Arizona Region No. 4 Project No.
Project Title: ECIP Facility Energy Improvements Fiscal Year FY96
Discrete Portion: Building **43083**: Roof Insulation and Low-E Roof Coat Preparer: KELLER & GANNON
Analysis Date: January 1995 Economic Life: 15 Years

1. Investment Costs			
A. Construction Costs	$52,292		
B. SIOH	$3,138		
C. Design Cost	$3,138		
D. Total Cost (1A + 1B + 1C)	$58,567		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$58,567

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.43	426		$7,857	12.02	$94,439
B. Dist		0		$0		$0
C. LPG		0		$0		$0
D. Natural Gas	$3.52	1,228		$4,318	14.17	$61,185
E. Demand Saved	Included above		kW	$0	12.02	$0
F. Total		1,654		$12,175		$155,623

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		10.74	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2 + 3Bd4)	$0	
4. First Year Dollar Savings (2F3 + 3A + (3Bd1/Years Economic Life))	$12,175	
5. Simple Payback (1G/4):	4.81	Years
6. Total Net Discounted Savings (2F5 + 3C):	$155,623	
7. Savings to Investment Ratio (SIR) 6/1G:	2.66	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Huachuca, Arizona | Region No. 4 | Project No.
Project Title: ECIP Facility Energy Improvements | Fiscal Year FY96
Discrete Portion: Building **51005**: Low-E Roof Coat | Preparer: KELLER & GANNON
Analysis Date: January 1995 | Economic Life: 15 Years

1. Investment Costs			
A. Construction Costs	$15,020		
B. SIOH	$901		
C. Design Cost	$901		
D. Total Cost (1A + 1B + 1C)	$16,822		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$16,822

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.43	(49.2)		($906)	12.02	($10,888)
B. Dist		0.0		$0		$0
C. LPG		0.0		$0		$0
D. Natural Gas	$3.52	928.3		$3,264	14.17	$46,253
E. Demand Saved	Included above		kW	$0	12.02	$0
F. Total		879.1		$2,358		$35,364

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		10.74	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2 + 3Bd4)	$0	
4. First Year Dollar Savings (2F3 + 3A + (3Bd1/Years Economic Life))	$2,358	
5. Simple Payback (1G/4):	7.13	Years
6. Total Net Discounted Savings (2F5 + 3C):	$35,364	
7. Savings to Investment Ratio (SIR) 6/1G:	2.10	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Huachuca, Arizona | Region No. 4 | Project No.
Project Title: ECIP Facility Energy Improvements | Fiscal Year FY96
Discrete Portion: Building **91114**: Low-E Roof Coat | Preparer: KELLER & GANNON
Analysis Date: January 1995 | Economic Life: 15 Years

1. Investment Costs			
A. Construction Costs	$5,747		
B. SIOH	$345		
C. Design Cost	$345		
D. Total Cost (1A + 1B + 1C)	$6,437		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$6,437

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.43	511.4	$9,426	12.02	$113,297
B. Dist		0.0	$0		$0
C. LPG		0.0	$0		$0
D. Natural Gas	$3.52	567.2	$1,994	14.17	$28,260
E. Demand Saved	Included above	kW	$0	12.02	$0
F. Total		1,078.6	$11,420		$141,556

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		10.74	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2 + 3Bd4) $0

4. First Year Dollar Savings (2F3 + 3A + (3Bd1/Years Economic Life))	$11,420	
5. Simple Payback (1G/4):	0.56	Years
6. Total Net Discounted Savings (2F5 + 3C):	$141,556	
7. Savings to Investment Ratio (SIR) 6/1G:	21.99	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Huachuca, Arizona | Region No. 4 | Project No.
Project Title: ECIP Facility Energy Improvements | Fiscal Year FY96
Discrete Portion: Building **91114**: Low-E Roof Coat | Preparer: KELLER & GANNON
Analysis Date: January 1995 | Economic Life: 15 Years

1. Investment Costs			
A. Construction Costs	$1,337		
B. SIOH	$80		
C. Design Cost	$80		
D. Total Cost (1A + 1B + 1C)	$1,498		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$1,498

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.43	18.6		$343	12.02	$4,128
B. Dist		0.0		$0		$0
C. LPG		0.0		$0		$0
D. Natural Gas	$3.52	(16.2)		($57)	14.17	($807)
E. Demand Saved	Included above		kW	$0	12.02	$0
F. Total		2.4		$286		$3,321

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		10.74	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2 + 3Bd4)	$0	
4. First Year Dollar Savings (2F3 + 3A + (3Bd1/Years Economic Life))	$286	
5. Simple Payback (1G/4):	5.23	Years
6. Total Net Discounted Savings (2F5 + 3C):	$3,321	
7. Savings to Investment Ratio (SIR) 6/1G:	2.22	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Fort Huachuca, Arizona	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements		Fiscal Year FY96
Discrete Portion:	Total Project		Preparer: KELLER & GANNON
Analysis Date:	January 1995	Economic Life: 15	Years

1. Investment Costs			
A. Construction Costs	$99,715		
B. SIOH	$5,983		
C. Design Cost	$5,983		
D. Total Cost (1A + 1B + 1C)	$111,681		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$111,681

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$18.43	1,016.0	$18,724	12.02	$225,060
B. Dist		0.0	$0		$0
C. LPG		0.0	$0		$0
D. Natural Gas	$3.52	3,213.8	$11,301	14.17	$160,131
E. Demand Saved	Included above	kW	$0	12.02	$0
F. Total		4,229.8	$30,025		$385,191

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		10.74	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2 + 3Bd4)	$0	
4. First Year Dollar Savings (2F3 + 3A + (3Bd1/Years Economic Life))	$30,025	
5. Simple Payback (1G/4):	3.72	Years
6. Total Net Discounted Savings (2F5 + 3C):	$385,191	
7. Savings to Investment Ratio (SIR) 6/1G:	3.45	

LO/MIT-I T.M.

RADIANT BARRIER COATING

For Energy Conservation and Light Reflection

LO/MIT-I is a silver colored, non-thickness dependent, low emissivity coating. Its superb ability to reflect both heat (infrared radiation) and light make it an excellent, low cost substitute for metallic foils or metallized plastic films. High temperature tolerance, excellent adhesion and the ability to produce uniformly low emissivities on a wide variety of substrates make LO/MIT-I unique in the field of high technology coatings.

OPTICAL CHARACTERISTICS
Laboratory application of LO/MIT-I on glass substrates has lowered emissivity from .86 to .22 and increased spectral reflectivity from 7.3% to 85%. LO/MIT-I can be applied to a wide variety of substrates and normally will create a surface emissivity of .21-.26, and a spectral reflectivity of 81%-85%, depending on the substrate used. The chart on the rear of this bulletin shows optical properties on specific materials.

CONSTITUENTS
Aromatic hydrocarbons, aliphatic ketones, proprietary pigments and binders.

SOLVENT
Solsolv 301 or xylene.

VISCOSITY
29 seconds #1 Zahn's cup.

HARDNESS
Extremely strong 3H hardness after 24 hour room temperature cure. Hardness increases with age.

DEGRADATION & OUTGASSING
Unaffected by UV or elevated temperatures. Thermally tolerant to 1000° F (538°C). No outgassing when correctly cured.

COVERAGE
400-800 square feet/gallon, depending on surface and application method.

CLEAN UP
Clean application equipment with Solsolv 301 or Xylene. Use Isopropyl Alcohol for operator clean up and removal from clothing.

MIXING
Coating supplied ready for use. No thinning is required or suggested. Shake well before using. If possible, agitate during application.

SURFACE PREPARATION
Normally, adhesion is the only factor that will be affected by surface preparation. Optical properties will remain constant except on surfaces that are very porous such as brick and cement. To improve optical properties on porous substrates, appropriate fillers and primers may be used to increase surface smoothness. This will also increase coverage. On metallic substrates, such as cold rolled or galvanized steel, that may be subject to possible corrosion or oxidation, appropriate primers should be used before applying LO/MIT-I. Where a surface is already primed or painted, apply a test patch of LO/MIT-I to ascertain that the prepared surface is compatible with the solvents used in LO/MIT-I. Plastics may require surface treatment to increase adhesion and should be tested for compatibility with LO/MIT-I. Most building materials, such as wood, plasterboard, paper faced insulation batts, fibrous ceiling tiles and painted metal roof decking require no surface preparation except that they be clean and dust free. Masonry surfaces should be allowed to cure for one month prior to the application of LO/MIT-I.

Any surface preparation questions not answered in this section should be referred to our Technical Services Department.

APPLICATION
Air Atomization: Use DeVilbiss pressure gun #JGA-502-704-FX; gun pressure of 30 psi (2.11 kg/cm²); tank pressure of 4-6 psi (.14-.42 kg/cm²). Remote paint supply pots should be equipped with an air driven agitator to keep coating thoroughly mixed during application.-OR-DeVilbiss suction gun #JGA-502-43-FF, gun pressure of 25 psi (1.76 kg/cm²). Needle adjustment = ½ open. Hold spray gun 8-14" from work. Spraying at the lower pressure (25-30 psi) indicated will lessen overspray and effect better coverage. Use 2 horsepower or larger compressor.

Airless and Electrostatic: Test airless and electrostatic equipment for compatability with LO/MIT-I before using. Remote paint supply pots should be equipped with an air driven agitator to keep coating thoroughly mixed during application.

Portable Compression Sprayer: The SOLEC Model LS-1 portable compression sprayer is a low cost, self-contained coating application device for the field application of LO/MIT-I to roof decks, cinder block walls, attics, or new construction where power is unavailable. Ask for Bulletin LS-1.

Brush and Roller: LO/MIT-I may also be applied using a solvent resistant paintbrush or roller. However, coverage may be substantially reduced.

Note: Good ventilation is necessary for operator safety and drying and curing of the applied coating.

DRYING AND CURE
Coating will skin dry within one minute after application. Drying to touch will generally occur within 15 minutes to one hour depending on ambient temperature and humidity. Curing can be accelerated by application of heat up to 500°F (260°C) for 4 to 30 minutes. Experimentation will determine the best curing procedures for your particular environment.

STORAGE
Keep at room temperature in tightly sealed container. Keep out of direct sunlight to avoid pressure increase in container. Full containers will remain usable for 1 year from date of manufacture.

CAUTION
Contains flammable solvents. Do not expose to elevated heat or open flames. Use with adequate ventilation and avoid excessive breathing of vapor or spray mist. Avoid contact with eyes. OSHA regulations, Sections 1915.24—Painting, 1915.25—Flammable Liquids and 1915.82—Respiratory Protection give additional helpful safety suggestions.

FIRST AID
Remove from skin using isopropyl alcohol and warm soapy water. In case of contact with eyes, flush with clean water for at least 15 minutes and get medical attention. If swallowed, get immediate medical attention. If headache, dizziness or nausea result from excessive inhalation of vapors, remove to fresh air and administer oxygen if necessary.

SOLAR ENERGY CORPORATION, BOX 3065, PRINCETON, NJ 08543-3065, U.S.A.

PACKAGING
Steel containers. Quarts, gallons, 5 gallon tight head pails. Weights including containers: Quart (.95 liters) = 2.5 lbs. (1.13 kilos), Gallons (3.79 liters) = 8.2 lbs. (4.24 kilos), 5 gallons (18.93 liters) = 42.5 lbs. (21.66 kilos).

ORDERING AND PRICING INFORMATION
Contact factory at 609-883-7700 for name of your local distributor, pricing and availability. F.O.B. Ewing, N.J. Shipping and packaging extra. Available for export.
Terms: Net 30 days for D&B rated firms.

U.S. GOVERNMENT PURCHASERS:
LO/MIT-I is available through GSA: Contract #TFTC-88-CK-NIIS-01 effective 7/1/89–Section Heading: 80 Brushes, Paint, Sealers & Adhesives. GSA, Proc. Div. (9FTP10-C-M) GSA Center, Auburn, WA 98001.

TECHNICAL SERVICES DEPARTMENT
Contact factory at 609-883-7700, 9-5 pm, EST
or fax 609-497-0182, 24 hours a day.

ACCESSORIES & ADDITIONAL PRODUCTS
LS-1, Modified Compression Sprayer, a low cost, self-contained, coating application device.
SOLKOTE HI/SORB-II, spray applied selective coating.
SOLKLEAN 101, Production metal cleaner.
SOLKLEAN 201, Water based aluminum conversion coating.
SOLSOLV 301, Low cost replacement solvent for Xylene.
ISOPROPYL ALCOHOL, For clean-up of LO/MIT-I coatings.

IMPORTANT NOTICE TO PURCHASER
This bulletin is an introductory summary of LO/MIT-I Radiant Barrier Coating. The information provided is based upon typical installation conditions and tests we believe to be reliable. However, due to a wide variety of possible use conditions, SOLEC does not guarantee that typical values expressed will necessarily be obtained. The following is made in lieu of warranties, expressed or implied, including merchantability.

Seller's only obligation shall be to replace such quantity of the product proved to be defective. Seller shall not be liable for any injury, loss or damage, direct or consequential, arising out of the use of or inability to use the product. Before using, user shall determine the suitability of the product for their intended use, and user assumes all risk and liability whatsoever in connection therewith.

No statement or recommendation shall have any force or effect unless in an agreement signed by officers of seller and user.

RESEARCH FACILITIES
The Solar Energy Corporation maintains a complete laboratory for the analysis of optical coatings. Our low cost services for the analysis of optical surfaces are used by many large manufacturers. Please contact us for prices.

LO/MIT/NOTES
The Solar Energy Corporation maintains a continuing research program in spray applied optical surfaces. Pertinent data is published in the form of bulletins called LO/MIT/NOTES. These bulletins are available, free to our customers and other interested parties. Please write us to have your name placed on our mailing list.

OPTICAL PROPERTIES OF SELECTED SUBSTRATES

Substrate	Emissivity Before LO/MIT Applied	Emissivity After LO/MIT Applied	Diffuse Reflectivity Before LO/MIT Applied	Diffuse Reflectivity After LO/MIT Applied
brick (red clay)	.92	.36	36%	71%
cement block	.93	.37	32	66
glass (soda lime)	.86	.22	7.3	85
galvanized steel (bright)	.03	.25	77	84
galvanized steel (dull paint lock)	.57	.26	15	82
paper (kraft)	.80	.24	48	81
plasterboard	.90	.21	55	85
plywood	.72	.22	46	81
poly carbonate (clear)	.84	.22	8.6	84
polypropylene (opaque)	.90	.23	8.1	84
steel, cold rolled, primed	.87	.25	22	83
steel, cold rolled, unprimed	.10	.23	57	84
steel, 316 stainless	.19	.23	59	84

LO/MIT-I Application Ideas

Aircraft
LO/MIT-I is extremely lightweight (less than .05 oz./ft²). It may be effectively used as a heat shield on many aircraft components including wiring harnesses, cowlings, fire walls and electronic components. It is also an excellent coating for balloon fabrics.

Automotive
LO/MIT-I may be used as a low cost, lightweight heat shield on many automotive components including wiring harnesses, battery boxes, exhaust systems, air conditioning ducts, fire walls, intake manifolds, fuel pumps, rubber hoses, shock absorber boots, floor pans, electronic and plastic components.

Building and Construction
LO/MIT-I is a low cost substitute for metallic or metallized plastic foils. Wherever these products are used for energy conservation in new or retrofit construction, spray application of LO/MIT-I will generally prove to be as effective at half the cost. In many instances, where it may be impractical to staple or tack reflective radiant barriers, LO/MIT-I may be easily spray applied.

Daylighting
Since LO/MIT-I exhibits a high diffuse reflectivity on many building materials, it may be effectively used to enhance daylighting and lower illumination costs.

Energy Conservation
The use of LO/MIT-I on ceiling and wall surfaces can result in substantial heating and cooling energy savings. (See Radiant Barriers, Building and Construction, Metal Buildings.) Also, in factory buildings and warehouses, the application of LO/MIT-I to interior ceiling surfaces may raise winter radiant temperatures and increase ceiling reflectivity, thereby lowering both heating and lighting costs.

Metal Buildings
LO/MIT-I, when applied to the exterior of metal buildings, has been shown to lessen building skin temperatures in excess of 30°F (16°C) in 95°F (35°C) ambient environments. This can lead to substantial decreases in heating and air conditioning costs.

Ovens, Process Piping, Power Generation Equipment
LO/MIT-I when applied to the exterior surfaces of boilers, ovens or high temperature process piping can effectively block thermal radiation and may lead to substantial efficiency increases.

Plastics
Whenever plastics are subjected to elevated temperatures, surface application of LO/MIT-I may lessen degradation due to adverse thermal environments. In many cases, lower cost and lower weight plastics may be used when they are coated with LO/MIT-I.

Radiant Barriers
Recent tests by the Florida Solar Energy Center (FSEC) indicate that the role of radiant heat transfer, particularly in hot, sunny climates, may be much more important than recently recognized. In these climates, heat gain prevention is often more critical to the energy performance of a building than stopping heat loss. Application of LO/MIT-I to the undersides of roofs and cavity wall surfaces creates an extremely effective radiant barrier that may lead to substantial energy savings at lower installed per square foot costs than aluminum foil or metallized plastic films.

Reflectors
LO/MIT-I exhibits excellent diffuse reflectivity on many substrates. It may be used as a low cost reflective surface in lighting fixtures, control panels and many other applications where reflectivity is needed.

Roof Coating
LO/MIT-I will lower roof skin temperatures 20-40°F. It is unaffected by UV radiation and highly reflective to infrared. It will greatly extend roof life and may be brushed, rolled or spray applied to bitumen, PVC, rubber, asphalt, tar and gravel, foam, shingle, tile, steel and most other roofing surfaces. It is hydrophobic and tends to be self-cleaning. Field testing in Southern climates has shown energy savings from 15% to in excess of 30% when LO/MIT-I is used as a reflective roof coating.

Selective Surfaces
High emissivity surfaces such as glass or cement, when coated with LO/MIT-I, exhibit low emissivities of .22-.30. By overcoating the LO/MIT-I surface with SOLKOTE Hi/Sorb-II spray applied selective coating, a semi-selective surface exhibiting emissivities of .42-.50 and absorptivities of 95 to 97% may be achieved. At an installed cost of 12 to 17 cents per square foot, substantial cost savings can be achieved over the use of selective metal foils.

Work Request 2

Gas Engine-Driven Chiller Retrofit

WORK REQUEST (IFS-M)

(For use of this form, see AR 420-17 and DA PAM 420-6; the proponent agency is USACE.)

PART A *(See Instructions)*	CUSTOMER ID CODE	DOCUMENT SERIAL NUMBER	FY	TYPE	SHORT JOB DESCRIPTION	DATE DA	DATE MON	DATE YR
	FEE		5	P	GAS ENGINE DRIVEN CHILLER			

INSTALLATION ABBREVIATION OF FACILITIES	BUILDING / FACILITY NUMBERS 1	2	3	4	5	6	7	8	9	10
1	HUA	56301								
2										
3										

REMARKS: **This Work Request is a result of the EEAP, ESOS conducted by Keller & Gannon under Contract No. DACA05-C-92-0155. Economic analysis results are: $13,290 energy cost saved less $ 1,032 added O&M costs per year for an investment of $122,512; SIR = 1.06; Payback Period = 9.99 years.**

INSTALLATION NAME:	CUSTOMER NAME	POC NAME	POC PHONE NUMBER
FORT HUACHUCA, ARIZONA	Directorate of Engineering and Housing	WILLIAM J STEIN	602 533-1861

WORK DESCRIPTION *(Description of work requested)*: **Refer to the attached information for details and specifics concerning the analyses.**

Replace the existing 80 Ton, electrically driven, air cooled chiller with a gas engine driven chiller to reduce energy costs to cool the building.

The replacement chiller shall be the following, or an approved equal:

ENCHILL Model ECA 70 G: HCFC R-22 Refrigerant 72 Tons nominal capacity 87 HP Engine
1.21 HP/Ton 7.21 Therms/Hour gas consumption 1.21 C.O.P.

Installation of this replacement chiller will reduce electric demand and usage charges while incurring additional natural gas costs under a reduced price rate schedule for natural gas fired cooling systems.

AUTHORIZED REQUESTOR (Type or Print) _____ *SIGNATURE* _____

PART B *(Approving Official Only)*

APPROVAL ACTION CODE: ☐
WORK REQUEST PRIORITY: ☐☐☐
PROGRAM INDICATOR CODE: ☐☐

SPECIAL INTEREST CODE: ☐☐☐☐☐☐
ESTIMATED WORK START DATE: DA ☐☐ MON ☐☐☐ YR ☐☐
ESTIMATED WORK COMPLETION DATE: DA ☐☐ MON ☐☐☐ YR ☐☐

ENVIRONMENTAL IMPACT

YES	NO	
☐	☐	ENVIRONMENTAL CONSIDERATION
☐	☐	EIS / EIA INITIATED
☐	☐	EIS / EIA COMPLETED

WORK TO BE PERFORMED
☐ IN-HOUSE
☐ SELF-HELP
☐ CONTRACT
☐ TROOP

WORKCLASS	APPROVAL AMOUNTS FUNDED	UNFUNDED
☐	$	$
☐	$	$
☐	$	$
TOTAL	$	$

SOURCE OF FUNDS
☐ DIRECT
☐ AUTOMATIC REIMBURSEMENT
☐ FUNDED REIMBURSEMENT

OTHER FUND CITATION ☐☐☐☐☐☐☐☐☐☐☐☐

DESIGN APPROVAL	DATE DA	DATE MON	DATE YR	APPROVAL AUTHORITY	APPROVAL ACTION	DATE DA	DATE MON	DATE YR
(Please type or print name)				*(Please type or print name)*	☐ APPROVED			
(Signature)				*(Signature)*	☐ DISAPPROVED			

EHSC FORM 4283-1 (On Microsoft Excel Version 5.0)

F:\PROJ\1640313\ENGR\PREFINAL\WORK-REQ.XLS Gas Engine Chiller

Natural Gas Cooling for CETEC Communications Equipment Facility Building 56301

Building cooling is presently provided by an air cooled reciprocating chiller serving rooftop multi-zone air handling units.

The existing electric powered chiller has a capacity of about 80 Tons and serves a design cooling load of 69 Tons; the chiller's maximum electric power demand is 67.0 kW.

The possibility of replacing the existing electric powered chiller with a natural gas powered chiller is investigated. Three types of natural gas powered chillers are available:

- Direct Fired Absorption Chillers
- Hot Water Heated Absorption Chillers
- Gas Engine-Driven Chillers

The possibility of installing an absorption chiller to be used in conjunction with the hot water output from the hot water boiler in building 56301 was investigated, and found not to be feasible. Trane, Carrier, and York absorption chillers were investigated. It was determined that the hot water output from the boiler will not attain the minimum input temperature required. The minimum input water temperature required, according to catalog information, is 240°F, whereas the maximum output temperature from the boiler is controlled at approximately 182°F.

Use of a direct fired absorption chiller was also considered. The smallest capacity offered is about 100 tons, too large for building 56301.

Gas engine driven chillers available as packaged systems from Tecochill and Enchill are considered.

Existing Chiller Energy Use

Power consumption data is not available for the building. Existing cooling energy use is calculated based on installed equipment capacity and building envelope data.

Capacities of installed air handling systems are as follows:

Unit Description	Sensible BTUH	Total BTUH
ACU/ACCU 1	48,300	56,820
AH1	240,440	253,095
AH2	248,760	261,860
AH3	240,550	253,210
Totals	778,050	824,985

Assuming capacity is selected at about 10% over the actual zone loads, the block cooling load is, thus:
907,484 BTUH, or 76 Tons.

The Cooling Load Temperature Difference for the building is found to be about 15.14 °F, based on envelope data. The annual cooling-degree-days from the Fort Huachuca Meteorological Team report dated November 30, 1992 are: 1,595 Cooling-Degree-Days per Year.

The annual cooling load is, thus estimated at 2,294 Million BTU per Year.

Based on vendor information for the existing chiller, energy use is based on: 1.4 kW/Ton; annual

power consumption is, thus: 267,690 kWH per Year.

Electric Power Demand is charged at: $10.65 per kW per month including applicable taxes and the effects of Fort Huachuca's high power factor.

Electric Power use is charged at: $0.04835 per kWH including applicable taxes.

Annual power cost to operate the existing chiller is, thus: $21,508 per year including demand & use charges.

Proposed Gas Engine Driven Chiller Energy Use

The proposed gas engine driven chiller is:

ENCHILL Model ECA 70 G: HCFC R-22 Refrigerant
72 Tons nominal capacity
87 HP Engine
1.21 HP/Ton
7.21 Therms/Hour gas consumption
1.21 C.O.P.

Full load operating hours, based on the above load calculations: 2,528 Hours per Year.

Fuel consumption based on chiller performance data: 1,823 Million BTU per Year

Natural Gas rate for gas engine driven systems offered by Southwest Gas Corporation under Schedule CG-35.
$4.2758 per Million BTU. Applicable taxes per current billings add an additional 5.430%
for an overall natural gas cost of $4.5080 per Million BTU.

Annual energy cost for operating a gas engine driven chiller are: $8,218 per year.

Operating and Maintenance (O&M) Costs

Based on a recent paper appearing in Energy Engineering, Vol. 91, No. 2, 1994, by D. J. Anderson, operating costs for the existing chiller and proposed engine driven chiller are:

80 Ton Existing:	$0.0075	per Ton per Hour x	2,528	Hours =	$1,517	per Year.
72 Ton Proposed:	$0.0140	per Ton per Hour x	2,528	Hours =	$2,549	per Year.

Analysis Results

Installation costs are estimated on the next page

Life cycle cost analysis resulted in the following measures for a 15 year economic life.

Simple Payback Period:	9.99	Years
Savings to Investment Ratio (SIR):	1.06	
Adjusted Internal Rate of Return (AIR	4.90%	

The proposed project is marginally economically attractive and should be considered for implementation.

CONSTRUCTION COST ESTIMATE

Date Prepared: January 1995 | Sheet 1 Of 1

Project: ECIP Facility Energy Improvements | Project No. | Basis for Estimate: Code A (no design competed)

Location: Fort Huachuca, Arizona

Engineer-Architect: Keller & Gannon

Drawing No. | Estimator: BIH | Checked By: RCL

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Enchill ECA 70 G 72 Ton Air Cooled Reciprocating Engine Driven Chiller	1	EA	$2,880	$2,880	$60,000	$60,000	$62,880
Concrete Equipment Pad (assumed 12" thick slab)	7	CY	$21.00	$147	$65.00	$455	$602
Connect to CHW Piping (8" Dia) (allowance includes fittings)	80	LF	$17.60	$1,408	$30.00	$2,400	$3,808
Connect to Condenser Piping (2-1/2" Dia) (allowance includes fittings)	60	LF	$6.40	$384	$15.00	$900	$1,284
Electrical Connections and Service	1	JOB	$2,500	$2,500	$2,000	$2,000	$4,500
Control Systems Modifications	1	JOB	$1,800	$1,800	$1,000	$1,000	$2,800
Subtotal				$9,119		$66,755	$75,874
Arizona Transaction Privilege Tax	3.75%	%		-		$2,503	$2,503
Subtotal							$78,377
Contractor OH & Profit	25.0%	%					$19,594
Subtotal							$97,972
Bond	1.5%	%					$1,470
Subtotal							$99,441
Estimating Contingency	10.0%	%					$9,944
Total Probable Construction Cost							$109,385

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Huachuca, Arizona Region No. 4 Project No.
Project Title: ECIP Facility Energy Improvements Fiscal Year FY96
Discrete Portion: Building 56301 Gas Engine Driven Chiller Retrofit Preparer: KELLER & GANNON
Analysis Date: January 1995 Economic Life: 15 Years

1. Investment Costs			
A. Construction Costs	$109,385		
B. SIOH	$6,563		
C. Design Cost	$6,563		
D. Total Cost (1A+1B+1C)	$122,512		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$122,512

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	914		$12,943	12.02	$155,572
B. Dist	$13.25	0		$0	-	$0
C. LPG	$7.37	0		$0	-	$0
D. Natural Gas	$4.51	(1,823)		($8,218)	14.17	($116,449)
E. Demand Saved	$127.84	67.0	kW	$8,565	12.02	$102,955
F. Total		(909)		$13,290		$142,078

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($1,032)		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			($12,317)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	($12,317)	
4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)):	9.99	Years
5. Total Net Discounted Savings (2F5+3C):	$129,761	
6. Savings to Investment Ratio (SIR) 5/1G:	1.06	
7. Adjusted Internal Rate of Return (AIRR):	4.9%	

EEAP Energy Savings Opportunity Survey
Fort Huachuca, Arizona

Work Request 3

Building HVAC Control Modifications And High Efficiency Motor Retrofits

WORK REQUEST (IFS-M)

(For use of this form, see AR 420-17 and DA PAM 420-6; the proponent agency is USACE.)

PART A *(See Instructions)*	CUSTOMER ID CODE	DOCUMENT SERIAL NUMBER	FY	TYPE	SHORT JOB DESCRIPTION	DATE DA	DATE MON	DATE YR
	FEE		5	P	HVAC CONTROL & MOTOR RETROFIT			

INSTALLATION ABBREVIATION OF FACILITIES	BUILDING / FACILITY NUMBERS 1	2	3	4	5	6	7	8	9	10
1 HUA	15544	43083	56301	57305	61701	62704	67601	80505	91114	
2										
3										

REMARKS: **This Work Request is a result of the EEAP, ESOS conducted by Keller & Gannon under Contract DACA05-C-92-0155. Economic analysis results are: $42,996 energy and $4,105 O&M annual cost savings; Total Cost of $41,877 less TEP Co. rebate of $1,778; SIR = 2.94; Payback Period = 4.88 years.**

INSTALLATION NAME:	CUSTOMER NAME	POC NAME	POC PHONE NUMBER
FORT HUACHUCA, ARIZONA	Directorate of Engineering and Housing	WILLIAM J STEIN	602 533-1861

WORK DESCRIPTION *(Description of work requested)*: **Refer to the attached information for details and specifics concerning the analyses.**

Building 56301 HVAC Control Retrofit: Install economizer ducting, dampers, instruments & controls to reset supply air temperature based on outside air temperature.

High Efficiency Motor Retrofits: Replace existing standard efficiency motors with high efficiency motors. Motor replacements consist of:

- 3 Each - 5 HP Open Drip Proof Motors
- 1 Each - 5 HP Totally Enclosed Fan Cooled Motors
- 5 Each - 7.5 HP Open Drip Proof Motors
- 1 Each - 7.5 HP Totally Enclosed Fan Cooled Motors
- 6 Each - 10 HP Open Drip Proof Motors
- 10 Each - 15 HP Open Drip Proof Motors
- 1 Each - 20 HP Open Drip Proof Motors
- 1 Each - 20 HP Totally Enclosed Fan Cooled Motors
- 1 Each - 25 HP Open Drip Proof Motors
- 1 Each - 25 HP Totally Enclosed Fan Cooled Motors
- 2 Each - 30 HP Open Drip Proof Motors

AUTHORIZED REQUESTOR (Type or Print) _____ *SIGNATURE* _____

PART B *(Approving Official Only)*			DATE DA	DATE MON	DATE YR
	APPROVAL ACTION CODE:	SPECIAL INTEREST CODE:			
	WORK REQUEST PRIORITY:	ESTIMATED WORK START DATE:			
	PROGRAM INDICATOR CODE:	ESTIMATED WORK COMPLETION DATE:			

ENVIRONMENTAL IMPACT

YES	NO	
☐	☐	ENVIRONMENTAL CONSIDERATION
☐	☐	EIS / EIA INITIATED
☐	☐	EIS / EIA COMPLETED

WORK TO BE PERFORMED

- ☐ IN-HOUSE
- ☐ SELF-HELP
- ☐ CONTRACT
- ☐ TROOP

WORKCLASS	APPROVAL AMOUNTS FUNDED	APPROVAL AMOUNTS UNFUNDED
☐	$	$
☐	$	$
☐	$	$
TOTAL	$	$

SOURCE OF FUNDS

- ☐ DIRECT
- ☐ AUTOMATIC REIMBURSEMENT
- ☐ FUNDED REIMBURSEMENT

OTHER FUND CITATION

DESIGN APPROVAL	DATE DA	DATE MON	DATE YR	APPROVAL AUTHORITY	APPROVAL ACTION	DATE DA	DATE MON	DATE YR
(Please type or print name)				*(Please type or print name)*	☐ APPROVED			
(Signature)				*(Signature)*	☐ DISAPPROVED			

Building 56301 Communications Equipment Facility - HVAC Controls Retrofit

Building 56301 is a communications equipment facility. The 30,000 square foot, single floor, building heating, ventilating and air conditioning (HVAC) system is comprised of three rooftop-mounted multi-zone air handling units. Each unit is fitted with both hot and chilled water coils. Hot water is supplied by a hot water boiler and chilled water is provided by an air cooled reciprocating chiller.

Existing Controls

Existing HVAC controls in the building are a combination of electronic and pneumatic. Each HVAC zone is provided with a thermostat. One zone from each air handling unit is provided with a set-back thermostat. The thermostats are used to control supply air temperature to each zone. Set-back thermostats are used for temperature control during scheduled unoccupied periods.

For energy savings, existing controls provide for 100% outside air whenever the outside temperature is less than 62 °F. Heating is prevented whenever the outside air temperature exceeds 60 °F. Design temperature setpoints are as follows:

Summer Indoor Temperature:	77 °F
Winter Indoor Temperature:	68 °F
Cooling Economizer active below:	62 °F
No Cooling below:	65 °F
No Heating above:	60 °F

HVAC Control System Retrofits Evaluated

Three HVAC control system modifications are evaluated:

1. Integrated dry-bulb temperature control,
2. Supply air temperature reset control based on outside air temperature, and
3. Supply air temperature reset control based on the zone with the greatest demand.

Integrated Dry-Bulb Temperature Control

This type of control compares outdoor and return air dry-bulb temperatures to determine the economizer damper position. The economizer control strategy is illustrated in Figure F-1, below. Operation of the control is discussed below, proceeding from right to left in the diagram.

- When the outdoor temperature is greater than the return air temperature, the economizer dampers are closed. The system receives normal outdoor ventilation air. This is region A in Figure F-1.
- When the outdoor temperature is less than the return air temperature, the economizer dampers are fully open. Supply air is 100% outdoor air. Economizer dampers are held in this position as long as mechanical cooling is still required. This is region B in Figure F-1.
- As the outdoor air temperature drops, a point will be reached where use of 100% outdoor air eliminates the need for mechanical cooling. Beginning at this point, the economizer dampers modulate so that the mixture of outdoor and return air streams produces air at a temperature sufficient to eliminate mechanical cooling. This is region C in Figure F-1.
- At cooler temperatures, economizer dampers finally modulate closed and the system returns to normal ventilation levels. No mechanical cooling is required. This is region D in Figure F-1.

Finally, in some cases, upper and lower cutoff temperatures will be specified. When the outdoor air dry-bulb temperature is greater than the upper cutoff temperature, or lower than the lower cutoff temperature, economizer operation will be automatically disabled.

Supply Air Temperature Reset Based on Outside Air Temperature

For this type of control, supply air temperature is reset based on an outdoor air temperature schedule. For this control the maximum and minimum supply air temperatures and their corresponding outdoor air temperatures must be known.

For example, the design supply temperature is 57°F at a corresponding outdoor temperature (OAT) of 95°F, and is 67°F at a corresponding OAT of 55°F. Above 95°F OAT, the supply temperature is held constant at 57°F. Below 55°F OAT, the supply temperature is held constant at 67°F. Between 95°F and 55°F, the supply temperature varies as a linear function of outdoor temperature.

Supply Air Temperature Reset Based on Greatest Zone Demand

For this type of control, supply air temperature is reset based on zone loads. The system supply temperature is determined by computing the required supply air temperatures for each zone served by the system. For cooling operation, the coldest supply temperature among the zones is used as the supply temperature for the system. For heating operation, the warmest supply temperature is used as the supply temperature for the system. This models the use of a discriminating controller for resetting supply air temperature.

Energy Saving Calculations

Energy consumption for HVAC is estimated using the Carrier HAP computerized building energy simulation model. The building input data includes fifty-four spaces, three air handling units with a total of sixteen zones and a central heating and cooling plant. Central plant inputs include an air cooled reciprocating chiller and a hot water boiler.

Three simulations are conducted, a baseline run and one for each of the control system strategies evaluated. Both the control system retrofit simulations include integrated dry-bulb temperature controls and supply air temperature reset control. One run is with supply air temperature control based on outside air temperature; the other simulation includes supply air temperature reset based on the zone with the greatest demand.

The energy use simulation uses El Paso, Texas weather data, the city for which data is available that has weather the most similar to that of Fort Huachuca. Energy consumption results from simulations are adjusted based on heating and cooling degree-days for each location.

Results of computer simulations and energy saving calculations are provided in tabular form. Selected input data and outputs from each simulation are appended.

Control Modifications

While the control system modifications appear to be significant, actual equipment changes are minimal. Existing sensors and actuators are reused as much as possible, a new control unit is installed on each air handler, and additional sensors are installed as required. Controls are rewired at each air handling unit.

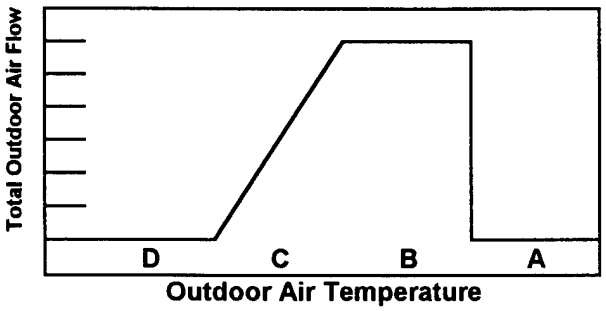

Figure F-1. Integrated Dry-Bulb Temperature Control

Summary of HVAC Control Retrofit Evaluations

Energy Costs and Adjustment Factors

Electric Usage Cost & Taxes, **including demand charges:**

$0.0629 per kWH 12.02 Uniform Present Worth, N=15

Natural Gas Cost, including Taxes:

$4.5080 per Mil BTU 14.17 Uniform Present Worth, N=15

Adjustment for El Paso, Texas vs. Fort Huachuca Energy Use:

Location	Heating DD/Year	Cooling DD/Year
Simulations @ El Paso, Texas	2,678	2,098
Actual Site Fort Huachuca	2,551	1,595
Adjustment Factors:	0.953	0.760

Economizer Control Description Note: Both Supply Air Reset Options include Integrated Dry-Bulb Control	Electric kWH/Year	Gas Therms/Yr	Savings kWH/Year	Savings Therms/Yr	Elec Saved ($/Year)	Gas Saved ($/Year)	Constr. Cost ($)	Invest-ment ($)	LCCA Saved ($)	SIR
Baseline	415,473	32,087	-	-	-	-	-	-	-	-
Supply Reset - Outside Air Temperature	382,501	28,726	25,067	3,202	$1,577	$1,443	$14,775	$16,548	$39,403	2.38
Supply Reset - Greatest Zone Demand	385,988	30,504	22,416	1,508	$1,410	$680	$21,374	$23,939	$26,580	1.11

Recommended Control Retrofit: **Integrated Dry-Bulb Temperature Control with Supply Air Temperature Reset (Economizer Control) Based on Outside Air Temperature**

CONSTRUCTION COST ESTIMATE

Date Prepared: January 1995 | Sheet 1 Of 1

Project: ECIP Facility Energy Improvements | Project No. | Basis for Estimate: Code A (no design competed)

Location: Fort Huachuca, Arizona

Engineer-Architect: Keller & Gannon

Drawing No.: Building 56301 HVAC Control Retrofits | Estimator: BIH | Checked By: RCL

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor & Equipment Per Unit	Labor & Equipment Total	Material Per Unit	Material Total	Total Cost
Integrated Dry-Bulb Economizer Control with Supply Air Reset Based on Outside Air Temperature							
Return Air Temperature Sensor, installed	3	EA	$181.33	$544	$90.67	$272	$816
DDC Controller, 16 Point, installed	3	EA	$1,600	$4,800	$800	$2,400	$7,200
Damper Motor, modulating type	6	EA	$13.68	$82	$280.00	$1,680	$1,762
Rewire, connect and test instrumentation	16	MH	$27.35	$438	$12.50	$200	$638
Subtotal				$5,864		$4,552	$10,416
Arizona Transaction Privilege Tax	3.75%	%		-		$171	$171
Subtotal							$10,586
Contractor OH & Profit	25.0%	%					$2,647
Subtotal							$13,233
Bond	1.5%	%					$198
Subtotal							$13,431
Estimating Contingency	10.0%	%					$1,343
Total Probable Construction Cost							$14,775
Integrated Dry-Bulb Economizer Control with Supply Air Temperature Reset Based on Greatest Zone Demand or Outdoor Air Temperature							
Supply Air Temperature Sensor, installed, including wiring	16	EA	$181.33	$2,901	$90.67	$1,451	$4,352
Return Air Temperature Sensor, installed	3	EA	$181.33	$544	$90.67	$272	$816
DDC Controller, 16 Point, installed	3	EA	$1,600	$4,800	$800	$2,400	$7,200
Damper Motor, modulating type	6	EA	$13.68	$82	$280.00	$1,680	$1,762
Rewire, connect and test instrumentation	24	MH	$27.35	$656	$12.50	$300	$956
Subtotal				$8,984		$6,103	$15,086
Arizona Transaction Privilege Tax	3.75%	%		-		$229	$229
Subtotal							$15,315
Contractor OH & Profit	25.0%	%					$3,829
Subtotal							$19,144
Bond	1.5%	%					$287
Subtotal							$19,431
Estimating Contingency	10.0%	%					$1,943
Total Probable Construction Cost							$21,374

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Huachuca, Arizona Region No. 4 Project No.
Project Title: ECIP Facility Energy Improvements Fiscal Year FY96
Discrete Portion Building **56301**: Integrated Dry-Bulb Temperature Control Preparer: KELLER & GANNON
Supply Air Temperature Reset Based on Outside Air Temperature
Analysis Date: January 1995 Economic Life: 15 Years

1. Investment Costs			
A. Construction Costs	$14,775		
B. SIOH	$886		
C. Design Cost	$886		
D. Total Cost (1A + 1B + 1C)	$16,548		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$16,548

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.*	$18.43	85.6		$1,577	12.02	$18,952
B. Dist		0		$0		$0
C. LPG		0		$0		$0
D. Natural Gas	$4.51	320		$1,443	14.17	$20,451
E. Demand Savings		$0	kW	$0	12.02	$0
F. Total		406		$3,020		$39,403

* includes demand charges

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2 + 3Bd4)	$0	
4. First Year Dollar Savings (2F3 + 3A +)3Bd1/Economic Life)):	$3,020	
5. Simple Payback (1G/4):	5.48	Years
6. Total Net Discounted Savings (2F5 + 3C):	$39,403	
7. Savings to Investment Ratio (SIR) 6/1G:	2.38	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Huachuca, Arizona Region No. 4 Project No.
Project Title: ECIP Facility Energy Improvements Fiscal Year FY96
Discrete Portion Building **56301**: Integrated Dry-Bulb Temperature Control Preparer: KELLER & GANNON
Supply Air Temperature Reset Based on Zone with Greatest Demand
Analysis Date: January 1995 Economic Life: 15 Years

1. Investment Costs			
A. Construction Costs	$21,374		
B. SIOH	$1,282		
C. Design Cost	$1,282		
D. Total Cost (1A + 1B + 1C)	$23,939		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$23,939

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.*	$18.43	76.5		$1,410	12.02	$16,948
B. Dist		0		$0		$0
C. LPG		0		$0		$0
D. Natural Gas	$4.51	151		$680	14.17	$9,632
E. Demand Savings		$0	kW	$0	12.02	$0
F. Total		227		$2,090		$26,580

* includes demand charges

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2 + 3Bd4)	$0	
4. First Year Dollar Savings (2F3 + 3A +)3Bd1/Economic Life)):	$2,090	
5. Simple Payback (1G/4):	11.46	Years
6. Total Net Discounted Savings (2F5 + 3C):	$26,580	
7. Savings to Investment Ratio (SIR) 6/1G:	1.11	

Motor Survey Data and Retrofit Calculations

Survey Methodology

The survey was limited to motors with a rated horsepower of 5HP or more since units below this size do not qualify for utility company rebates and have little likelihood of a cost-effective retrofit.

Performance data collected included operating speed RPM using a digital tachometer; and input voltage, input current and power factor using clamp-on instruments.

A summary of motor nameplate data and performance data collected during the field investigation appears in Table 1.

Energy-Efficient Motor Retrofit Evaluations

The following data and assumptions were used to evaluate the feasibility of replacing existing motors with energy-efficient units:

- Efficiency improvements between standard and energy-efficient motors are valid at partial loads since energy-efficient motors operate at higher partial-load efficiencies than standard motors.
- The replacement energy-efficient electric motor will match the full-load speed of the replaced standard motor.
- Efficiencies of energy-efficient motors were based on averages provided in the DOE "Energy-Efficient Electric Motor Selection Handbook, Revision 3," January 1993. In instances where the average energy-efficient motor efficiency was less than the minimum required to qualify for a TEP rebate, the rebate-qualifying efficiency was used.
- Motor costs were based on the list price averages provided in the DOE motor handbook, adjusted for inflation and a contractor's discount.

The following formulae were used in the spreadsheet calculations summarized in Table 2:

Savings, kW = (1/Existing Eff. - 1/New Eff.) X Estimated Load Factor X Motor HP X 0.746 kW/HP

Savings, kWH = Savings kW X Op. Hours/Month X Op. Months/Year

Savings,$/Year = (Saved,kWH x $0.04835) + (Saved,kW X Op.Month/Yr ÷ 12 X $127.84/kW-Yr)

Savings, LCC$ = Savings, $/Year X 15.08 UPV Factor for a 20 year life.

Construction Cost = From Table 3

SIOH & Design = Construction Cost X 0.12

TEP Rebate = From attached schedule from Tucson Electric Power Corporation

Total Investment = Construction Cost + SIOH & Design - TEP Rebate

SIR = Savings LCC$, Total Investment

TABLE 1. SUMMARY OF MOTOR NAMEPLATE AND TEST DATA

Nameplate Data									Measured Data				Calculated Values				
Building No.	Equipment	Motor Manufacturer	Motor HP	Voltage Rating	Enclosure Type (1)	Frame Size	Existing Efficiency	Full Load Speed, RPM	Input Volts Avg.	Input Amps Avg.	Input P. F.	Speed RPM	Operating Slip RPM	Load Factor	HP Output	Input kW	Input kVA
15644	SA Fan HVAC Unit	BALDOR	20	230	TEFC	256T	0.830	1760	208	41.5	0.67	1773.0	27	0.68	13.50	10.02	14.95
43083	SA Fan AHU No. 1	MARATHON	7.5	200	ODP	213T	0.853 (2)	1755	200	23.3	0.7	1766.3	33.7	0.75	5.62	5.65	8.07
43083	SA Fan AHU No. 2	DAYTON	7.5	230	ODP	213T	0.853 (2)	1740	210	12.6	0.55	1784.5	15.5	0.26	1.94	2.52	4.58
53301	SA Fan HVAC Unit	CENTURY	30	460	ODP	S286T	0.924	1760	487.3	17.1	0.60	1790.7	9.3	0.23	6.97	8.68	14.46
53301	SA Fan	CENTURY	50	460	ODP	326T	0.930	1770	487.3	26.2	0.69	1794.5	5.5	0.18	9.17	13.06	22.14
56301	CHW Circ. Pump 1	BALDOR	5	460	ODP	184T	0.815	1725	NA	NA	NA	NA	NA	NA	NA	NA	NA
56301	CHW Circ. Pump 2	NA	5	460	ODP	NA	0.838 (2)	1750	NA	NA	NA	NA	NA	NA	NA	NA	NA
56301	SA Fan, North HVAC Unit	NA	10	460	ODP	NA	0.872 (2)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
56301	SA Fan, Central HVAC Unit	NA	10	460	ODP	NA	0.872 (2)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
56301	SA Fan, South HVAC Unit	NA	10	460	ODP	NA	0.872 (2)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
56301	Condenser Fan 1	NA	7.5	460	ODP	NA	0.853 (2)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
56301	Condenser Fan 2	NA	7.5	460	ODP	NA	0.853 (2)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
57305	CHW Circ. Pump 2	US ELECT MTRS	25	460	TEFC	324T	0.895	NA	477.7	22.2	0.81	1189.0 (3)	NA	NA	NA	14.88	18.37
61701	Pool Circ. Pump	BALDOR	20	230	ODP	286U	0.895	1760	212.0	51.6	0.86	1765.0	35	0.88	17.50	16.28	18.94
62704	RA Fan	GOULD	10	460	ODP	S215T	0.872 (2)	1750	485.3	10.1	0.58	1767.2	32.8	0.66	6.56	4.92	8.49
62704	SA Fan	GOULD	25	460	ODP	284T	0.892 (2)	1750	484.7	20.7	0.59	1784.2	15.8	0.32	7.90	10.25	17.38
67601	AHU 1 SA Fan	MAGNATEK	15	460	ODP	S256T	0.860	1760	NA	NA	NA	NA	NA	NA	NA	NA	NA
67601	AHU 2 SA Fan	MAGNATEK	15	460	ODP	S256T	0.860	1760	484.7	14.5	0.58	1785.1	14.9	0.37	5.59	7.06	12.17
67601	AHU 3 SA Fan	MAGNATEK	15	460	ODP	S256T	0.860	1760	482.0	13.3	0.60	1194.4 (3)	NA	NA	NA	5.55	11.10
67601	AHU 4 SA Fan	MAGNATEK	15	460	ODP	S256T	0.860	1760	NA	NA	NA	NA	NA	NA	NA	NA	NA
67601	AHU 5 SA Fan	MAGNATEK	15	460	ODP	S256T	0.860	1760	483.3	14.1	0.44	1789.5	10.5	0.26	3.94	5.20	11.83
67601	AHU 7 SA Fan	MAGNATEK	15	460	ODP	S256T	0.860	1760	484.7	14.7	0.57	1782.0	18	0.45	6.75	7.05	12.37
67601	HVAC Sys. Circ. Pump	UNIMOUNT	15	460	ODP	NA	0.895	NA	485.3	13.4	0.69	1785.7	14.3	NA	NA	7.77	11.26
70525	Furnace SA Fan	LINCOLN	10	200	TEFC	256-U	0.860 (2)	1740	203.2	16.4	0.11	1775.0	25	0.42	4.17	0.64	5.78
80505	CHWP-1	US ELECT MTRS	15	460	ODP	254T	0.875	1745	NA	NA	NA	NA	NA	NA	NA	NA	NA
80505	CHWP-2	US ELECT MTRS	15	460	ODP	254T	0.875	1745	471.1	13.1	0.54	1780.5	19.5	0.35	5.32	5.77	10.69
80505	HWP-1	US ELECT MTRS	7.5	460	ODP	213T	0.840	1740	467.6	7.0	0.40	1767.0	33	0.55	4.13	2.28	5.69
80505	Fan Coil Unit, Rm 249	NA	7.5	460	NA	NA	0.852 (2)	NA	467.6	7.8	0.70	NA	NA	NA	NA	4.42	6.32
80505	Fan Coil Unit, Rm 213	WEQ	5	460	TEFC	NA	0.833 (2)	1740	467.6	4.9	0.80	1743.0	57	0.95	4.75	3.19	3.99
80505	VAVH2 West, Roof FCU	MAGNATEK	15	460	ODP	S254T	0.895	1750	467.6	10.4	0.35	1792.0	8	0.16	2.40	2.94	8.40
80505	VAVH2, Roof FCU	MAGNATEK	15	460	ODP	S254T	0.895	1750	NA	NA	NA	NA	NA	NA	NA	NA	NA
80505	SA Fan East	MAGNATEK	30	460	ODP	S286T	0.883	1750	467.6	18.8	0.60	1450.0 (3)	NA	NA	NA	9.12	15.20
80505	SA Fan West	MAGNATEK	30	460	ODP	S286T	0.883	1750	NA	NA	NA	NA	NA	NA	NA	NA	NA
80505	RA Fan East	MAGNATEK	10	460	ODP	S215T	0.856	1750	474.6	9.2	0.45	1719.0 (3)	NA	NA	NA	3.39	7.54
80505	RA Fan West	MAGNATEK	10	460	ODP	S215T	0.856	1750	NA	NA	NA	NA	NA	NA	NA	NA	NA
91114	HW Circ. Pump	US ELECT MTRS	5	200	ODP	184JM	0.815	1730	204.7	13.6	0.86	1731.0	69	0.99	4.93	4.15	4.82

NA - Data Not Available
(1) ODP = Open Drip Proof
TEFC = Totally Enclosed Fan-Cooled
(2) Assumed Value, Based on Average Standard Motor Efficiencies
(3) Motor Operated by Variable Speed Drive

Table 2. Summary of Energy Efficient Motor Retrofit Evaluations

Building No.	Equipment	Motor HP	Enclosure Type {1}	Oper. Hours/ Month	Oper. Months/ Year	Existing Efficiency		New Efficiency {4}		Est. Avg. Load Factor	Savings kW	Savings kWH	Savings $/Year {5}	Savings LCC $	Construction Cost $ {6}	SIOH & Design $	TEP Rebate $	Total Investment $	SIR
15544	SA Fan HVAC Unit	20	TEFC	730	12	0.830		0.920		0.70	1.231	10,783	$679	$10,235	$1,282	$154	$80	$1,356	7.55
43083	SA Fan AHU No. 1	7.5	ODP	730	12	0.853	{2}	0.896		0.75	0.236	2,068	$130	$1,963	$466	$56	$46	$476	4.12
43083	SA Fan AHU No. 2	7.5	ODP	730	12	0.853	{2}	0.896		0.75	0.236	2,068	$130	$1,963	$466	$56	$46	$476	4.12
53301	SA Fan HVAC Unit	30	ODP	730	12	0.924		0.928		0.70	0.073	640	$40	$608	$1,206	$145	$87	$1,264	0.48
53301	SA Fan	50	ODP	730	12	0.930		0.936		0.70	0.180	1,577	$99	$1,496	$1,763	$212	$119	$1,855	0.81
56301	CHW Circ. Pump 1	5	ODP	730	6	0.815		0.879		0.80	0.267	1,168	$73	$1,108	$391	$47	$17	$421	2.63
56301	CHW Circ. Pump 2	5	ODP	730	6	0.838	{2}	0.879		0.80	0.166	727	$46	$691	$391	$47	$17	$421	1.64
56301	SA Fan, North HVAC Unit	10	ODP	730	12	0.872	{2}	0.911		0.70	0.256	2,246	$141	$2,132	$566	$68	$56	$578	3.69
56301	SA Fan, Central HVAC Unit	10	ODP	730	12	0.872	{2}	0.911		0.70	0.256	2,246	$141	$2,132	$566	$68	$56	$578	3.69
56301	SA Fan, South HVAC Unit	10	ODP	730	12	0.872	{2}	0.911		0.70	0.256	2,246	$141	$2,132	$566	$68	$56	$578	3.69
56301	Condenser Fan 1	7.5	ODP	500	6	0.853	{2}	0.896		0.70	0.220	661	$46	$694	$466	$56	$46	$476	1.46
56301	Condenser Fan 2	7.5	ODP	500	6	0.853	{2}	0.896		0.70	0.220	661	$46	$694	$466	$56	$46	$476	1.46
57305	CHW Circ. Pump 2	25	TEFC	730	6	0.895		0.925		0.80	0.541	2,368	$149	$2,248	$1,528	$183	$88	$1,623	1.38
61701	Pool Circ. Pump	20	ODP	730	12	0.895		0.920		0.88	0.396	3,472	$219	$3,296	$913	$110	$75	$947	3.48
62704	RA Fan	10	ODP	730	12	0.872	{2}	0.911		0.70	0.256	2,246	$141	$2,132	$566	$68	$56	$578	3.69
62704	SA Fan	25	ODP	730	12	0.892	{2}	0.928		0.70	0.568	4,974	$313	$4,721	$1,051	$126	$87	$1,091	4.33
67601	AHU 1 SA Fan	15	ODP	180	9	0.860		0.915		0.70	0.547	887	$95	$1,438	$736	$88	$58	$766	1.88
67601	AHU 2 SA Fan	15	ODP	180	9	0.860		0.915		0.70	0.547	887	$95	$1,438	$736	$88	$58	$766	1.88
67601	AHU 3 SA Fan	15	ODP	180	9	0.860		0.915		0.70	0.547	887	$95	$1,438	$736	$88	$58	$766	1.88
67601	AHU 4 SA Fan	15	ODP	180	9	0.860		0.915		0.70	0.547	887	$95	$1,438	$736	$88	$58	$766	1.88
67601	AHU 5 SA Fan	15	ODP	180	9	0.860		0.915		0.70	0.547	887	$95	$1,438	$736	$88	$58	$766	1.88
67601	AHU 7 SA Fan	15	ODP	180	9	0.860		0.915		0.70	0.547	887	$95	$1,438	$736	$88	$58	$766	1.88
67601	HVAC Sys. Circ. Pump	15	ODP	180	9	0.895		0.915		0.80	0.219	354	$38	$574	$736	$88	$58	$766	0.75
70525	Furnace SA Fan	10	TEFC	365	6	0.860	{2}	0.895	{3}	0.70	0.237	520	$40	$608	$796	$96	$40	$852	0.71
80505	CHWP-1	15	ODP	730	6	0.875		0.915		0.80	0.447	1,959	$123	$1,859	$736	$88	$58	$766	2.43
80505	CHWP-2	15	ODP	730	6	0.875		0.915		0.80	0.447	1,959	$123	$1,859	$736	$88	$58	$766	2.43
80505	HWP-1	7.5	ODP	730	6	0.840		0.896		0.80	0.333	1,459	$92	$1,385	$466	$56	$46	$476	2.91
80505	Fan Coil Unit, Rm 249	7.5	TEFC	730	12	0.852	{2}	0.895		0.70	0.221	1,935	$122	$1,836	$673	$81	$46	$708	2.59
80505	Fan Coil Unit, Rm 213	5	TEFC	730	12	0.833	{2}	0.875	{3}	0.95	0.204	1,789	$113	$1,698	$496	$59	$35	$520	3.26
80505	VAVH2 West, Roof FCU	15	ODP	730	12	0.895		0.915		0.70	0.191	1,676	$105	$1,591	$736	$88	$58	$766	2.08
80505	VAVH2, Roof FCU	15	ODP	730	12	0.895		0.915		0.70	0.191	1,676	$105	$1,591	$736	$88	$58	$766	2.08
80505	SA Fan East	30	ODP	730	12	0.883		0.928		0.70	0.860	7,536	$474	$7,154	$1,206	$145	$85	$1,266	5.65
80505	SA Fan West	30	ODP	730	12	0.883		0.928		0.70	0.860	7,536	$474	$7,154	$1,206	$145	$85	$1,266	5.65
80505	RA Fan East	10	ODP	730	12	0.856		0.911		0.70	0.368	3,226	$203	$3,062	$566	$68	$56	$578	5.30
80505	RA Fan West	10	ODP	730	12	0.856		0.911		0.70	0.368	3,226	$203	$3,062	$566	$68	$56	$578	5.30
91114	HW Circ. Pump	5	ODP	730	6	0.815		0.879		0.99	0.328	1,439	$91	$1,366	$391	$47	$17	$421	3.24
Totals for Motor Retrofits with SIR > 1.0											13.213	78,671	$5,198	$78,386	$22,615	$2,714	$1,778	$23,551	3.33

{1} ODP = Open Drip Proof
TEFC = Totally Enclosed Fan-Cooled
{2} Assumed Value, Based on Average Standard Motor Efficiencies
{3} Minimum Qualifying Efficiency for TEP Rebates
{4} Average Efficiency for Energy Efficient Motor from DOE Energy Efficient Electric Motor Selection Handbook, Rev. 3, January 1993
{5} Energy Cost Saved is based on $0.04835 per kWH and $127.84 per kW-Year, usage and demand costs, respectively.
{6} See Table C - 3

TABLE 3. ENERGY EFFICIENT MOTOR RETROFIT COSTS

Motor Size HP	Manhours	Cost $ {1}	ODP Material Cost $ {2}	TEFC Material Cost $ {2}	ODP Construction Cost $ {3}	TEFC Construction Cost $ {3}	Motor Size HP
5	3.6	76	197	269	$391	$496	5
7.5	3.8	80	245	388	$466	$673	7.5
10	4.0	85	309	468	$566	$796	10
15	5.0	106	406	625	$736	$1,053	15
20	6.1	129	506	761	$913	$1,282	20
25	6.4	135	596	925	$1,051	$1,528	25
30	6.7	142	696	1,095	$1,206	$1,784	30
40	8.0	169	867	1,404	$1,491	$2,269	40
50	10.0	212	1,013	1,729	$1,763	$2,799	50

{1} $21.15/Hr Electrician per Means Bare Trade Rate, adjusted for location
Labor - Use 2 x Means Manhours

{2} Averages from "DOE Energy Efficient Electric Motor Handbook Rev. 3"
Jan. 1993 Escalated from 1990 Prices = (1 Jan. '94 Index/1 Jan. '90 Index) = (1887/1676)
Reduced by 40% to Equal 'Supply' Contractor Price, Therefore
Average List Price Multiplier = (0.60)(1887/1676) = 0.676

{3} Construction Cost = {Labor Cost + (Mat'l Cost x 1.0375)} x 1.25 OH & P
x 1.015 Bond x 1.10 Contingency

TUCSON ELECTRIC COMPANY HIGH EFFICIENCY MOTOR REBATES

1994 TOTALLY ENCLOSED FAN COOLED HIGH-EFFICIENCY MOTOR REBATE SCHEDULE

MOTOR	MINIMUM QUALIFYING EFFICIENCY				BASE REBATE				BONUS
HP	900 RPM	1200 RPM	1800 RPM	3600 RPM	900 RPM	1200 RPM	1800 RPM	3600 RPM	FACTOR
5	85.5	87.5	87.5	87.5	$20	$35	$35	$35	$10 per %
7.5	85.5	89.5	89.5	88.5	$35	$50	$50	$45	$15 per %
10	88.5	89.5	89.5	89.5	$40	$40	$40	$40	$15 per %
15	88.5	90.2	91.0	90.2	$60	$60	$60	$60	$15 per %
20	89.5	90.2	91.0	90.2	$65	$50	$55	$50	$25 per %
25	89.5	91.7	92.4	91.0	$85	$80	$85	$65	$30 per %
30	91.0	91.7	92.4	91.0	$75	$70	$80	$65	$35 per %
40	91.0	93.0	93.0	91.7	$145	$155	$145	$105	$55 per %
50	91.7	93.0	93.0	92.4	$85	$100	$85	$60	$55 per %
60	91.7	93.6	93.6	93.0	$190	$200	$180	$180	$100 per %
75	93.0	93.6	94.1	93.0	$210	$190	$200	$150	$100 per %
100	93.0	94.1	94.5	93.6	$290	$280	$290	$280	$130 per %
125	93.6	94.1	94.5	94.5	$545	$525	$555	$675	$300 per %
150	93.6	95.0	95.0	94.5	$545	$535	$545	$535	$300 per %
200	94.1	95.0	95.0	95.0	$510	$500	$425	$595	$425 per %

1994 OPEN DRIP PROOF HIGH-EFFICIENCY MOTOR REBATE SCHEDULE

MOTOR	MINIMUM QUALIFYING EFFICIENCY				BASE REBATE				BONUS
HP	900 RPM	1200 RPM	1800 RPM	3600 RPM	900 RPM	1200 RPM	1800 RPM	3600 RPM	FACTOR
5	87.5	87.5	87.5	85.5	$15	$15	$15	$10	$5 per %
7.5	88.5	88.5	88.5	87.5	$40	$30	$35	$35	$10 per %
10	89.5	90.2	89.5	88.5	$40	$35	$40	$35	$10 per %
15	89.5	90.2	91.0	89.5	$55	$40	$50	$55	$15 per %
20	90.2	91.0	91.0	90.2	$60	$55	$60	$40	$20 per %
25	90.2	91.7	91.7	91.0	$70	$65	$55	$60	$20 per %
30	91.0	92.4	92.4	91.0	$70	$75	$70	$65	$25 per %
40	91.0	93.0	93.0	91.7	$95	$85	$90	$70	$35 per %
50	91.7	93.0	93.0	92.4	$95	$95	$100	$95	$40 per %
60	92.4	93.6	93.6	93.0	$120	$105	$110	$130	$40 per %
75	93.6	93.6	94.1	93.0	$105	$85	$105	$90	$45 per %
100	93.6	94.1	94.1	93.0	$125	$125	$115	$120	$55 per %
125	93.6	94.1	94.5	93.6	$155	$175	$185	$120	$110 per %
150	93.6	94.5	95.0	93.6	$230	$230	$295	$255	$135 per %
200	93.6	94.5	95.0	94.5	$335	$335	$420	$465	$210 per %

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Huachuca, Arizona Region No. 4 Project No.
Project Title: ECIP Facility Energy Improvements Fiscal Year FY96
Discrete Portion: Energy Efficient Motor Retrofits Preparer: KELLER & GANNON

Analysis Date: January 1995 Economic Life: 20 Years

1. Investment Costs		$3,810.77	
A. Construction Costs	$22,615		
B. SIOH	$1,357		
C. Design Cost	$1,357		
D. Total Cost (1A+1B+1C)	$25,329		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$1,778	
G. Total Investment (1D-1E-1F)			$23,551

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	269.0		$3,811	15.08	$57,466
B. Dist		0		$0		$0
C. Demand (9mos)	$95.88	3.501	kW	$336	15.08	$5,062
D. Demand (6 mos	$63.92	2.969	kW	$190	15.08	$2,862
E. Demand(12 mos	$127.84	6.743	kW	$862	15.08	$12,999
F. Total				$5,198		$78,390

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. First Year Dollar Savings (2F3 + 3A +)3Bd1/Economic Life)):	$5,198	
5. Simple Payback (1G/4):	4.53	Years
6. Total Net Discounted Savings (2F5+3C):	$78,390	
7. Savings to Investment Ratio (SIR) 6/1G:	3.33	

EEAP Energy Savings Opportunity Survey
Fort Huachuca, Arizona

Work Request 4

Lighting Fixture and Control Retrofits

WORK REQUEST (IFS-M)

(For use of this form, see AR 420-17 and DA PAM 420-6; the proponent agency is USACE.)

PART A *(See Instructions)*	CUSTOMER ID CODE	DOCUMENT SERIAL NUMBER	FY	TYPE	SHORT JOB DESCRIPTION	DATE DA	DATE MON	DATE YR
	FEE		5	P	LIGHT FIXTURE&CONTROL CHANGES			

INSTALLATION ABBREVIATION OF FACILITIES	BUILDING / FACILITY NUMBERS 1	2	3	4	5	6	7	8	9	10
1	HUA	15544	20200	22422	43002	53015	63015	74286	17016	27047	70525
2	HUA	80305	80505	90312	90507	90508	91114				
3											

REMARKS: **This Work Request is a result of the EEAP, ESOS conducted by Keller & Gannon under Contract DACA05-C-92-0155. Economic analysis results are: $42,996 energy and $ 4,105 O&M annual cost savings; Total Cost of $287,695 less TEP Co. rebate of $36,359; SIR = 2.25; Payback Period = 5.34 years.**

INSTALLATION NAME:	CUSTOMER NAME	POC NAME	POC PHONE NUMBER
FORT HUACHUCA, ARIZONA	Directorate of Engineering and Housing	WILLIAM J STEIN	602 533-1861

WORK DESCRIPTION (*Description of work requested*): **Perform the following lighting fixture and lighting system control modifications; see attached information for details:**

A.	108 EA	Exit Fixture LED Retrofit	F1.	20 EA	Electr. Blsts & T8 Lmps - 2 Lmp F96T12 Fxtrs	G5.	28 EA	TRI 23W Comp. Fluor. Lamp Replacements
B2.	124 EA	Electronic Ballasts & T8 Lamps - 2 Lamp F30T12 Fxtrs	F2.	1 EA	Electr. Blsts & T8 Lmps - 4 Lmp F96T12 Fxtrs	H1.	249 EA	17W Comp. Fluor. Lamps for Table Lamps
D1.	120 EA	Electr. Blsts & T8 Lmps - 1 Lmp F34T12 & F40T12 Fxtrs	G1.	2 EA	DTT 13W Comp. Fluor. Lamps for Downlights	J1.	33 EA	150W HPS Lamps & Blsts for 250W MV Fxtrs
D2.	1401EA	Electr. Blsts & T8 Lmps - 2 Lmp F34T12 & F40T12 Fxtrs	G2.	24 EA	TRI 20W Comp. Fluor. Lamp Replacements	J2.	54 EA	200W HPS Lamps & Blsts for 400W MV Fxtrs
D5.	671 EA	Reflector, DeLmp 4 to 3 Lmps w/ Electr. Blsts & T8 Lmps	G3.	71 EA	TT 7W Comp. Fluor. Lamp Replacements	K1.	239 EA	Ceiling Mounted PIR Sensors to Control Lights
E1.	48 EA	Electronic Ballasts - 2 Lamp F48T12HO Fxtrs	G4.	45 EA	DTT 13W Comp. Fluor. Lamps for Ceiling Fxtr	K3.	162 EA	Wall Switch Type PIR Sensors to Control Lights

AUTHORIZED REQUESTOR (Type or Print) _____ *SIGNATURE* _____

PART B *(Approving Official Only)*

APPROVAL ACTION CODE: ☐

WORK REQUEST PRIORITY: ☐☐☐

PROGRAM INDICATOR CODE: ☐☐

SPECIAL INTEREST CODE: ☐☐☐☐☐☐

ESTIMATED WORK START DATE: DA MON YR

ESTIMATED WORK COMPLETION DATE: DA MON YR

ENVIRONMENTAL IMPACT

YES	NO	
☐	☐	ENVIRONMENTAL CONSIDERATION
☐	☐	EIS / EIA INITIATED
☐	☐	EIS / EIA COMPLETED

WORK TO BE PERFORMED

- ☐ IN-HOUSE
- ☐ SELF-HELP
- ☐ CONTRACT
- ☐ TROOP

WORKCLASS

APPROVAL AMOUNTS

	FUNDED	UNFUNDED
☐	$	$
☐	$	$
☐	$	$
TOTAL	$	$

SOURCE OF FUNDS

- ☐ DIRECT
- ☐ AUTOMATIC REIMBURSEMENT
- ☐ FUNDED REIMBURSEMENT

OTHER FUND CITATION

DESIGN APPROVAL	DATE DA	DATE MON	DATE YR	APPROVAL AUTHORITY	APPROVAL ACTION	DATE DA	DATE MON	DATE YR
(Please type or print name)				*(Please type or print name)*	☐ APPROVED			
(Signature)				*(Signature)*	☐ DISAPPROVED			

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Lighting Fixture & Control Retrofits

Two types of energy saving retrofits are included in this project:

- Lighting fixture modifications
- Lighting controls modifications

Specific retrofits included in this project are listed below. Evaluations for these retrofits are summarized on Table 1.

Lighting Fixture and Control Retrofits

Proj.	Description	Type	Table
A	Exit Fixture LED Retrofit	Fixture	Table 2
B2	Install Electronic Ballasts and T8 Lamps - 2 Lamp F30T12 Fixtures	Fixture	Table 3
D1	Install Electronic Ballasts and T8 Lamps - 1 Lamp F34T12 & F40T12 Fixtures	Fixture	Table 4
D2	Install Electronic Ballasts and T8 Lamps - 2 Lamp F34T12 & F40T12 Fixtures	Fixture	Table 5
D5	Install Reflector and Delamp 4 Lamp Fixtures to 3 Lamps with Electronic Ballasts and T8 Lamps	Fixture	Table 6
E1	Install Electronic Ballasts - 2 Lamp F48T12HO Fixtures	Fixture	Table 7
F1	Install Electronic Ballasts and T8 Lamps - 2 Lamp F96T12 Fixtures	Fixture	Table 8
F2	Install Electronic Ballasts and T8 Lamps - 4 Lamp F96T12 Fixtures	Fixture	Table 9
G1	Install DTT 13W Compact Fluorescent Lamps for Downlight Incandescents	Fixture	Table 10
G2	Install TRI 20W Compact Fluorescent Lamps to Replace Incandescents	Fixture	Table 11
G3	Install TT 7W Compact Fluorescent Lamps to Replace Incandescents	Fixture	Table 12
G4	Install DTT 13W Compact Fluorescent Lamps for Ceiling Incandescents	Fixture	Table 13
G5	Install TRI 23W Compact Fluorescent Lamps to Replace Incandescents	Fixture	Table 14
H1	Install 17W Compact Fluorescent Lamps for Incandescent Table Lamps	Fixture	Table 15
J1	Install 150W HPS Lamps and Ballasts to Replace 250W MV Lamps	Fixture	Table 16
J2	Install 200W HPS Lamps and Ballasts to Replace 400W MV Lamps	Fixture	Table 17
K1	Install Ceiling Mounted PIR Occupancy Sensors to Control Lights	Control	Table 18
K3	Install Wall Switch Type PIR Occupancy Sensors to Control Lights	Control	Table 19

Results of economic evaluations are summarized on Table 1. Calculations for each retrofit included in this project appear on Tables 2 through 19. Detailed cost estimates, Life Cycle Cost Analysis summary sheets and catalog data for selected components are appended. Lighting and control retrofit evaluations which resulted in SIR's below 1.0 are not listed here. Refer to Appendix H of the EEAP, ESOS for Fort Huachuca, prepared under Contract No. DACA05-C-92-0155 for information on energy saving opportunities evaluated but not recommended.

Fixture Retrofit Evaluations

Lighting fixture modifications are considered. Most existing fluorescent fixtures use 40-watt T12 fluorescent lamps and standard ballasts. (Some energy saving 34-watt lamps and energy saving ballasts are installed, as are some F32T8 lamps, but they do not predominate.) Room-by-room calculations for fixture modifications included in this project appear as Tables H-2 through H-19.

Retrofit A involves the replacement of existing incandescent lamps in exit signs with light emitting diode (LED) lamp kits.

Retrofits B, D, E and F are one-for-one lamp and/or ballast replacements in existing fixtures. Retrofitting existing one-lamp fluorescent fixtures with electronic ballasts and 32-watt T8 lamps will reduce fixture input power by about 19 watts if standard core and coil ballasts are installed.

Project D5 involves installing a reflector and delamping existing 4-lamp fluorescent fixtures to three F32T8 lamps with electronic ballast.

Retrofits G and H are for replacing existing incandescent lamps in various fixtures with compact fluorescent lamps and ballasts. Retrofits are developed assuming the use of fluorescent retrofit lamps with standard screw-in bases. Acceptable substitute products are available for installation into standard screw-in bases which, when screwed-in, deform the existing base such that, thereafter, they are useable only for compatible compact fluorescent lamps. Costs are roughly equivalent.

Retrofits J involve the replacement of existing mercury vapor lamps with high pressure sodium lamps and ballasts.

Pricing shown on the attached unit cost estimates are taken, in large part, from the February 1994 issue of "Defense General Supply Center - Energy Efficient Lighting Catalog". Components are available at prices listed in this document to DoD agencies; it is assumed that contractor pricing would be similar.

Energy savings and economic analysis calculations for proposed fixture retrofits use the following procedures:

Lighting Retrofit Evaluation Calculations

Label	Contents / Calculation Explanation
RET_TYP	Retrofit type (See schedule above)
KW_SVD	E_KW) ¾ (S_KW) = Demand savings (kW) (Difference in "Watts per Fixture" values in Tables 20 and 21 (See note below)
KWH_SV	KW_SVD * HR/WK * 52 * Demand Factor = = Electric savings from retrofit Usage Schedule (HR/WK) and Demand Schedule are provided in Appendix G of the EEAP, ESOS for Fort Huachuca.
DEM_$/Y	KW_SVD * $127.84 per kW-Year = = Annual electric demand cost savings (TEP power demand charge including Taxes)
USE_$/Y	KWH_SVD * $0.04835 = Annual electric power cost savings (TEP power use charge including Taxes)
PWR_LCC$	[DEM_$/Y + USE_$/Y] * 12.02 = Life cycle savings, Life of 15 years; Uniform Present Value (UPV)
O&M_$/Y	[Table 20 $/1000 LAMP-Hr - Table 21 $/1000 LAMP-Hr] * HR/WK * 52 * * No. FXTRS * NO. LAMPS / 1000 = Annual O&M savings (additional cost) for lamp replacements; refer to Tables 20 and 21
O&M_LCC$	(O&M_$/Y * 11.94) = Life cycle O&M cost for Life of 15 years; UPV factor
TOT_$/Y	(DEM_$/Y + USE_$/Y + O&M_$/Y) = Total annual cost savings
TOT_LCC$	(O&M_LCC$ + PWR_LCC$) = Total life cycle cost savings
CONST$	Retrofit Unit Cost * NO. FIXTURES =Construction cost from retrofit unit cost estimates, attached
SIOH	CONST$ * 0.120 = SIOH and design at 6% each of construction cost
REBATE	REBATE = Tucson Electric Power rebates for lighting lamp and/or fluorescent electronic ballast and HPS fixture retrofits (See schedule in Appendix B)
INVE$T	CONST$ + SI0H Ä REBATE = Total investment per ECIP guidance
SIR	(TOT_LCC$) / (INVE$T) = Savings-to-investment ratio
PAYBCK	(INVE$T) / (TOT_$/Y) = Payback period (years)
Note: Parameters shown above for existing and retrofit (savings) cases are indicated by prefixes: "E_" and "S_", respectively, corresponding to labels used above to explain lighting energy use calculations. Refer to Tables 20 and 21 for existing and proposed retrofit energy use and O&M costs.	

Controls Retrofits

Lighting control retrofits included involve installing occupancy sensor switching in offices, conference rooms, and other areas where lights are normally turned on for periods when no one is present. Two types of occupancy sensors are considered. A wall switch type passive infrared (PIR) sensor is evaluated as Retrofit K3. This is the least expensive control retrofit investigated and simply replaces a small office's toggle switch. For larger offices and open areas, ceiling mounted sensors are evaluated. Ceiling mounted switches are more expensive since a relay and additional wiring are required.

Retrofit K1 proposes ceiling-mounted PIR sensors for rooms with more than 6 fixtures, it is assumed that up to 12 fixtures may be controlled by each sensor installation

Detailed evaluations appear as Tables 18 and 19.

Energy savings of at least 25% have been achieved in many similar retrofits according to Arizona Public Service Company. This savings lis assumed here. This figure may be low for many offices observed during field investigations. In several buildings, many offices and other rooms were observed to be unoccupied at least 50% of the time (with lights left on). Manufacturers of occupancy sensor switches report savings of between 35% and 75% depending on the application.

Energy and cost savings are determined using the same formulae as are shown above for lighting energy use calculations. The operating hours per week are simply factored down.

Table 1. Summary of Lighting and Controls Retrofit Evaluations

Lighting ECO Number	Description	Number Retrofit Units	Demand Saved (kW)	Energy Saved (kWH/Year)	Total LCC Cost Saved ($)	ECO Investment ($)	SIR	Payback (Years)
A	Exit Fixture LED Retrofit	108	1.97	17,171	$11,025	$5,438	2.03	5.94
B2	Install Electronic Ballasts and T8 Lamps - 2 Lamp F30T12 Fixtures	124	3.72	8,124	$11,682	$5,502	2.12	5.66
D1	Install Electronic Ballasts and T8 Lamps - 1 Lamp F34T12 & F40T12 Fixtures	120	1.72	9,066	$6,286	$5,217	1.20	9.99
D2	Install Electronic Ballasts and T8 Lamps - 2 Lamp F34T12 & F40T12 Fixtures	1,401	30.03	107,700	$108,164	$67,229	1.61	7.47
D5	Install Reflector and Delamp 4 Lamp Fixtures to 3 Lamps with Electronic Ballasts and T8	671	49.34	144,543	$165,753	$43,531	3.81	3.16
E1	Install Electronic Ballasts - 2 Lamp F48T12HO Fixtures	48	1.58	5,491	$5,625	$2,107	2.67	4.50
F1	Install Electronic Ballasts and T8 Lamps - 2 Lamp F96T12 Fixtures	20	0.80	1,872	$1,932	$1,822	1.06	11.35
F2	Install Electronic Ballasts and T8 Lamps - 4 Lamp F96T12 Fixtures	1	0.08	166	$187	$182	1.03	11.73
G1	Install DTT 13W Compact Flourescent Lamps for Downlight Incandescents	2	0.09	139	$306	$37	8.36	1.44
G2	Install TRI 20W Compact Flourescent Lamps to Replace Incandescents	24	2.37	4,547	$9,598	$62	153.60	0.08
G3	Install TT 7W Compact Flourescent Lamps to Replace Incandescents	71	2.36	4,488	$9,175	$1,166	7.87	1.52
G4	Install DTT 13W Compact Flourescent Lamps for Ceiling Incandescents	45	2.06	3,786	$7,117	$876	8.12	1.48
G5	Install TRI 23W Compact Flourescent Lamps to Replace Incandescents	28	2.31	4,965	$5,386	$894	6.02	2.00
H1	Install 17W Compact Fluorescent Lamps for Incandescent Table Lamps	249	10.71	23,384	$41,911	$4,876	8.60	1.40

Table 1. Summary of Lighting and Controls Retrofit Evaluations

Lighting ECO Number	Description	Number Retrofit Units	Demand Saved (kW)	Energy Saved (kWH/Year)	Total LCC Cost Saved ($)	ECO Investment ($)	SIR	Payback (Years)
J1	Install 150W HPS Lamps and Ballasts to Replace 250W MV Lamps	33	3.20	5,448	$8,724	$6,568	1.33	9.05
J2	Install 200W HPS Lamps and Ballasts to Replace 400W MV Lamps	54	11.29	23,475	$32,880	$8,387	3.92	3.06
K1	Install Ceiling Mounted PIR Occupancy Sensors to Control Lights	239	0.00	162,912	$114,686	$79,611	1.44	8.33
K3	Install Wall Switch Type PIR Occupancy Sensors to Control Lights	162	0.00	35,138	$25,393	$17,829	1.42	8.43
Total Successful Lighting Fixture and Controls Retrofits		**3,400**	**123.62**	**562,417**	**$565,829**	**$251,336**	**2.25**	**5.34**

Table 2. Lighting Retrofit A: Exit Light LED Retrofit

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
15544	111	3	0.055	477	$27	$151	$25	$306
43002	1 A	3	0.055	477	$27	$151	$25	$306
43002	1st Floor	2	0.036	318	$18	$101	$17	$204
43002	2 C	2	0.036	318	$18	$101	$17	$204
43002	Basement	1	0.018	159	$9	$50	$8	$102
53301	103	2	0.036	318	$18	$101	$17	$204
53301	202	4	0.073	636	$36	$201	$34	$408
53301	217	2	0.036	318	$18	$101	$17	$204
53301	ENTRY	3	0.055	477	$27	$151	$25	$306
53301	STAIR	2	0.036	318	$18	$101	$17	$204
53301	STAIR	2	0.036	318	$18	$101	$17	$204
56301	Exit Signs	10	0.182	1,590	$90	$503	$85	$1,021
57428	-	15	0.273	2,385	$135	$755	$127	$1,531
61701	Corridor	1	0.018	159	$9	$50	$8	$102
61701	Corridor	5	0.091	795	$45	$252	$42	$510
61701	Main Corridor	1	0.018	159	$9	$50	$8	$102
61701	Pool	1	0.018	159	$9	$50	$8	$102
61701	Pool Lobby	1	0.018	159	$9	$50	$8	$102
62704	-	17	0.309	2,703	$153	$856	$144	$1,735
70525	Dining	1	0.018	159	$9	$50	$8	$102
70525	Dining	3	0.055	477	$27	$151	$25	$306
70525	Kitchen	1	0.018	159	$9	$50	$8	$102
70525	Kitchen	2	0.036	318	$18	$101	$17	$204
80305	101	1	0.018	159	$9	$50	$8	$102
80305	102	1	0.018	159	$9	$50	$8	$102
80305	105	1	0.018	159	$9	$50	$8	$102
80305	107	1	0.018	159	$9	$50	$8	$102
80305	108	2	0.036	318	$18	$101	$17	$204
80305	116	2	0.036	318	$18	$101	$17	$204
80305	177	2	0.036	318	$18	$101	$17	$204
80305	212	2	0.036	318	$18	$101	$17	$204
80305	213	2	0.036	318	$18	$101	$17	$204
80305	312	2	0.036	318	$18	$101	$17	$204
80305	313	2	0.036	318	$18	$101	$17	$204
80305	OR	1	0.018	159	$9	$50	$8	$102
91114	1st E Battery Shop	1	0.018	159	$9	$50	$8	$102
91114	1st E Stairs	1	0.018	159	$9	$50	$8	$102
91114	1st Hangar	2	0.036	318	$18	$101	$17	$204
91114	1st W Stairs	1	0.018	159	$9	$50	$8	$102
Totals for Retrofit Type A:		**108**	**1.966**	**17,171**	**$972**	**$5,438**	**$916**	**$11,025**
					SIR	**2.03**	**Payback**	**5.94**

Table 3. Lighting Retrofit B2 F30T12, 2 Lamp Fixtures: Replace Existing Lamps and Ballasts

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
80305	117	1	0.030	66	$10	$44	$8	$94
80305	119	1	0.030	66	$10	$44	$8	$94
80305	120	1	0.030	66	$10	$44	$8	$94
80305	122	1	0.030	66	$10	$44	$8	$94
80305	123	1	0.030	66	$10	$44	$8	$94
80305	125	1	0.030	66	$10	$44	$8	$94
80305	126	1	0.030	66	$10	$44	$8	$94
80305	128	1	0.030	66	$10	$44	$8	$94
80305	130	1	0.030	66	$10	$44	$8	$94
80305	131	1	0.030	66	$10	$44	$8	$94
80305	132	1	0.030	66	$10	$44	$8	$94
80305	134	1	0.030	66	$10	$44	$8	$94
80305	135	1	0.030	66	$10	$44	$8	$94
80305	137	1	0.030	66	$10	$44	$8	$94
80305	138	1	0.030	66	$10	$44	$8	$94
80305	140	1	0.030	66	$10	$44	$8	$94
80305	141	1	0.030	66	$10	$44	$8	$94
80305	143	1	0.030	66	$10	$44	$8	$94
80305	144	1	0.030	66	$10	$44	$8	$94
80305	146	1	0.030	66	$10	$44	$8	$94
80305	147	1	0.030	66	$10	$44	$8	$94
80305	148	1	0.030	66	$10	$44	$8	$94
80305	150	1	0.030	66	$10	$44	$8	$94
80305	151	1	0.030	66	$10	$44	$8	$94
80305	153	1	0.030	66	$10	$44	$8	$94
80305	155	1	0.030	66	$10	$44	$8	$94
80305	156	1	0.030	66	$10	$44	$8	$94
80305	158	1	0.030	66	$10	$44	$8	$94
80305	159	1	0.030	66	$10	$44	$8	$94
80305	160	1	0.030	66	$10	$44	$8	$94
80305	162	1	0.030	66	$10	$44	$8	$94
80305	164	1	0.030	66	$10	$44	$8	$94
80305	165	1	0.030	66	$10	$44	$8	$94
80305	167	1	0.030	66	$10	$44	$8	$94
80305	168	1	0.030	66	$10	$44	$8	$94
80305	170	1	0.030	66	$10	$44	$8	$94
80305	171	1	0.030	66	$10	$44	$8	$94
80305	173	1	0.030	66	$10	$44	$8	$94
80305	174	1	0.030	66	$10	$44	$8	$94
80305	176	1	0.030	66	$10	$44	$8	$94
80305	208	1	0.030	66	$10	$44	$8	$94
80305	210	1	0.030	66	$10	$44	$8	$94
80305	214	1	0.030	66	$10	$44	$8	$94
80305	216	1	0.030	66	$10	$44	$8	$94
80305	219	1	0.030	66	$10	$44	$8	$94
80305	219.1	1	0.030	66	$10	$44	$8	$94
80305	220	1	0.030	66	$10	$44	$8	$94
80305	222	1	0.030	66	$10	$44	$8	$94
80305	223	1	0.030	66	$10	$44	$8	$94
80305	225	1	0.030	66	$10	$44	$8	$94
80305	226	1	0.030	66	$10	$44	$8	$94
80305	228	1	0.030	66	$10	$44	$8	$94
80305	229	1	0.030	66	$10	$44	$8	$94
80305	231	1	0.030	66	$10	$44	$8	$94
80305	232	1	0.030	66	$10	$44	$8	$94
80305	234	1	0.030	66	$10	$44	$8	$94
80305	235	1	0.030	66	$10	$44	$8	$94
80305	237	1	0.030	66	$10	$44	$8	$94
80305	238	1	0.030	66	$10	$44	$8	$94
80305	240	1	0.030	66	$10	$44	$8	$94
80305	241	1	0.030	66	$10	$44	$8	$94
80305	243	1	0.030	66	$10	$44	$8	$94
80305	244	1	0.030	66	$10	$44	$8	$94

Table 3. Lighting Retrofit B2 F30T12, 2 Lamp Fixtures: Replace Existing Lamps and Ballasts

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
80305	246	1	0.030	66	$10	$44	$8	$94
80305	247	1	0.030	66	$10	$44	$8	$94
80305	249	1	0.030	66	$10	$44	$8	$94
80305	250	1	0.030	66	$10	$44	$8	$94
80305	252	1	0.030	66	$10	$44	$8	$94
80305	253	1	0.030	66	$10	$44	$8	$94
80305	255	1	0.030	66	$10	$44	$8	$94
80305	256	1	0.030	66	$10	$44	$8	$94
80305	258	1	0.030	66	$10	$44	$8	$94
80305	259	1	0.030	66	$10	$44	$8	$94
80305	261	1	0.030	66	$10	$44	$8	$94
80305	264	1	0.030	66	$10	$44	$8	$94
80305	264.1	1	0.030	66	$10	$44	$8	$94
80305	265	1	0.030	66	$10	$44	$8	$94
80305	267	1	0.030	66	$10	$44	$8	$94
80305	268	1	0.030	66	$10	$44	$8	$94
80305	270	1	0.030	66	$10	$44	$8	$94
80305	271	1	0.030	66	$10	$44	$8	$94
80305	273	1	0.030	66	$10	$44	$8	$94
80305	308	1	0.030	66	$10	$44	$8	$94
80305	310	1	0.030	66	$10	$44	$8	$94
80305	314	1	0.030	66	$10	$44	$8	$94
80305	316	1	0.030	66	$10	$44	$8	$94
80305	319	1	0.030	66	$10	$44	$8	$94
80305	319.1	1	0.030	66	$10	$44	$8	$94
80305	320	1	0.030	66	$10	$44	$8	$94
80305	322	1	0.030	66	$10	$44	$8	$94
80305	323	1	0.030	66	$10	$44	$8	$94
80305	325	1	0.030	66	$10	$44	$8	$94
80305	326	1	0.030	66	$10	$44	$8	$94
80305	328	1	0.030	66	$10	$44	$8	$94
80305	329	1	0.030	66	$10	$44	$8	$94
80305	331	1	0.030	66	$10	$44	$8	$94
80305	332	1	0.030	66	$10	$44	$8	$94
80305	334	1	0.030	66	$10	$44	$8	$94
80305	335	1	0.030	66	$10	$44	$8	$94
80305	337	1	0.030	66	$10	$44	$8	$94
80305	338	1	0.030	66	$10	$44	$8	$94
80305	340	1	0.030	66	$10	$44	$8	$94
80305	341	1	0.030	66	$10	$44	$8	$94
80305	343	1	0.030	66	$10	$44	$8	$94
80305	344	1	0.030	66	$10	$44	$8	$94
80305	346	1	0.030	66	$10	$44	$8	$94
80305	347	1	0.030	66	$10	$44	$8	$94
80305	349	1	0.030	66	$10	$44	$8	$94
80305	350	1	0.030	66	$10	$44	$8	$94
80305	352	1	0.030	66	$10	$44	$8	$94
80305	353	1	0.030	66	$10	$44	$8	$94
80305	355	1	0.030	66	$10	$44	$8	$94
80305	356	1	0.030	66	$10	$44	$8	$94
80305	358	1	0.030	66	$10	$44	$8	$94
80305	359	1	0.030	66	$10	$44	$8	$94
80305	361	1	0.030	66	$10	$44	$8	$94
80305	364	1	0.030	66	$10	$44	$8	$94
80305	364.1	1	0.030	66	$10	$44	$8	$94
80305	365	1	0.030	66	$10	$44	$8	$94
80305	367	1	0.030	66	$10	$44	$8	$94
80305	368	1	0.030	66	$10	$44	$8	$94
80305	370	1	0.030	66	$10	$44	$8	$94
80305	371	1	0.030	66	$10	$44	$8	$94
80305	373	1	0.030	66	$10	$44	$8	$94
Totals for Retrofit Typ		**124**	**3.720**	**8,124**	**$1,240**	**$5,502**	**$973**	**$11,682**
					SIR	**2.12**	**Payback**	**5.66**

Table 4. Lighting Retrofit D1 F34T12 and F40T12, 1 Lamp Fixtures: Replace Lamps and Ballasts

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
22422	Basement	1	0.019	30	$9	$43	$4	$46
22422	Basement	1	0.019	30	$9	$43	$7	$85
43002	1st Floor	9	0.171	267	$81	$391	$28	$342
43002	1st Floor	3	0.057	178	$27	$130	$14	$171
53301	114	1	0.012	25	$9	$43	$6	$73
53301	115	3	0.036	150	$27	$130	$13	$157
53301	115	3	0.036	150	$27	$130	$13	$157
53301	203	10	0.120	1,048	$90	$435	$39	$474
53301	203	6	0.072	300	$54	$261	$21	$252
53301	211	5	0.060	524	$45	$217	$21	$254
53301	214	6	0.072	300	$54	$261	$21	$252
53301	214	1	0.012	25	$9	$43	$8	$101
53301	ENTRY	11	0.132	1,153	$99	$478	$46	$555
53301	STAIR	7	0.084	734	$63	$304	$27	$331
53301	STAIR	7	0.084	734	$63	$304	$27	$331
53301	STAIR	10	0.120	1,048	$90	$435	$45	$540
53301	STAIR	10	0.120	1,048	$90	$435	$40	$477
57428	112	4	0.076	316	$36	$174	$25	$300
57428	117	1	0.019	79	$9	$43	$9	$106
57428	127	1	0.019	166	$9	$43	$14	$163
61701	Area	12	0.228	474	$108	$522	$48	$578
61701	Locker Rooms	6	0.114	237	$54	$261	$27	$328
80305	112	1	0.019	10	$9	$43	$7	$89
80305	307	1	0.019	41	$9	$43	$10	$121
Totals for Retrofit Type D1:		**120**	**1.720**	**9,066**	**$1,080**	**$5,217**	**$522**	**$6,286**
					SIR	**1.20**	**Payback**	**9.99**

Table 5. Lighting Retrofit D2 F34T12 and F40T12, 2 Lamp Fixtures: Replace Lamps and Ballasts

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
15544	107	6	0.150	1,310	$60	$288	$82	$387
20200	Kitchen	1	0.025	27	$10	$48	$4	$54
22422	101	4	0.100	250	$40	$192	$25	$298
22422	102	4	0.100	250	$40	$192	$25	$298
22422	103	2	0.050	125	$20	$96	$12	$149
22422	104	2	0.050	125	$20	$96	$12	$149
22422	107	4	0.100	250	$40	$192	$25	$298
22422	108	8	0.200	499	$80	$384	$50	$595
22422	109	2	0.050	125	$20	$96	$12	$149
22422	110	2	0.050	125	$20	$96	$12	$149
22422	111	15	0.375	936	$150	$720	$93	$1,116
22422	112	2	0.050	125	$20	$96	$12	$149
22422	113	2	0.050	125	$20	$96	$12	$149
22422	114	2	0.050	125	$20	$96	$12	$149
22422	115	2	0.050	125	$20	$96	$12	$149
22422	116	10	0.250	624	$100	$480	$62	$744
22422	201	4	0.100	250	$40	$192	$25	$298
22422	202	4	0.100	250	$40	$192	$25	$298
22422	203	8	0.200	499	$80	$384	$50	$595
22422	204	2	0.050	125	$20	$96	$12	$149
22422	205	28	0.700	1,747	$280	$1,344	$173	$2,083
22422	206	2	0.050	125	$20	$96	$12	$149
22422	207	2	0.050	125	$20	$96	$12	$149
22422	208	4	0.100	250	$40	$192	$25	$298
22422	209	2	0.050	125	$20	$96	$12	$149
22422	210	2	0.050	125	$20	$96	$12	$149
22422	108A	4	0.100	250	$40	$192	$25	$298
22422	Basement	2	0.050	437	$20	$96	$27	$329
22422	Basement	2	0.050	78	$20	$96	$10	$122
22422	Basement	2	0.050	78	$20	$96	$10	$122
22422	Basement	1	0.025	13	$10	$48	$4	$46
22422	PS1	5	0.125	312	$50	$240	$31	$372
43002	1 D	2	0.050	125	$20	$96	$12	$149
43002	1 E	2	0.050	13	$20	$96	$7	$84
43002	1 F/G	3	0.075	187	$30	$144	$19	$223
43002	1 H	3	0.075	20	$30	$144	$11	$126
43002	1st Floor	8	0.200	1,248	$80	$384	$86	$1,028
43002	1st Floor	5	0.125	390	$50	$240	$35	$417
43002	1st Floor	1	0.025	62	$10	$48	$6	$74
43002	1st Floor	1	0.025	62	$10	$48	$6	$74
43002	1st Floor	2	0.050	125	$20	$96	$12	$149
43002	1st Floor	2	0.050	125	$20	$96	$12	$149
43002	1st Floor	2	0.050	125	$20	$96	$12	$149
43002	1st Floor	2	0.050	156	$20	$96	$14	$167
43002	1st Floor	2	0.050	156	$20	$96	$14	$167
43002	1st Floor	1	0.025	7	$10	$48	$4	$42
43002	2 Balcony A	8	0.200	52	$80	$384	$28	$337
43002	2 Balcony B	8	0.200	52	$80	$384	$28	$337
43002	2 C	6	0.150	374	$60	$288	$37	$446
43002	2 D	2	0.050	125	$20	$96	$12	$149
43002	2 E	1	0.025	156	$10	$48	$11	$128
43002	2 F	1	0.025	156	$10	$48	$11	$128
43002	Basement	1	0.025	156	$10	$48	$11	$128
43002	Basement	2	0.050	13	$20	$96	$7	$84
43002	Basement	2	0.050	125	$20	$96	$12	$149
53301	103	113	1.243	5,171	$1,130	$5,422	$405	$4,870
53301	109	5	0.055	114	$50	$240	$12	$149
53301	117	6	0.066	275	$60	$288	$22	$259
53301	119	29	0.319	1,327	$290	$1,392	$104	$1,250
53301	120	13	0.143	595	$130	$624	$47	$560
53301	124	31	0.341	1,419	$310	$1,488	$111	$1,336
53301	127	2	0.022	92	$20	$96	$7	$86
53301	128	8	0.088	366	$80	$384	$29	$345

Table 5. Lighting Retrofit D2 F34T12 and F40T12, 2 Lamp Fixtures: Replace Lamps and Ballasts

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
56301	114	4	0.044	165	$40	$192	$13	$162
56301	115	20	0.220	824	$200	$960	$67	$810
56301	116	4	0.044	165	$40	$192	$13	$162
56301	117	3	0.033	124	$30	$144	$10	$121
56301	118	16	0.176	659	$160	$768	$54	$648
56301	119	2	0.022	82	$20	$96	$7	$81
56301	120	4	0.044	165	$40	$192	$13	$162
56301	121	24	0.264	988	$240	$1,152	$81	$972
56301	122	2	0.022	82	$20	$96	$7	$81
56301	130	2	0.022	82	$20	$96	$7	$81
56301	147	3	0.033	124	$30	$144	$10	$121
56301	148	2	0.022	82	$20	$96	$7	$81
56301	130, Lab	12	0.132	494	$120	$576	$40	$486
56301	153A	8	0.088	329	$80	$384	$27	$324
56301	Conr	3	0.033	288	$30	$144	$18	$216
56301	Conr	5	0.055	480	$50	$240	$30	$360
56301	Conr 1	10	0.110	961	$100	$480	$60	$719
56301	Conr Cross	2	0.022	192	$20	$96	$12	$144
57428	102	2	0.050	104	$20	$96	$11	$136
57428	112	2	0.050	437	$20	$96	$27	$329
57428	112	2	0.050	437	$20	$96	$27	$329
57428	112	2	0.050	437	$20	$96	$27	$329
57428	112	3	0.075	655	$30	$144	$41	$494
57428	112	6	0.150	1,310	$60	$288	$82	$987
57428	210	2	0.050	437	$20	$96	$27	$329
61701	Corridor	1	0.025	130	$10	$48	$9	$113
61701	Corridor	2	0.050	260	$20	$96	$19	$227
61701	Corridor	2	0.050	260	$20	$96	$19	$227
61701	Corridor	3	0.075	390	$30	$144	$28	$340
61701	Corridor	4	0.100	520	$40	$192	$38	$454
61701	Corridor	9	0.225	1,170	$90	$432	$85	$1,021
61701	Locker Rooms	90	2.250	4,680	$900	$4,319	$512	$6,159
61701	Main Corridor	9	0.225	1,170	$90	$432	$85	$1,021
61701	Office	2	0.050	104	$20	$96	$11	$137
61701	Office	3	0.075	156	$30	$144	$17	$205
61701	Office	12	0.300	624	$120	$576	$68	$821
61701	Pool	12	0.300	624	$120	$576	$68	$821
61701	Pool Lobby	9	0.225	1,170	$90	$432	$85	$1,021
61701	Pool Office	2	0.050	104	$20	$96	$11	$137
61701	Supplies	4	0.100	52	$40	$192	$15	$184
61701	Toilet	3	0.075	156	$30	$144	$17	$205
61701	Toilet	3	0.075	156	$30	$144	$17	$205
62704	-	6	0.150	468	$60	$288	$42	$501
62704	-	4	0.100	234	$40	$192	$24	$288
62704	-	7	0.175	410	$70	$336	$42	$505
62704	W11	10	0.250	780	$100	$480	$69	$834
70525	Corridor	4	0.100	624	$40	$192	$43	$514
70525	Corridor	5	0.125	780	$50	$240	$53	$642
70525	Dishwash	1	0.025	78	$10	$48	$7	$83
70525	Office	2	0.050	156	$20	$96	$14	$166
70525	Offices	5	0.125	390	$50	$240	$35	$416
70525	Offices	10	0.250	780	$100	$480	$69	$832
70525	Offices	2	0.050	234	$20	$96	$18	$212
70525	Supply	1	0.025	78	$10	$48	$7	$83
70525	Toilet	2	0.050	234	$20	$96	$18	$212
70525	Whse	1	0.025	78	$10	$48	$7	$83
70525	Whse	4	0.100	312	$40	$192	$28	$333
80305	101	2	0.050	437	$20	$96	$27	$329
80305	102	2	0.050	437	$20	$96	$27	$329
80305	103	4	0.100	520	$40	$192	$38	$454
80305	104	3	0.075	390	$30	$144	$28	$340
80305	105	2	0.050	437	$20	$96	$27	$329
80305	107	1	0.025	218	$10	$48	$14	$165

Table 5. Lighting Retrofit D2 F34T12 and F40T12, 2 Lamp Fixtures: Replace Lamps and Ballasts

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
80305	108	4	0.100	874	$40	$192	$55	$658
80305	109	2	0.050	260	$20	$96	$19	$227
80305	110	1	0.025	62	$10	$48	$6	$74
80305	111	1	0.025	175	$10	$48	$12	$139
80305	113	1	0.025	26	$10	$48	$4	$53
80305	114	1	0.025	13	$10	$48	$4	$46
80305	115	2	0.050	52	$20	$96	$9	$107
80305	116	6	0.150	1,310	$60	$288	$82	$987
80305	116	1	0.025	55	$10	$48	$6	$70
80305	117	1	0.025	55	$10	$48	$6	$70
80305	119	1	0.025	55	$10	$48	$6	$70
80305	120	1	0.025	55	$10	$48	$6	$70
80305	121	1	0.025	55	$10	$48	$6	$70
80305	122	1	0.025	55	$10	$48	$6	$70
80305	123	1	0.025	55	$10	$48	$6	$70
80305	124	1	0.025	55	$10	$48	$6	$70
80305	125	1	0.025	55	$10	$48	$6	$70
80305	126	1	0.025	55	$10	$48	$6	$70
80305	127	1	0.025	55	$10	$48	$6	$70
80305	128	1	0.025	55	$10	$48	$6	$70
80305	130	1	0.025	55	$10	$48	$6	$70
80305	130	1	0.025	55	$10	$48	$6	$70
80305	131	1	0.025	55	$10	$48	$6	$70
80305	132	1	0.025	55	$10	$48	$6	$70
80305	133	1	0.025	55	$10	$48	$6	$70
80305	134	1	0.025	55	$10	$48	$6	$70
80305	135	1	0.025	55	$10	$48	$6	$70
80305	136	1	0.025	55	$10	$48	$6	$70
80305	137	1	0.025	55	$10	$48	$6	$70
80305	138	1	0.025	55	$10	$48	$6	$70
80305	139	1	0.025	55	$10	$48	$6	$70
80305	140	1	0.025	55	$10	$48	$6	$70
80305	141	1	0.025	55	$10	$48	$6	$70
80305	142	1	0.025	55	$10	$48	$6	$70
80305	143	1	0.025	55	$10	$48	$6	$70
80305	144	1	0.025	55	$10	$48	$6	$70
80305	145	1	0.025	55	$10	$48	$6	$70
80305	146	1	0.025	55	$10	$48	$6	$70
80305	147	1	0.025	55	$10	$48	$6	$70
80305	148	1	0.025	55	$10	$48	$6	$70
80305	148	1	0.025	55	$10	$48	$6	$70
80305	150	1	0.025	55	$10	$48	$6	$70
80305	151	1	0.025	55	$10	$48	$6	$70
80305	151	1	0.025	55	$10	$48	$6	$70
80305	153	1	0.025	55	$10	$48	$6	$70
80305	154	1	0.025	55	$10	$48	$6	$70
80305	155	1	0.025	55	$10	$48	$6	$70
80305	156	1	0.025	55	$10	$48	$6	$70
80305	157	1	0.025	55	$10	$48	$6	$70
80305	158	1	0.025	55	$10	$48	$6	$70
80305	159	1	0.025	55	$10	$48	$6	$70
80305	160	1	0.025	55	$10	$48	$6	$70
80305	160	1	0.025	55	$10	$48	$6	$70
80305	162	1	0.025	55	$10	$48	$6	$70
80305	163	1	0.025	55	$10	$48	$6	$70
80305	164	1	0.025	55	$10	$48	$6	$70
80305	165	1	0.025	55	$10	$48	$6	$70
80305	166	1	0.025	55	$10	$48	$6	$70
80305	167	1	0.025	55	$10	$48	$6	$70
80305	168	1	0.025	55	$10	$48	$6	$70
80305	169	1	0.025	55	$10	$48	$6	$70
80305	170	1	0.025	55	$10	$48	$6	$70
80305	171	1	0.025	55	$10	$48	$6	$70

Table 5. Lighting Retrofit D2 F34T12 and F40T12, 2 Lamp Fixtures: Replace Lamps and Ballasts

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
80305	172	1	0.025	55	$10	$48	$6	$70
80305	173	1	0.025	55	$10	$48	$6	$70
80305	174	1	0.025	55	$10	$48	$6	$70
80305	175	1	0.025	55	$10	$48	$6	$70
80305	176	1	0.025	55	$10	$48	$6	$70
80305	177	5	0.125	1,092	$50	$240	$68	$823
80305	200	1	0.025	218	$10	$48	$14	$165
80305	200	8	0.200	1,747	$80	$384	$109	$1,316
80305	201	2	0.050	125	$20	$96	$12	$149
80305	202	1	0.025	13	$10	$48	$4	$46
80305	203	4	0.100	520	$40	$192	$38	$454
80305	204	1	0.025	62	$10	$48	$6	$74
80305	205	3	0.075	655	$30	$144	$41	$494
80305	206	1	0.025	218	$10	$48	$14	$165
80305	206.1	1	0.025	218	$10	$48	$14	$165
80305	208	4	0.100	250	$40	$192	$25	$298
80305	208	1	0.025	55	$10	$48	$6	$70
80305	208	6	0.150	780	$60	$288	$57	$681
80305	210	1	0.025	55	$10	$48	$6	$70
80305	210	1	0.025	55	$10	$48	$6	$70
80305	212	6	0.150	1,310	$60	$288	$82	$987
80305	213	5	0.125	1,092	$50	$240	$68	$823
80305	214	1	0.025	55	$10	$48	$6	$70
80305	215	1	0.025	55	$10	$48	$6	$70
80305	216	1	0.025	55	$10	$48	$6	$70
80305	218	1	0.025	55	$10	$48	$6	$70
80305	219	1	0.025	55	$10	$48	$6	$70
80305	219.1	1	0.025	55	$10	$48	$6	$70
80305	220	1	0.025	55	$10	$48	$6	$70
80305	221	1	0.025	55	$10	$48	$6	$70
80305	222	1	0.025	55	$10	$48	$6	$70
80305	223	1	0.025	55	$10	$48	$6	$70
80305	224	1	0.025	55	$10	$48	$6	$70
80305	225	1	0.025	55	$10	$48	$6	$70
80305	226	1	0.025	55	$10	$48	$6	$70
80305	227	1	0.025	55	$10	$48	$6	$70
80305	228	1	0.025	55	$10	$48	$6	$70
80305	229	1	0.025	55	$10	$48	$6	$70
80305	230	1	0.025	55	$10	$48	$6	$70
80305	231	1	0.025	55	$10	$48	$6	$70
80305	232	1	0.025	55	$10	$48	$6	$70
80305	233	1	0.025	55	$10	$48	$6	$70
80305	234	1	0.025	55	$10	$48	$6	$70
80305	235	1	0.025	55	$10	$48	$6	$70
80305	236	1	0.025	55	$10	$48	$6	$70
80305	237	1	0.025	55	$10	$48	$6	$70
80305	238	1	0.025	55	$10	$48	$6	$70
80305	239	1	0.025	55	$10	$48	$6	$70
80305	240	1	0.025	55	$10	$48	$6	$70
80305	241	1	0.025	55	$10	$48	$6	$70
80305	242	1	0.025	55	$10	$48	$6	$70
80305	243	1	0.025	55	$10	$48	$6	$70
80305	244	1	0.025	55	$10	$48	$6	$70
80305	245	1	0.025	55	$10	$48	$6	$70
80305	246	1	0.025	55	$10	$48	$6	$70
80305	247	1	0.025	55	$10	$48	$6	$70
80305	248	1	0.025	55	$10	$48	$6	$70
80305	249	1	0.025	55	$10	$48	$6	$70
80305	250	1	0.025	55	$10	$48	$6	$70
80305	251	1	0.025	55	$10	$48	$6	$70
80305	252	1	0.025	55	$10	$48	$6	$70
80305	253	1	0.025	55	$10	$48	$6	$70
80305	254	1	0.025	55	$10	$48	$6	$70

Table 5. Lighting Retrofit D2 F34T12 and F40T12, 2 Lamp Fixtures: Replace Lamps and Ballasts

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
80305	255	1	0.025	55	$10	$48	$6	$70
80305	256	1	0.025	55	$10	$48	$6	$70
80305	257	1	0.025	55	$10	$48	$6	$70
80305	258	1	0.025	55	$10	$48	$6	$70
80305	259	1	0.025	55	$10	$48	$6	$70
80305	260	1	0.025	55	$10	$48	$6	$70
80305	261	1	0.025	55	$10	$48	$6	$70
80305	263	1	0.025	55	$10	$48	$6	$70
80305	264	1	0.025	55	$10	$48	$6	$70
80305	264.1	1	0.025	55	$10	$48	$6	$70
80305	265	1	0.025	55	$10	$48	$6	$70
80305	266	1	0.025	55	$10	$48	$6	$70
80305	267	1	0.025	55	$10	$48	$6	$70
80305	268	1	0.025	55	$10	$48	$6	$70
80305	269	1	0.025	55	$10	$48	$6	$70
80305	270	1	0.025	55	$10	$48	$6	$70
80305	271	1	0.025	55	$10	$48	$6	$70
80305	272	1	0.025	55	$10	$48	$6	$70
80305	273	1	0.025	55	$10	$48	$6	$70
80305	300	1	0.025	218	$10	$48	$14	$165
80305	300	8	0.200	1,747	$80	$384	$109	$1,316
80305	301	2	0.050	125	$20	$96	$12	$149
80305	302	1	0.025	13	$10	$48	$4	$46
80305	303	4	0.100	166	$40	$192	$21	$250
80305	303	4	0.100	520	$40	$192	$38	$454
80305	304	1	0.025	62	$10	$48	$6	$74
80305	305	3	0.075	655	$30	$144	$41	$494
80305	305	3	0.075	655	$30	$144	$41	$494
80305	306	1	0.025	218	$10	$48	$14	$165
80305	306.1	1	0.025	218	$10	$48	$14	$165
80305	308	4	0.100	250	$40	$192	$25	$298
80305	308	1	0.025	55	$10	$48	$6	$70
80305	310	1	0.025	55	$10	$48	$6	$70
80305	310	1	0.025	55	$10	$48	$6	$70
80305	312	6	0.150	1,310	$60	$288	$82	$987
80305	313	5	0.125	1,092	$50	$240	$68	$823
80305	314	1	0.025	55	$10	$48	$6	$70
80305	315	1	0.025	55	$10	$48	$6	$70
80305	316	1	0.025	55	$10	$48	$6	$70
80305	318	1	0.025	55	$10	$48	$6	$70
80305	319	1	0.025	55	$10	$48	$6	$70
80305	319.1	1	0.025	55	$10	$48	$6	$70
80305	320	1	0.025	55	$10	$48	$6	$70
80305	321	1	0.025	55	$10	$48	$6	$70
80305	322	1	0.025	55	$10	$48	$6	$70
80305	323	1	0.025	55	$10	$48	$6	$70
80305	324	1	0.025	55	$10	$48	$6	$70
80305	325	1	0.025	55	$10	$48	$6	$70
80305	326	1	0.025	55	$10	$48	$6	$70
80305	327	1	0.025	55	$10	$48	$6	$70
80305	328	1	0.025	55	$10	$48	$6	$70
80305	329	1	0.025	55	$10	$48	$6	$70
80305	330	1	0.025	55	$10	$48	$6	$70
80305	331	1	0.025	55	$10	$48	$6	$70
80305	332	1	0.025	55	$10	$48	$6	$70
80305	333	1	0.025	55	$10	$48	$6	$70
80305	334	1	0.025	55	$10	$48	$6	$70
80305	335	1	0.025	55	$10	$48	$6	$70
80305	336	1	0.025	55	$10	$48	$6	$70
80305	337	1	0.025	55	$10	$48	$6	$70
80305	338	1	0.025	55	$10	$48	$6	$70
80305	339	1	0.025	55	$10	$48	$6	$70
80305	340	1	0.025	55	$10	$48	$6	$70

Table 5. Lighting Retrofit D2 F34T12 and F40T12, 2 Lamp Fixtures: Replace Lamps and Ballasts

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
80305	341	1	0.025	55	$10	$48	$6	$70
80305	342	1	0.025	55	$10	$48	$6	$70
80305	343	1	0.025	55	$10	$48	$6	$70
80305	344	1	0.025	55	$10	$48	$6	$70
80305	345	1	0.025	55	$10	$48	$6	$70
80305	346	1	0.025	55	$10	$48	$6	$70
80305	347	1	0.025	55	$10	$48	$6	$70
80305	348	1	0.025	55	$10	$48	$6	$70
80305	349	1	0.025	55	$10	$48	$6	$70
80305	350	1	0.025	55	$10	$48	$6	$70
80305	351	1	0.025	55	$10	$48	$6	$70
80305	352	1	0.025	55	$10	$48	$6	$70
80305	353	1	0.025	55	$10	$48	$6	$70
80305	354	1	0.025	55	$10	$48	$6	$70
80305	355	1	0.025	55	$10	$48	$6	$70
80305	356	1	0.025	55	$10	$48	$6	$70
80305	357	1	0.025	55	$10	$48	$6	$70
80305	358	1	0.025	55	$10	$48	$6	$70
80305	359	1	0.025	55	$10	$48	$6	$70
80305	360	1	0.025	55	$10	$48	$6	$70
80305	361	1	0.025	55	$10	$48	$6	$70
80305	363	1	0.025	55	$10	$48	$6	$70
80305	364	1	0.025	55	$10	$48	$6	$70
80305	364.1	1	0.025	55	$10	$48	$6	$70
80305	365	1	0.025	55	$10	$48	$6	$70
80305	366	1	0.025	55	$10	$48	$6	$70
80305	367	1	0.025	55	$10	$48	$6	$70
80305	368	1	0.025	55	$10	$48	$6	$70
80305	369	1	0.025	55	$10	$48	$6	$70
80305	370	1	0.025	55	$10	$48	$6	$70
80305	371	1	0.025	55	$10	$48	$6	$70
80305	372	1	0.025	55	$10	$48	$6	$70
80305	373	1	0.025	55	$10	$48	$6	$70
80305	Entry	5	0.125	1,092	$50	$240	$68	$823
80305	Stairs A	6	0.150	1,310	$60	$288	$82	$987
80305	Stairs B	6	0.150	1,310	$60	$288	$82	$987
80305	Stairs C	6	0.150	1,310	$60	$288	$82	$987
80305	Vestibles	4	0.100	874	$40	$192	$55	$658
80505	118A	24	0.264	618	$240	$1,152	$63	$758
90312	Toilet	3	0.075	156	$30	$144	$17	$205
90312	Toilet	3	0.075	156	$30	$144	$17	$205
90507	Office	4	0.100	166	$40	$192	$21	$250
90507	Office	9	0.225	374	$90	$432	$47	$562
90507	Toilet	2	0.050	104	$20	$96	$11	$137
90507	Toilet	2	0.050	104	$20	$96	$11	$137
90508	508	10	0.250	65	$100	$480	$35	$421
91114	1st E Battery Shop	9	0.225	936	$90	$432	$74	$886
91114	1st E Office	9	0.225	749	$90	$432	$65	$777
91114	1st E Stairs	2	0.050	208	$20	$96	$16	$197
91114	1st W Inst. Shop	9	0.225	936	$90	$432	$74	$886
91114	1st W Mech. Shop	18	0.450	1,872	$180	$864	$147	$1,772
91114	1st W QC Library	3	0.075	156	$30	$144	$17	$205
91114	1st W QC Office	9	0.225	749	$90	$432	$65	$777
91114	1st W Seat Shop	9	0.225	936	$90	$432	$74	$886
91114	1st W Stairs	2	0.050	208	$20	$96	$16	$197
91114	1st W Stairs	2	0.050	208	$20	$96	$16	$197
91114	1st W Toilet	1	0.025	104	$10	$48	$8	$98
91114	1st W Toilet	1	0.025	104	$10	$48	$8	$98
91114	1st W Toilet	2	0.050	208	$20	$96	$16	$197
91114	1st W Weld. Shop	11	0.275	1,144	$110	$528	$90	$1,083
91114	2nd E Acet	6	0.150	499	$60	$288	$43	$518
91114	2nd E Admin	6	0.150	499	$60	$288	$43	$518
91114	2nd E Chief	9	0.225	749	$90	$432	$65	$777

Table 5. Lighting Retrofit D2 F34T12 and F40T12, 2 Lamp Fixtures: Replace Lamps and Ballasts

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
91114	2nd E GM	6	0.150	499	$60	$288	$43	$518
91114	2nd E Key Punch	6	0.150	499	$60	$288	$43	$518
91114	2nd E Office	3	0.075	250	$30	$144	$22	$259
91114	2nd E Office	6	0.150	499	$60	$288	$43	$518
91114	2nd E OP Mgr	6	0.150	499	$60	$288	$43	$518
91114	2nd E PLT	6	0.150	499	$60	$288	$43	$518
91114	2nd E QC	6	0.150	499	$60	$288	$43	$518
91114	2nd E Supply Admin	6	0.150	499	$60	$288	$43	$518
91114	2nd E Supply Spec	2	0.050	156	$20	$96	$14	$167
91114	2nd E Toilet	2	0.050	208	$20	$96	$16	$197
91114	2nd E Toilet	2	0.050	208	$20	$96	$16	$197
91114	2nd W Corridor	5	0.125	520	$50	$240	$41	$492
91114	2nd W Elec. Repair	10	0.250	832	$100	$480	$72	$864
91114	2nd W Elec. Repair	2	0.050	208	$20	$96	$16	$197
91114	2nd W Elec. Repair	7	0.175	728	$70	$336	$57	$689
91114	2nd W Elec. Repair	10	0.250	520	$100	$480	$57	$682
91114	2nd W Storage	19	0.475	988	$190	$912	$108	$1,297
Totals for Retrofit Type D2:		**1401**	**30.027**	**107,700**	**$14,010**	**$67,229**	**$8,998**	**$108,164**
					SIR	**1.61**	**Payback**	**7.47**

Table 6. Lighting Retrofit D5 F34T12 and F40T12, 4 Lamp Fixtures: Delamp to 3 F32T8 Lamps and Electronic Ballass with Reflectors

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
15544	103	16	1.284	3,615	$304	$1,038	$346	$4,160
15544	104	22	1.738	3,728	$418	$1,427	$416	$4,997
15544	105	34	2.686	5,761	$646	$2,206	$643	$7,723
15544	106	21	1.659	4,745	$399	$1,362	$454	$5,460
15544	107	38	3.002	8,586	$722	$2,465	$822	$9,879
15544	111	31	2.449	7,004	$589	$2,011	$671	$8,060
15544	113	28	2.212	6,326	$532	$1,817	$606	$7,280
15544	114	21	1.659	3,559	$399	$1,362	$397	$4,770
15544	103A	4	0.316	904	$76	$260	$87	$1,040
43002	1 D	4	0.316	789	$76	$260	$81	$976
43002	1st Floor	4	0.316	986	$76	$260	$91	$1,090
43002	1st Floor	8	0.632	1,972	$152	$519	$181	$2,181
43002	Basement	2	0.158	41	$38	$130	$23	$272
53301	202	122	6.222	25,884	$2,318	$7,915	$2,155	$25,896
53301	203	3	0.153	636	$57	$195	$53	$637
53301	204	3	0.153	636	$57	$195	$53	$637
53301	206	3	0.153	636	$57	$195	$53	$637
57428	130	31	2.449	10,188	$589	$2,011	$833	$10,012
57428	131	12	0.948	3,944	$228	$779	$323	$3,876
61701	Sports Admin.	1	0.079	164	$19	$65	$18	$222
62704	W10	14	1.106	2,588	$266	$908	$276	$3,315
62704	W11	14	1.106	2,588	$266	$908	$276	$3,315
62704	W2	14	1.106	2,588	$266	$908	$276	$3,315
62704	W3	18	1.422	3,327	$342	$1,168	$355	$4,262
62704	W4	2	0.158	493	$38	$130	$45	$545
62704	W4	14	1.106	2,588	$266	$908	$276	$3,315
62704	W5	14	1.106	2,588	$266	$908	$276	$3,315
62704	W6	14	1.106	2,588	$266	$908	$276	$3,315
62704	W7	14	1.106	2,588	$266	$908	$276	$3,315
62704	W8	14	1.106	2,588	$266	$908	$276	$3,315
62704	W9	14	1.106	2,588	$266	$908	$276	$3,315
62704		18	1.422	3,327	$342	$1,168	$355	$4,262
70525	Bar	6	0.474	1,479	$114	$389	$140	$1,683
70525	Dining	5	0.395	1,232	$95	$324	$117	$1,403
70525	Dishwash	1	0.079	370	$19	$65	$29	$352
70525	Dishwash	8	0.632	2,958	$152	$519	$234	$2,817
70525	Kitchen	30	2.370	11,092	$570	$1,946	$879	$10,565
70525	Serving	2	0.158	493	$38	$130	$47	$561
90312	Office	6	0.474	789	$114	$389	$101	$1,219
90312	Office	8	0.632	1,052	$152	$519	$135	$1,625
90312	Office	8	0.632	1,052	$152	$519	$135	$1,625
90312	Office	8	0.632	1,052	$152	$519	$135	$1,625
90312	Office	10	0.790	1,315	$190	$649	$169	$2,031
90507	Office	1	0.079	131	$19	$65	$17	$203
90507	Office	5	0.395	657	$95	$324	$84	$1,015
91114	1st E Battery Shop	1	0.079	329	$19	$65	$27	$323
Totals for Retrofit Type D4:		**671**	**49.341**	**144,543**	**$12,749**	**$43,531**	**$13,793**	**$165,753**
					SIR	**3.81**	**Payback**	**3.16**

Table 7. Lighting Retrofit E1 F48T12HO, 2 Lamp Fixtures: Replace Existing Ballasts with Electronic Ballasts

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
91114	2nd W Elec. Repair	2	0.066	275	$8	$86	$22	$261
91114	2nd W Elec. Repair	6	0.198	824	$24	$263	$65	$783
91114	1st E Shop	24	0.792	3,295	$96	$1,053	$261	$3,132
91114	1st E Tools	16	0.528	1,098	$64	$702	$121	$1,450
Totals for Retrofit Type E1:		**48**	**1.584**	**5,491**	**$192**	**$2,107**	**$468**	**$5,625**
					SIR	**2.67**	**Payback**	**4.50**

Table 8. Lighting Retrofit F1 F96T12, 2 Lamp Fixtures: Replace Lamps and Ballasts

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
70525	Kitchen	2	0.080	374	$20	$182	$20	$244
90312	Warehouse	18	0.720	1,498	$180	$1,640	$140	$1,688
Totals for Retrofit Type F1:		**20**	**0.800**	**1,872**	**$200**	**$1,822**	**$161**	**$1,932**
					SIR	**1.06**	**Payback**	**11.35**

Table 9. Lighting Retrofit F2 F96T12, 4 Lamp Fixtures: Replace Lamps and Ballasts

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
61701	Sports Admin.	1	0.080	166	$20	$182	$16	$187
Totals for Retrofit Type F2:		**1**	**0.080**	**166**	**$20**	**$182**	**$16**	**$187**
					SIR	**1.03**	**Payback**	**11.73**

Table 10. Lighting Retrofit G1 Incandescent 60W Downlight: Replace Lamp with Compact Fluorescent Lamp

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
22422	Basement	1	0.045	70	$5	$18	$13	$153
22422	Basement	1	0.045	70	$5	$18	$13	$153
Totals for Retrofit Type G1:		**2**	**0.089**	**139**	**$10**	**$37**	**$26**	**$306**
					SIR	**8.36**	**Payback**	**1.44**

Table 11. Lighting Retrofit G2 Incandescent 75W Downlight: Replace Lamp with Compact Fluorescent Lamp

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
20200	Corridor	1	0.055	80	$5	$9	$24	$291
20200	Extr.Entry	1	0.055	60	$5	$9	$24	$291
20200	Extr.Storage	1	0.055	29	$5	$9	$10	$122
20200	Furnace	1	0.055	14	$5	$9	$9	$103
43002	1 A	10	0.550	858	$5	$9	$214	$2,569
43002	1 B	6	1.380	2,153	$5	$9	$342	$4,107
43002	Basement	4	0.220	1,373	$5	$9	$177	$2,116
Totals for Retrofit Type G2:		**24**	**2.370**	**4,547**	**$35**	**$62**	**$800**	**$9,598**
					SIR	**153.60**	**Payback**	**0.08**

Table 12. Lighting Retrofit G3 Incand. 40W Ceiling or Wall-Mount Fixture: Replacement Compact Fluorescent

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
43002	1st Floor	5	0.158	246	$15	$78	$47	$561
43002	1st Floor	8	0.252	393	$24	$124	$75	$898
43002	1st Floor	16	0.504	786	$48	$249	$150	$1,795
43002	1st Floor	37	1.166	1,818	$111	$575	$346	$4,151
57428	106	1	0.032	66	$3	$16	$11	$133
70525	Toilet	2	0.126	590	$12	$62	$68	$818
70525	Toilet	2	0.126	590	$12	$62	$68	$818
Totals for Retrofit Type G3:		**71**	**2.363**	**4,488**	**$225**	**$1,166**	**$765**	**$9,175**
					SIR	**7.87**	**Payback**	**1.52**

Table 13. Lighting Retrofit G4 Incand. 60W Ceiling or Wall-Mount Fixture: Replacement Compact Fluorescent

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
20200	Bathroom	1	0.089	279	$10	$38	$34	$411
20200	Entry	1	0.045	49	$5	$19	$15	$175
43002	1 A	4	0.179	279	$20	$76	$55	$661
43002	1 C	4	0.179	46	$20	$76	$31	$376
43002	Basement	1	0.045	112	$5	$19	$16	$189
61701	Locker Rooms	32	1.430	2,975	$160	$610	$427	$5,121
80305	207	1	0.045	23	$5	$19	$8	$92
80305	307	1	0.045	23	$5	$19	$8	$92
Totals for Retrofit Type G4:		**45**	**2.056**	**3,786**	**$230**	**$876**	**$593**	**$7,117**
					SIR	**8.12**	**Payback**	**1.48**

Table 14. Lighting Retrofit G5 Incandescent 100W Ceiling Fixture: Replace Lamp with Compact Fluorescent

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
20200	Dining	1	0.231	252	$15	$89	$55	$664
20200	Living Room	1	0.077	168	$5	$30	$23	$270
43002	1st Floor	20	1.540	3,844	$100	$596	$272	$3,281
43002	Basement	3	0.231	60	$15	$89	$39	$474
61701	Sports Admin.	1	0.077	160	$5	$30	$27	$320
70525	Dishwash	2	0.154	480	$10	$60	$31	$378
Totals for Retrofit Type G5:		**28**	**2.310**	**4,965**	**$150**	**$894**	**$448**	**$5,386**
					SIR	**6.02**	**Payback**	**2.00**

Table 15. Lighting Retrofit H1 Incandescent 60W and 75W Table Lamps: Replacement Compact Fluorescents

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
20200	Bedroom(master)	1	0.043	94	$5	$20	$14	$168
80305	117	2	0.086	188	$10	$39	$28	$337
80305	119	2	0.086	188	$10	$39	$28	$337
80305	120	2	0.086	188	$10	$39	$28	$337
80305	122	2	0.086	188	$10	$39	$28	$337
80305	123	2	0.086	188	$10	$39	$28	$337
80305	125	2	0.086	188	$10	$39	$28	$337
80305	126	2	0.086	188	$10	$39	$28	$337
80305	128	2	0.086	188	$10	$39	$28	$337
80305	130	2	0.086	188	$10	$39	$28	$337
80305	131	2	0.086	188	$10	$39	$28	$337
80305	132	2	0.086	188	$10	$39	$28	$337
80305	134	2	0.086	188	$10	$39	$28	$337
80305	135	2	0.086	188	$10	$39	$28	$337
80305	137	2	0.086	188	$10	$39	$28	$337
80305	138	2	0.086	188	$10	$39	$28	$337
80305	140	2	0.086	188	$10	$39	$28	$337
80305	141	2	0.086	188	$10	$39	$28	$337
80305	143	2	0.086	188	$10	$39	$28	$337
80305	144	2	0.086	188	$10	$39	$28	$337
80305	146	2	0.086	188	$10	$39	$28	$337
80305	147	2	0.086	188	$10	$39	$28	$337
80305	148	2	0.086	188	$10	$39	$28	$337
80305	150	2	0.086	188	$10	$39	$28	$337
80305	151	2	0.086	188	$10	$39	$28	$337
80305	153	2	0.086	188	$10	$39	$28	$337
80305	155	2	0.086	188	$10	$39	$28	$337
80305	156	2	0.086	188	$10	$39	$28	$337
80305	158	2	0.086	188	$10	$39	$28	$337
80305	159	2	0.086	188	$10	$39	$28	$337
80305	160	2	0.086	188	$10	$39	$28	$337
80305	162	2	0.086	188	$10	$39	$28	$337
80305	164	2	0.086	188	$10	$39	$28	$337
80305	165	2	0.086	188	$10	$39	$28	$337
80305	167	2	0.086	188	$10	$39	$28	$337
80305	168	2	0.086	188	$10	$39	$28	$337
80305	170	2	0.086	188	$10	$39	$28	$337
80305	171	2	0.086	188	$10	$39	$28	$337
80305	173	2	0.086	188	$10	$39	$28	$337
80305	174	2	0.086	188	$10	$39	$28	$337
80305	176	2	0.086	188	$10	$39	$28	$337
80305	208	2	0.086	188	$10	$39	$28	$337
80305	210	2	0.086	188	$10	$39	$28	$337
80305	214	2	0.086	188	$10	$39	$28	$337
80305	216	2	0.086	188	$10	$39	$28	$337
80305	219	2	0.086	188	$10	$39	$28	$337
80305	219.1	2	0.086	188	$10	$39	$28	$337
80305	220	2	0.086	188	$10	$39	$28	$337
80305	222	2	0.086	188	$10	$39	$28	$337
80305	223	2	0.086	188	$10	$39	$28	$337
80305	225	2	0.086	188	$10	$39	$28	$337
80305	226	2	0.086	188	$10	$39	$28	$337
80305	228	2	0.086	188	$10	$39	$28	$337
80305	229	2	0.086	188	$10	$39	$28	$337
80305	231	2	0.086	188	$10	$39	$28	$337
80305	232	2	0.086	188	$10	$39	$28	$337
80305	234	2	0.086	188	$10	$39	$28	$337
80305	235	2	0.086	188	$10	$39	$28	$337
80305	237	2	0.086	188	$10	$39	$28	$337
80305	238	2	0.086	188	$10	$39	$28	$337

Table 15. Lighting Retrofit H1 Incandescent 60W and 75W Table Lamps: Replacement Compact Fluorescents

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
80305	240	2	0.086	188	$10	$39	$28	$337
80305	241	2	0.086	188	$10	$39	$28	$337
80305	243	2	0.086	188	$10	$39	$28	$337
80305	244	2	0.086	188	$10	$39	$28	$337
80305	246	2	0.086	188	$10	$39	$28	$337
80305	247	2	0.086	188	$10	$39	$28	$337
80305	249	2	0.086	188	$10	$39	$28	$337
80305	250	2	0.086	188	$10	$39	$28	$337
80305	252	2	0.086	188	$10	$39	$28	$337
80305	253	2	0.086	188	$10	$39	$28	$337
80305	255	2	0.086	188	$10	$39	$28	$337
80305	256	2	0.086	188	$10	$39	$28	$337
80305	258	2	0.086	188	$10	$39	$28	$337
80305	259	2	0.086	188	$10	$39	$28	$337
80305	261	2	0.086	188	$10	$39	$28	$337
80305	264	2	0.086	188	$10	$39	$28	$337
80305	264.1	2	0.086	188	$10	$39	$28	$337
80305	265	2	0.086	188	$10	$39	$28	$337
80305	267	2	0.086	188	$10	$39	$28	$337
80305	268	2	0.086	188	$10	$39	$28	$337
80305	270	2	0.086	188	$10	$39	$28	$337
80305	271	2	0.086	188	$10	$39	$28	$337
80305	273	2	0.086	188	$10	$39	$28	$337
80305	308	2	0.086	188	$10	$39	$28	$337
80305	310	2	0.086	188	$10	$39	$28	$337
80305	314	2	0.086	188	$10	$39	$28	$337
80305	316	2	0.086	188	$10	$39	$28	$337
80305	319	2	0.086	188	$10	$39	$28	$337
80305	319.1	2	0.086	188	$10	$39	$28	$337
80305	320	2	0.086	188	$10	$39	$28	$337
80305	322	2	0.086	188	$10	$39	$28	$337
80305	323	2	0.086	188	$10	$39	$28	$337
80305	325	2	0.086	188	$10	$39	$28	$337
80305	326	2	0.086	188	$10	$39	$28	$337
80305	328	2	0.086	188	$10	$39	$28	$337
80305	329	2	0.086	188	$10	$39	$28	$337
80305	331	2	0.086	188	$10	$39	$28	$337
80305	332	2	0.086	188	$10	$39	$28	$337
80305	334	2	0.086	188	$10	$39	$28	$337
80305	335	2	0.086	188	$10	$39	$28	$337
80305	337	2	0.086	188	$10	$39	$28	$337
80305	338	2	0.086	188	$10	$39	$28	$337
80305	340	2	0.086	188	$10	$39	$28	$337
80305	341	2	0.086	188	$10	$39	$28	$337
80305	343	2	0.086	188	$10	$39	$28	$337
80305	344	2	0.086	188	$10	$39	$28	$337
80305	346	2	0.086	188	$10	$39	$28	$337
80305	347	2	0.086	188	$10	$39	$28	$337
80305	349	2	0.086	188	$10	$39	$28	$337
80305	350	2	0.086	188	$10	$39	$28	$337
80305	352	2	0.086	188	$10	$39	$28	$337
80305	353	2	0.086	188	$10	$39	$28	$337
80305	355	2	0.086	188	$10	$39	$28	$337
80305	356	2	0.086	188	$10	$39	$28	$337
80305	358	2	0.086	188	$10	$39	$28	$337
80305	359	2	0.086	188	$10	$39	$28	$337
80305	361	2	0.086	188	$10	$39	$28	$337
80305	364	2	0.086	188	$10	$39	$28	$337
80305	364.1	2	0.086	188	$10	$39	$28	$337
80305	365	2	0.086	188	$10	$39	$28	$337

Table 15. Lighting Retrofit H1 Incandescent 60W and 75W Table Lamps: Replacement Compact Fluorescents

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
80305	367	2	0.086	188	$10	$39	$28	$337
80305	368	2	0.086	188	$10	$39	$28	$337
80305	370	2	0.086	188	$10	$39	$28	$337
80305	371	2	0.086	188	$10	$39	$28	$337
80305	373	2	0.086	188	$10	$39	$28	$337
Totals for Retrofit Type H1:		**249**	**10.707**	**23,384**	**$1,245**	**$4,876**	**$3,493**	**$41,911**
					SIR	**8.60**	**Payback**	**1.40**

Table 16. Lighting Retrofit J1 250W MV Pendant-Mount Fixture: Replace Lamp & Ballast with HPS

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
61701	Workout	9	0.873	1,816	$87	$1,791	$214	$2,571
61701	Racquetball Court	12	1.164	1,816	$116	$2,388	$256	$3,076
61701	Racquetball Court	12	1.164	1,816	$116	$2,388	$256	$3,076
Totals for Retrofit Type J1:		**33**	**3.201**	**5,448**	**$320**	**$6,568**	**$726**	**$8,724**
					SIR	**1.33**	**Payback**	**9.05**

Table 17. Lighting Retrofit J2 400W MV Pendant-Mount Fixture: Replace Lamp & Ballast with HPS

Bldg No	Room No	No of Fixtures	ECO Savings (kW)	ECO Savings (kWH/Yr)	ECO Rebate ($)	ECO Investment ($)	ECO Total Savings ($/Year)	ECO LCC Savings ($)
61701	Gym	48	10.032	20,867	$1,003	$7,455	$2,432	$29,226
61701	Racquetball Court	6	1.254	2,608	$125	$932	$304	$3,653
Totals for Retrofit Type J2:		**54**	**11.286**	**23,475**	**$1,129**	**$8,387**	**$2,736**	**$32,880**
					SIR	**3.92**	**Payback**	**3.06**

Table 18. Lighting Controls Retrofit K1: Ceiling Mounted PIR Occupancy Sensors

Bldg No	Room No	Number Sensors Required	Energy Saved (kWH/Year)	Annual Cost Saved ($/Year)	Total LCC Cost Saved ($)	ECO Construction Cost ($)	ECO Rebate ($)	ECO Investment ($)
15544	103	2	1,968	$110.31	$1,325	$608	$16	$665
15544	104	2	2,029	$118.97	$1,428	$608	$16	$665
15544	105	6	3,136	$183.86	$2,207	$1,824	$48	$1,995
15544	106	2	2,583	$144.78	$1,739	$608	$16	$665
15544	107	4	4,673	$261.98	$3,146	$1,216	$32	$1,330
15544	111	3	3,812	$213.72	$2,567	$912	$24	$998
15544	113	3	3,443	$193.04	$2,318	$912	$24	$998
15544	114	2	1,937	$113.56	$1,363	$608	$16	$665
22422	101	1	215	$12.72	$153	$304	$4	$337
22422	108	1	429	$25.45	$306	$304	$8	$333
22422	111	2	805	$47.72	$573	$608	$16	$665
22422	116	1	537	$31.81	$382	$304	$8	$333
22422	201	1	215	$12.72	$153	$304	$4	$337
22422	202	1	215	$12.72	$153	$304	$4	$337
22422	203	1	429	$25.45	$306	$304	$8	$333
22422	205	3	1,503	$89.07	$1,069	$912	$24	$998
22422	212	1	177	$10.99	$132	$304	$4	$337
43002	1st Floor	1	107	$6.36	$76	$304	$4	$337
43002	1st Floor	2	287	$100.48	$1,201	$608	$16	$665
53301	103	10	8,461	$497.49	$5,973	$3,041	$80	$3,326
53301	104	1	312	$18.38	$221	$304	$4	$337
53301	105	1	312	$18.38	$221	$304	$4	$337
53301	107	1	312	$18.38	$221	$304	$4	$337
53301	117	1	449	$26.42	$317	$304	$8	$333
53301	119	3	2,172	$127.67	$1,533	$912	$24	$998
53301	120	2	973	$57.23	$687	$608	$16	$665
53301	121	1	208	$12.25	$147	$304	$4	$337
53301	124	3	2,321	$136.48	$1,639	$912	$24	$998
53301	126	1	208	$12.25	$147	$304	$4	$337
53301	128	1	599	$35.22	$423	$304	$8	$333
53301	129	1	208	$12.25	$147	$304	$4	$337
53301	202	11	18,271	$1,051.62	$12,627	$3,345	$88	$3,658
53301	217	6	7,176	$422.77	$5,076	$1,824	$48	$1,995
53301	220	1	832	$49.02	$588	$304	$8	$333
56301	107	1	655	$38.6	$463	$304	$8	$333
56301	109	1	749	$44.12	$530	$304	$8	$333
56301	113	2	1,685	$99.26	$1,192	$608	$16	$665
56301	115	2	1,348	$79.25	$951	$608	$16	$665
56301	118	2	1,078	$63.4	$761	$608	$16	$665
56301	121	2	1,617	$95.09	$1,142	$608	$16	$665
56301	126	2	1,685	$99.26	$1,192	$608	$16	$665
56301	134	2	1,966	$115.8	$1,390	$608	$16	$665
56301	137	2	2,246	$132.35	$1,589	$608	$16	$665
56301	138	2	1,872	$110.29	$1,324	$608	$16	$665
56301	140	1	936	$55.14	$662	$304	$8	$333
56301	141	1	468	$27.57	$331	$304	$4	$337
56301	154	1	1,030	$60.66	$728	$304	$8	$333
56301	130, Lab	1	809	$47.55	$571	$304	$8	$333
56301	143	1	1,123	$66.17	$794	$304	$8	$333
56301	144	1	842	$49.63	$596	$304	$8	$333
56301	145	1	1,123	$66.17	$794	$304	$8	$333
56301	153A	1	539	$31.7	$381	$304	$8	$333
57428	105	1	1,248	$73.53	$883	$304	$8	$333
57428	107	2	1,872	$110.29	$1,324	$608	$16	$665
57428	114	1	416	$24.51	$294	$304	$4	$337
57428	115	1	416	$24.51	$294	$304	$4	$337
57428	123	2	1,664	$98.03	$1,177	$608	$16	$665
57428	130	3	5,545	$310.86	$3,733	$912	$24	$998
57428	131	1	2,147	$120.33	$1,445	$304	$8	$333
57428	202	1	416	$24.51	$294	$304	$4	$337
57428	209	1	416	$24.51	$294	$304	$4	$337
57428	217	2	1,872	$110.29	$1,324	$608	$16	$665
61701	Area	1	312	$17.6	$211	$304	$8	$333
61701	Gym	4	6,115	$301.59	$3,625	$1,216	$32	$1,330

Table 18. Lighting Controls Retrofit K1: Ceiling Mounted PIR Occupancy Sensors

Bldg No	Room No	Number Sensors Required	Energy Saved (kWH/Year)	Annual Cost Saved ($/Year)	Total LCC Cost Saved ($)	ECO Construction Cost ($)	ECO Rebate ($)	ECO Investment ($)
61701	Office	1	537	$30.64	$368	$304	$8	$333
62704	W10	2	1,409	$82.59	$992	$608	$16	$665
62704	W11	2	1,409	$82.59	$992	$608	$16	$665
62704	W2	2	1,409	$82.59	$992	$608	$16	$665
62704	W3	2	1,811	$106.19	$1,275	$608	$16	$665
62704	W4	2	1,409	$82.59	$992	$608	$16	$665
62704	W5	2	1,409	$82.59	$992	$608	$16	$665
62704	W6	2	1,409	$82.59	$992	$608	$16	$665
62704	W7	2	1,409	$82.59	$992	$608	$16	$665
62704	W8	2	1,409	$82.59	$992	$608	$16	$665
62704	W9	2	1,409	$82.59	$992	$608	$16	$665
62704		2	1,811	$106.19	$1,275	$608	$16	$665
70525	Offices	1	671	$44.16	$530	$304	$8	$333
70525	Whse	1	156	$10.84	$130	$304	$4	$337
80305	OR	1	187	$11.52	$138	$304	$4	$337
80305	OR	1	187	$11.52	$138	$304	$4	$337
80305	OR	1	499	$30.73	$369	$304	$8	$333
80305	OR	1	562	$34.57	$415	$304	$8	$333
80505	102	2	374	$23.52	$282	$608	$8	$673
80505	103	3	1,121	$70.57	$847	$912	$24	$998
80505	104	2	374	$23.52	$282	$608	$8	$673
80505	106	2	374	$23.52	$282	$608	$8	$673
80505	108	2	374	$23.52	$282	$608	$8	$673
80505	110	2	374	$23.52	$282	$608	$8	$673
80505	131	2	872	$48.53	$583	$608	$16	$665
80505	142	2	332	$18.49	$222	$608	$8	$673
80505	145	2	390	$25.65	$308	$608	$16	$665
80505	146	6	1,994	$110.93	$1,332	$1,824	$48	$1,995
80505	151	1	498	$27.73	$333	$304	$8	$333
80505	176	2	665	$36.98	$444	$608	$16	$665
80505	179	1	249	$13.87	$167	$304	$8	$333
80505	181	1	374	$18.76	$225	$304	$8	$333
80505	210	5	1,246	$87.5	$1,050	$1,520	$40	$1,663
80505	212	1	498	$35.	$420	$304	$8	$333
80505	213	1	74	$10.84	$130	$304	$8	$333
80505	231	1	208	$14.58	$175	$304	$4	$337
80505	234	2	498	$35.	$420	$608	$16	$665
80505	236	2	498	$35.	$420	$608	$16	$665
80505	237	1	231	$12.98	$156	$304	$8	$333
80505	245	2	748	$52.5	$630	$608	$16	$665
80505	248	1	498	$33.18	$398	$304	$8	$333
80505	249	1	74	$9.63	$115	$304	$8	$333
80505	278	1	498	$33.18	$398	$304	$8	$333
80505	280	6	1,994	$118.19	$1,419	$1,824	$48	$1,995
80505	118 C	2	665	$33.34	$401	$608	$16	$665
80505	162B	1	332	$17.28	$208	$304	$8	$333
80505	203-5	3	1,121	$56.27	$676	$912	$24	$998
80505	242 + 276	2	665	$34.55	$415	$608	$16	$665
80505	244 + 246	2	665	$39.4	$473	$608	$16	$665
80505	277 + 281	2	748	$37.51	$451	$608	$16	$665
90312	Office	1	572	$33.19	$399	$304	$8	$333
90312	Office	1	572	$33.19	$399	$304	$8	$333
90312	Office	1	572	$33.19	$399	$304	$8	$333
90312	Office	1	716	$41.49	$498	$304	$8	$333
90312	Warehouse	2	1,479	$85.55	$1,027	$608	$16	$665
90507	Office	1	322	$19.09	$229	$304	$8	$333
91114	1st E Office	1	644	$38.17	$458	$304	$8	$333
91114	1st E Tools	2	932	$45.05	$542	$608	$16	$665
91114	1st W QC Office	1	644	$38.17	$458	$304	$8	$333
91114	2nd E Chief	1	644	$38.17	$458	$304	$8	$333
91114	2nd W Elec. Repair	1	716	$42.42	$509	$304	$8	$333
91114	2nd W Storage	2	850	$55.94	$671	$608	$16	$665
Totals for ECO K1		**239**	**162,912**	**$9,552**	**$114,686**	**$72,674**	**$1,784**	**$79,611**
					SIR 1.44		**Payback 8.33**	

Table 19. Lighting Controls Retrofit K3: Wall Switch PIR Occupancy Sensor

Bldg No	Room No	Number Sensors Required	Energy Saved (kWH/Year)	Annual Cost Saved ($/Year)	Total LCC Cost Saved ($)	ECO Construction Cost ($)	ECO Rebate ($)	ECO Investment ($)
15544	103A	1	492	$27.58	$331	$102	$4	$111
20200	Extr.Storage	1	3	$.78	$9	$102	$4	$111
20200	Furnace	1	1	$.39	$5	$102	$4	$111
22422	102	1	215	$12.72	$153	$102	$4	$111
22422	103	1	107	$6.36	$76	$102	$4	$111
22422	104	1	107	$6.36	$76	$102	$4	$111
22422	107	1	215	$12.72	$153	$102	$4	$111
22422	109	1	107	$6.36	$76	$102	$4	$111
22422	110	1	107	$6.36	$76	$102	$4	$111
22422	112	1	107	$6.36	$76	$102	$4	$111
22422	113	1	107	$6.36	$76	$102	$4	$111
22422	114	1	107	$6.36	$76	$102	$4	$111
22422	115	1	107	$6.36	$76	$102	$4	$111
22422	204	1	107	$6.36	$76	$102	$4	$111
22422	206	1	107	$6.36	$76	$102	$4	$111
22422	207	1	107	$6.36	$76	$102	$4	$111
22422	208	1	215	$12.72	$153	$102	$4	$111
22422	209	1	107	$6.36	$76	$102	$4	$111
22422	210	1	107	$6.36	$76	$102	$4	$111
22422	211	1	187	$11.52	$138	$102	$4	$111
22422	108A	1	215	$12.72	$153	$102	$4	$111
22422	Basement	1	11	$.64	$8	$102	$4	$111
22422	PS1	1	268	$15.91	$191	$102	$4	$111
43002	1 C	1	4	$6.86	$82	$102	$4	$111
43002	1 E	1	11	$.93	$11	$102	$4	$111
43002	1 F/G	1	161	$9.54	$115	$102	$4	$111
43002	1 H	1	17	$1.4	$17	$102	$4	$111
43002	1st Floor	1	54	$3.18	$38	$102	$4	$111
43002	1st Floor	1	54	$3.18	$38	$102	$4	$111
43002	1st Floor	1	107	$6.36	$76	$102	$4	$111
43002	1st Floor	1	107	$6.36	$76	$102	$4	$111
43002	1st Floor	1	6	$.47	$6	$102	$4	$111
43002	2 Balcony A	1	45	$3.73	$45	$102	$8	$107
43002	2 Balcony B	1	45	$3.73	$45	$102	$8	$107
43002	2 C	1	322	$19.09	$229	$102	$8	$107
43002	2 D	1	107	$6.36	$76	$102	$4	$111
43002	Basement	1	22	$1.77	$21	$102	$4	$111
43002	Basement	1	11	$.93	$11	$102	$4	$111
43002	Basement	1	4	$3.31	$40	$102	$4	$111
53301	109	1	187	$12.96	$155	$102	$4	$111
53301	114	1	22	$1.5	$18	$102	$4	$111
53301	124	1	312	$18.38	$221	$102	$4	$111
53301	127	1	150	$8.81	$106	$102	$4	$111
53301	203	1	449	$25.86	$311	$102	$4	$111
53301	204	1	449	$25.86	$311	$102	$4	$111
53301	206	1	449	$25.86	$311	$102	$4	$111
53301	214	1	312	$18.38	$221	$102	$4	$111
53301	214	1	22	$1.5	$18	$102	$4	$111
53301	218	1	416	$24.51	$294	$102	$4	$111
53301	221	1	416	$24.51	$294	$102	$4	$111
53301	222	1	416	$24.51	$294	$102	$4	$111
53301	223	1	416	$24.51	$294	$102	$4	$111
53301	224	1	416	$24.51	$294	$102	$4	$111
53301	225	1	416	$24.51	$294	$102	$4	$111
56301	108	1	562	$33.09	$397	$102	$8	$107
56301	109	1	562	$33.09	$397	$102	$8	$107
56301	114	1	270	$15.85	$190	$102	$4	$111
56301	116	1	270	$15.85	$190	$102	$4	$111
56301	117	1	202	$11.89	$143	$102	$4	$111
56301	119	1	135	$7.92	$95	$102	$4	$111
56301	120	1	270	$15.85	$190	$102	$4	$111
56301	122	1	135	$7.92	$95	$102	$4	$111
56301	128	1	187	$11.03	$132	$102	$4	$111
56301	129	1	187	$11.03	$132	$102	$4	$111

Table 19. Lighting Controls Retrofit K3: Wall Switch PIR Occupancy Sensor

Bldg No	Room No	Number Sensors Required	Energy Saved (kWH/Year)	Annual Cost Saved ($/Year)	Total LCC Cost Saved ($)	ECO Construction Cost ($)	ECO Rebate ($)	ECO Investment ($)
56301	130	1	135	$7.92	$95	$102	$4	$111
56301	133	1	281	$16.54	$199	$102	$4	$111
56301	135	1	187	$11.03	$132	$102	$4	$111
56301	136	1	187	$11.03	$132	$102	$4	$111
56301	139	1	187	$11.03	$132	$102	$4	$111
56301	140	1	94	$6.75	$81	$102	$4	$111
56301	152	1	468	$27.57	$331	$102	$4	$111
56301	154	1	67	$4.8	$58	$102	$4	$111
56301	113C	1	562	$33.09	$397	$102	$8	$107
57428	102	1	89	$5.89	$71	$102	$4	$111
57428	106	1	4	$.43	$5	$102	$4	$111
57428	108	1	208	$14.45	$173	$102	$4	$111
57428	109	1	312	$21.68	$260	$102	$8	$107
57428	118	1	624	$36.76	$441	$102	$8	$107
57428	120	1	624	$36.76	$441	$102	$8	$107
57428	126	1	312	$21.68	$260	$102	$8	$107
57428	127	1	312	$21.68	$260	$102	$8	$107
57428	203	1	416	$24.51	$294	$102	$4	$111
57428	204	1	624	$36.76	$441	$102	$8	$107
57428	207	1	520	$30.64	$368	$102	$4	$111
57428	208	1	520	$30.64	$368	$102	$4	$111
57428	216A	1	416	$24.51	$294	$102	$4	$111
57428	216B	1	416	$24.51	$294	$102	$4	$111
61701	Office	1	89	$5.11	$61	$102	$4	$111
61701	Office	1	134	$7.66	$92	$102	$4	$111
61701	Pool Office	1	89	$5.11	$61	$102	$4	$111
61701	Sports Admin.	1	164	$9.41	$113	$102	$4	$111
61701	Sports Admin.	1	89	$5.01	$60	$102	$4	$111
61701	Sports Admin.	1	12	$3.16	$38	$102	$4	$111
61701	Supplies	1	45	$2.55	$31	$102	$4	$111
70525	Dishwash	1	67	$4.42	$53	$102	$4	$111
70525	Dishwash	1	36	$4.83	$58	$102	$4	$111
70525	Office	1	134	$8.83	$106	$102	$4	$111
70525	Offices	1	335	$22.08	$265	$102	$4	$111
70525	Supply	1	67	$4.42	$53	$102	$4	$111
70525	Whse	1	67	$4.42	$53	$102	$4	$111
70525	Whse	1	268	$17.67	$212	$102	$4	$111
80305	103	1	447	$25.53	$307	$102	$4	$111
80305	104	1	335	$19.15	$230	$102	$4	$111
80305	109	1	224	$12.77	$153	$102	$4	$111
80305	110	1	54	$3.18	$38	$102	$4	$111
80305	112	1	7	$.37	$4	$102	$4	$111
80305	113	1	22	$1.28	$15	$102	$4	$111
80305	114	1	11	$.64	$8	$102	$4	$111
80305	115	1	45	$2.55	$31	$102	$4	$111
80305	201	1	107	$6.36	$76	$102	$4	$111
80305	202	1	11	$.64	$8	$102	$4	$111
80305	203	1	447	$25.53	$307	$102	$4	$111
80305	204	1	54	$3.18	$38	$102	$4	$111
80305	205	1	563	$32.17	$386	$102	$4	$111
80305	207	1	2	$.2	$2	$102	$4	$111
80305	208	1	215	$12.72	$153	$102	$4	$111
80305	208	1	671	$38.3	$460	$102	$8	$107
80305	301	1	107	$6.36	$76	$102	$4	$111
80305	302	1	11	$.64	$8	$102	$4	$111
80305	303	1	143	$8.48	$102	$102	$4	$111
80305	303	1	447	$25.53	$307	$102	$4	$111
80305	304	1	54	$3.18	$38	$102	$4	$111
80305	305	1	563	$32.17	$386	$102	$4	$111
80305	305	1	563	$32.17	$386	$102	$4	$111
80305	307	1	2	$.69	$8	$102	$4	$111
80305	308	1	215	$12.72	$153	$102	$4	$111
80305	OR	1	187	$11.52	$138	$102	$4	$111
80305	OR	1	187	$11.52	$138	$102	$4	$111

Table 19. Lighting Controls Retrofit K3: Wall Switch PIR Occupancy Sensor

Bldg No	Room No	Number Sensors Required	Energy Saved (kWH/Year)	Annual Cost Saved ($/Year)	Total LCC Cost Saved ($)	ECO Construction Cost ($)	ECO Rebate ($)	ECO Investment ($)
80305	OR	1	166	$10.24	$123	$102	$4	$111
80305	OR	1	499	$30.73	$369	$102	$8	$107
80305	OR	1	13	$.77	$9	$102	$4	$111
80505	139	1	115	$5.73	$69	$102	$4	$111
80505	143	1	115	$6.49	$78	$102	$4	$111
80505	148	1	332	$22.12	$265	$102	$8	$107
80505	152	1	332	$19.7	$236	$102	$8	$107
80505	154	1	19	$1.38	$17	$102	$4	$111
80505	156	1	19	$1.38	$17	$102	$4	$111
80505	158	1	19	$1.38	$17	$102	$4	$111
80505	177	1	74	$8.66	$104	$102	$4	$111
80505	233	1	173	$8.83	$106	$102	$8	$107
80505	250	1	38	$2.16	$26	$102	$4	$111
80505	1 MECH	1	55	$3.13	$38	$102	$8	$107
80505	118B	1	55	$4.04	$48	$102	$4	$111
80505	136+118D	1	87	$4.49	$54	$102	$4	$111
90312	Office	1	429	$24.89	$299	$102	$8	$107
90507	Office	1	72	$4.15	$50	$102	$4	$111
90507	Office	1	358	$20.75	$249	$102	$4	$111
90507	Office	1	143	$8.48	$102	$102	$4	$111
90508	508	1	447	$25.53	$307	$102	$8	$107
91114	1st W QC Library	1	134	$8.83	$106	$102	$4	$111
91114	2nd E Acet	1	429	$25.45	$306	$102	$8	$107
91114	2nd E Admin	1	429	$25.45	$306	$102	$8	$107
91114	2nd E GM	1	429	$25.45	$306	$102	$8	$107
91114	2nd E Key Punch	1	429	$25.45	$306	$102	$8	$107
91114	2nd E Office	1	215	$12.72	$153	$102	$4	$111
91114	2nd E Office	1	429	$25.45	$306	$102	$8	$107
91114	2nd E OP Mgr	1	429	$25.45	$306	$102	$8	$107
91114	2nd E PLT	1	429	$25.45	$306	$102	$8	$107
91114	2nd E QC	1	429	$25.45	$306	$102	$8	$107
91114	2nd E Supply Admin	1	429	$25.45	$306	$102	$8	$107
91114	2nd E Supply Spec	1	134	$8.05	$97	$102	$4	$111
91114	2nd W Elec. Repair	1	447	$29.44	$353	$102	$8	$107
Totals		**162**	**35,138**	**$2,115**	**$25,393**	**$16,605**	**$768**	**$17,829**
					SIR 1.42		**Payback 8.43**	

Table 20. Energy Use and Operating Costs for Existing Fixtures

Existing Fixture Type Description	Watts per Fixture	Lamp Life (Hours)	Lamp Cost ($ Each)	Labor (Hr/Lamp)	Cost/1,000 Lamp-Hrs	Proposed Lighting Fixture Retrofits
Exit I-10W - 2 Lamps per Fixture	20.0	131,400	$2.45	0.083	$0.032	A: LED Retrofit Kit
Exit LED	1.8	220,000	$31.50	NA	NA	NA
F13 Mini-Tube Downlight - 2 Lamps per Fixture	32.0	10,000	$2.38	NA	NA	NA
F13 Mini-Tube Wall-Mounted - 2 Lamps per Fixture	32.0	10,000	$2.38	NA	NA	NA
F20T12 - 1 Lamp per Fixture	12.0	9,000	$1.18	NA	NA	NA
F30T12 - 2 Lamps per Fixture	74.0	NA	NA	NA	NA	B1: Electronic Ballast, or
F30T12 - 2 Lamps per Fixture	74.0	18,000	$3.70	0.150	$0.382	B2: Electronic Ballast & T8 Lamps
F32T8 - 1 Lamp per Fixture (Non-electronic Ballast)	37.0	20,000	$2.65	NA	NA	C1: Electronic Ballast
F32T8 - 2 Lamps per Fixture (Non-electronic Ballast)	71.0	20,000	$2.65	0.150	$0.291	C2: Electronic Ballast
F34T12 - 1 Lamps per Fixture	43.0	20,000	$2.75	0.167	$0.314	D1: Ballast & T8 Lamps
F34T12 - 2 Lamps per Fixture	72.0	20,000	$2.75	0.150	$0.296	D2: Ballast & T8 Lamps
F34T12 - 3 Lamps per Fixture	100.0	20,000	$2.75	0.135	$0.280	D3: Ballast & T8 Lamps
F34T12 - 4 Lamps per Fixture	144.0	20,000	$2.75	0.122	$0.267	D4: Ballast & T8 Lamps
F40T12 - 1 Lamp per Fixture	50.0	20,000	$2.75	0.167	$0.314	D1: Ballast & T8 Lamps
F40T12 - 2 Lamps per Fixture	86.0	20,000	$2.75	0.150	$0.296	D2: Ballast & T8 Lamps
F40T12 - 3 Lamps per Fixture	100.0	20,000	$2.75	0.135	$0.280	D3: Ballast & T8 Lamps
F40T12 - 4 Lamps per Fixture	172.0	20,000	$2.75	0.122	$0.267	D4: Ballast & T8 Lamps & D5: Delamping & Reflector
F40T12 - Wall Surface-Mount Fixture 1 Lamp	50.0	20,000	$2.75	0.167	$0.314	D1: Ballast & T8 Lamps
F40T12HO - 2 Lamps per Fixture	145.0	12,000	$5.51	0.150	$0.724	E1: Replace Ballast
F40T12U - 2 Lamps per Fixture	72.0	12,000	$5.62	0.135	$0.706	E2: Replace T8U Lamps & Ballasts
F40T12U - 3 Lamps per Fixture	100.0	12,000	$5.62	0.122	$0.683	E3: Replace T8U Lamps & Ballasts
F96T12 - 2 Lamps per Fixture	158.0	12,000	$3.63	0.169	$0.600	F1: Ballasts & T8 Lamps
F96T12 - 4 Lamps per Fixture	316.0	12,000	$3.63	0.152	$0.570	F2: Ballasts & T8 Lamps
FC12T9 - 32W Circline	43.0	12,000	$2.51	0.167	$0.504	NA
HPS 400W - 1 Lamp per Fixture	457.0	24,000	$22.86	0.300	$1.217	NA
I-100W - Ceiling-Mount Fixture 1 Lamp per Fixture	100.0	750	$0.51	0.083	$3.021	G5: Compact Fluorescent
I-100W - Pendant, decorative	100.0	750	$0.51	NA	NA	NA
I-12x5W - Pendant, decorative	60.0	NA	NA	NA	NA	NA - decorative
I-40W - Wall Surface-Mount Fixture - 1 Lamp per Fixture	40.0	1,500	$0.30	0.083	$1.370	G3: Compact Fluorescent
I-4x100W - Pendant, decorative	400.0	750	$0.51	NA	NA	NA - decorative
I-4x40W - Pendant, decorative	160.0	1,500	$0.30	NA	NA	NA - decorative
I-5x40W - Pendant, decorative	200.0	1,500	$0.30	NA	NA	NA - decorative
I-5x5W - Pendant, decorative	25.0	NA	NA	NA	NA	NA - decorative
I-60W - Ceiling-Mount Fixture 1 Lamp per Fixture	60.0	1,000	$0.51	0.083	$2.265	G4: Compact Fluorescent
I-60W - Desk Lamp	60.0	1,000	$0.51	0.083	$2.265	H1: Replace Lamp with Compact Fluorescent
I-60W Par Downlight Fixture	60.0	2,000	$3.16	0.083	$2.458	G1: Compact Fluorescent
I-60W - Wall Surface-Mount Fixture	60.0	1,000	$0.51	0.083	$2.265	G4: Compact Fluorescent
I-75W - Desk Lamp	75.0	750	$0.71	0.083	$3.287	H1: Replace Lamp with Compact Fluorescent
I-75W Par Downlight Fixture	75.0	2,000	$6.21	0.083	$3.983	G2: Compact Fluorescent
LPS 180W - 1 Lamp per Fixture	220.0	33,000	$56.24	NA	NA	NA
LPS 55W - 1 Lamp per Fixture	80.0	8,000	$30.59	NA	NA	NA
LPS 90W - 1 Lamp per Fixture	125.0	13,500	$33.98	NA	NA	NA
MV 250W - Pendant-Mount	285.0	24,000	$31.62	0.300	$1.582	J1: Replace with HPS Lamp & Ballast
MV 400W - Pendant-Mount	454.0	24,000	$50.34	0.300	$2.362	J2: Replace with HPS Lamp & Ballast

Table 21. Energy Use and Operating Costs for Proposed Lighting Fixture Retrofits

Retrofit Type	Retrofit Description	Watts per Fixture	Lamp Life (Hours)	Lamp Cost ($ Each)	Labor (Hr/Lamp)	Cost/1,000 Lamp-Hrs
A	A: LED Retrofit Kit	1.8	220,000	$31.50	1.000	$0.239
B1	B1: Electronic Ballast, or	61.0	NA	NA	NA	NA
B2	B2: Electronic Ballast & T8 Lamps	44.0	20,000	$2.54	0.150	$0.286
C1	C1: Electronic Ballast	31.0	NA	NA	NA	NA
C2	C2: Electronic Ballast	60.0	NA	NA	NA	NA
D1	D1: Ballast & T8 Lamps	31.0	20,000	$2.83	0.167	$0.318
D2	D2: Ballast & T8 Lamps	61.0	20,000	$2.83	0.150	$0.300
D3	D3: Ballast & T8 Lamps	93.0	20,000	$2.83	0.135	$0.284
D4	D4: Ballast & T8 Lamps	122.0	20,000	$2.83	0.122	$0.271
D5	D5: Reflector, Delamp to 3 F32T8s & Ballast	93.0	20,000	$2.83	0.135	$0.284
E1	E1: Replace Ballast	112.0	NA	NA	NA	NA
E2	E2: Replace T8U Lamps & Ballasts	61.0	20,000	$9.34	0.135	$0.610
E3	E3: Replace T8U Lamps & Ballasts	88.0	20,000	$9.34	0.122	$0.596
F1	F1: Ballasts & T8 Lamps	118.0	15,000	$10.28	0.169	$0.924
F2	F2: Ballasts & T8 Lamps	236.0	15,000	$10.28	0.152	$0.900
G1	G1: Compact Flourescent	15.3	10,000	$5.19	0.083	$0.695
G2	G2: Compact Fluorescent	20.0	10,000	$5.19	0.083	$0.695
G3	G3: Compact Fluorescent	8.5	10,000	$2.49	0.083	$0.425
G4	G4: Compact Flourescent	15.3	10,000	$5.88	0.083	$0.764
G5	G5: Compact Fluorescent	23.0	10,000	$18.07	0.083	$1.983
H1	H1: Replace Lamp with Compact Fluorescent	17.0	10,000	$11.76	0.083	$1.352
J1	J1: Replace with HPS Lamp & Ballast	188.0	24,000	$12.91	0.300	$0.802
J2	J2: Replace with HPS Lamp & Ballast	245.0	24,000	$16.44	0.300	$0.949

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Fort Huachuca, Arizona	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements		Fiscal Year FY96
Discrete Portion:	Total Successful Lighting Fixture Retrofits & Control Projects		Preparer: KELLER & GANNON

Analysis Date: January 1995 Economic Life: 15 Years

1. Investment Costs			
A. Construction Costs	$256,870		
B. SIOH	$15,412		
C. Design Cost	$15,412		
D. Total Cost (1A + 1B + 1C)	$287,695		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$36,359	
G. Total Investment (1D-1E-1F)			$251,336

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	1,920		$27,193	12.02	$326,858
B. Dist		0		$0		$0
C. LPG		0		$0		$0
D. Natural Gas	$4.51	0		$0	14.17	
E. Demand Saved	$127.84	123.6	kW	$15,804	12.02	$189,959
F. Total		1,920		$42,996		$516,817

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$4,105		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$49,012

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2 + 3Bd4)	$49,012	
4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$47,101	
5. Simple Payback (1G/4):	5.34	Years
6. Total Net Discounted Savings (2F5 + 3C):	$565,829	
7. Savings to Investment Ratio (SIR) (6/1G):	2.25	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Fort Huachuca, Arizona	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements		Fiscal Year FY96
Discrete Portion:	Fixture Retrofit A - LED Exit Signs		Preparer: KELLER & GANNON
Analysis Date:	January 1995	Economic Life:	15 Years

1. Investment Costs

A. Construction Costs	$5,723		
B. SIOH	$343		
C. Design Cost	$343		
D. Total Cost (1A+1B+1C)	$6,410		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$972	
G. Total Investment (1D-1E-1F)			$5,438

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	59		$830	12.02	$9,979
B. Dist		0		$0		$0
C. LPG		0		$0		$0
D. Natural Gas	$4.51	0		$0	14.17	
E. Demand Saved	$127.84	2.0	kW	$251	12.02	$3,020
F. Total		59		$1,082		$13,000

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($165)		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			($1,975)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	($1,975)	
4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$916	
5. Simple Payback (1G/4):	5.94	Years
6. Total Net Discounted Savings (2F5+3C):	$11,025	
7. Savings to Investment Ratio (SIR) (6/1G):	2.03	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Fort Huachuca, Arizona	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements		Fiscal Year FY96
Discrete Portion:	Fixture Retrofit B2 - Electronic Ballasts & T8 Lamps for 2 Lamp F30T12 Fixtures		Preparer: KELLER & GANNON
Analysis Date:	January 1995	Economic Life: 15	Years

1. Investment Costs

A. Construction Costs	$6,020		
B. SIOH	$361		
C. Design Cost	$361		
D. Total Cost (1A+1B+1C)	$6,742		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$1,240	
G. Total Investment (1D-1E-1F)			$5,502

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	28		$393	12.02	$4,722
B. Dist		0		$0		$0
C. LPG		0		$0		$0
D. Natural Gas	$4.51	0		$0	14.17	
E. Demand Saved	$127.84	3.7	kW	$476	12.02	$5,716
F. Total		28		$868		$10,438

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$104		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$1,244

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$1,244	
4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$973	
5. Simple Payback (1G/4):	5.66	Years
6. Total Net Discounted Savings (2F5+3C):	$11,682	
7. Savings to Investment Ratio (SIR) (6/1G):	2.12	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Huachuca, Arizona — Region No. 4 — Project No.
Project Title: ECIP Facility Energy Improvements — Fiscal Year FY96
Discrete Portion: Fixture Retrofit D1 - Electronic Ballasts and T8 Lamps for 1 Lamp F34T12 & F40T12 Fixtures — Preparer: KELLER & GANNON
Analysis Date: January 1995 — Economic Life: 15 Years

1. Investment Costs			
A. Construction Costs	$5,623		
B. SIOH	$337		
C. Design Cost	$337		
D. Total Cost (1A+1B+1C)	$6,297		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$1,080	
G. Total Investment (1D-1E-1F)			$5,217

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	31		$438	12.02	$5,269
B. Dist		0		$0		$0
C. LPG		0		$0		$0
D. Natural Gas	$4.51	0		$0	14.17	
E. Demand Saved	$127.84	1.7	kW	$220	12.02	$2,643
F. Total		31		$658		$7,912

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($136)		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			($1,626)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	($1,626)	
4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$522	
5. Simple Payback (1G/4):	9.99	Years
6. Total Net Discounted Savings (2F5+3C):	$6,286	
7. Savings to Investment Ratio (SIR) (6/1G):	1.20	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Fort Huachuca, Arizona	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements		Fiscal Year FY96
Discrete Portion:	Fixture Retrofit D2 - Electronic Ballasts and T8 Lamps for 2 Lamp F34T12 & F40T12 Fixtures		Preparer: KELLER & GANNON
Analysis Date:	January 1995	Economic Life: 15	Years

1. Investment Costs

A. Construction Costs	$72,535		
B. SIOH	$4,352		
C. Design Cost	$4,352		
D. Total Cost (1A + 1B + 1C)	$81,239		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$14,010	
G. Total Investment (1D-1E-1F)			$67,229

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	368		$5,207	12.02	$62,592
B. Dist		0		$0		$0
C. LPG		0		$0		$0
D. Natural Gas	$4.51	0		$0	14.17	
E. Demand Saved	$127.84	30.0	kW	$3,839	12.02	$46,141
F. Total		368		$9,046		$108,733

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($48)		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			($569)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2 + 3Bd4)	($569)	
4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$8,998	
5. Simple Payback (1G/4):	7.47	Years
6. Total Net Discounted Savings (2F5 + 3C):	$108,164	
7. Savings to Investment Ratio (SIR) (6/1G):	1.61	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Fort Huachuca, Arizona	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements		Fiscal Year FY96
Discrete Portion:	Fixture Retrofit D5 - Reflector and Delamp 4 Lamp F34T12 & F40T12 Fixtures to 3 x F32T8 Lamps and Electronic Ballast		Preparer: KELLER & GANNON
Analysis Date:	January 1995	Economic Life:	15 Years

1. Investment Costs

A. Construction Costs	$50,250		
B. SIOH	$3,015		
C. Design Cost	$3,015		
D. Total Cost (1A + 1B + 1C)	$56,280		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$12,749	
G. Total Investment (1D-1E-1F)			$43,531

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	493		$6,989	12.02	$84,004
B. Dist		0		$0		$0
C. LPG		0		$0		$0
D. Natural Gas	$4.51	0		$0	14.17	
E. Demand Saved	$127.84	49.3	kW	$6,308	12.02	$75,819
F. Total		493		$13,296		$159,823

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$497		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$5,930

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2 + 3Bd4) $5,930

4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$13,793	
5. Simple Payback (1G/4):	3.16	Years
6. Total Net Discounted Savings (2F5 + 3C):	$165,753	
7. Savings to Investment Ratio (SIR) (6/1G):	3.81	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Fort Huachuca, Arizona	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements		Fiscal Year FY96
Discrete Portion:	Fixture Retrofit E1 - Electronic Ballasts for 2 Lamp F48T12HO Fixtures		Preparer: KELLER & GANNON
Analysis Date:	January 1995	Economic Life: 15	Years

1. Investment Costs			
A. Construction Costs	$2,052		
B. SIOH	$123		
C. Design Cost	$123		
D. Total Cost (1A+1B+1C)	$2,299		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$192	
G. Total Investment (1D-1E-1F)			$2,107

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	19		$265	12.02	$3,191
B. Dist		0		$0		$0
C. LPG		0		$0		$0
D. Natural Gas	$4.51	0		$0	14.17	
E. Demand Saved	$127.84	1.6	kW	$202	12.02	$2,434
F. Total		19		$468		$5,625

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$0	
4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$468	
5. Simple Payback (1G/4):	4.50	Years
6. Total Net Discounted Savings (2F5+3C):	$5,625	
7. Savings to Investment Ratio (SIR) (6/1G):	2.67	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Fort Huachuca, Arizona	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements		Fiscal Year FY96
Discrete Portion:	Fixture Retrofit F1 - Electronic Ballasts and T8 Lamps for 2 Lamp F96T12 Fixtures		Preparer: KELLER & GANNON
Analysis Date:	January 1995	Economic Life: 15	Years

1. Investment Costs			
A. Construction Costs	$1,805		
B. SIOH	$108		
C. Design Cost	$108		
D. Total Cost (1A+1B+1C)	$2,022		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$200	
G. Total Investment (1D-1E-1F)			$1,822

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	6.39		$91	12.02	$1,088
B. Dist		0.00		$0		$0
C. LPG		0.00		$0		$0
D. Natural Gas	$4.51	0.00		$0	14.17	
E. Demand Saved	$127.84	0.80	kW	$102	12.02	$1,229
F. Total		6.39		$193		$2,317

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($32)		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			($385)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	($385)	
4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$161	
5. Simple Payback (1G/4):	11.35	Years
6. Total Net Discounted Savings (2F5+3C):	$1,932	
7. Savings to Investment Ratio (SIR) (6/1G):	1.06	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Fort Huachuca, Arizona	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements		Fiscal Year FY96
Discrete Portion:	Fixture Retrofit F2 - Electronic Ballasts and T8 Lamps for 4 Lamp F96T12 Fixtures		Preparer: KELLER & GANNON
Analysis Date:	January 1995	Economic Life: 15 Years	

1. Investment Costs

A. Construction Costs	$181		
B. SIOH	$11		
C. Design Cost	$11		
D. Total Cost (1A+1B+1C)	$202		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$20	
G. Total Investment (1D-1E-1F)			$182

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	0.57		$8	12.02	$97
B. Dist		0.00		$0		$0
C. LPG		0.00		$0		$0
D. Natural Gas	$4.51	0.00		$0	14.17	
E. Demand Saved	$127.84	0.08	kW	$10	12.02	$123
F. Total		0.57		$18		$220

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($3)		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			($33)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	($33)	
4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$16	
5. Simple Payback (1G/4):	11.73	Years
6. Total Net Discounted Savings (2F5+3C):	$187	
7. Savings to Investment Ratio (SIR) (6/1G):	1.03	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Huachuca, Arizona Region No. 4 Project No.
Project Title: ECIP Facility Energy Improvements Fiscal Year FY96
Discrete Portion: Fixture Retrofit G1 - Compact Fluorescent DTT 13W for Downlight Incandescent Lamp Fixtures Preparer: KELLER & GANNON
Analysis Date: January 1995 Economic Life: 15 Years

1. Investment Costs

A. Construction Costs	$42		
B. SIOH	$2		
C. Design Cost	$2		
D. Total Cost (1A+1B+1C)	$47		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$10	
G. Total Investment (1D-1E-1F)			$37

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	0.48		$7	12.02	$81
B. Dist		0.00		$0		$0
C. LPG		0.00		$0		$0
D. Natural Gas	$4.51	0.00		$0	14.17	
E. Demand Saved	$127.84	0.09	kW	$11	12.02	$137
F. Total		0.48		$18		$218

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$7		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$88

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $88

4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$26	
5. Simple Payback (1G/4):	1.44	Years
6. Total Net Discounted Savings (2F5+3C):	$306	
7. Savings to Investment Ratio (SIR) (6/1G):	8.36	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Huachuca, Arizona Region No. 4 Project No.
Project Title: ECIP Facility Energy Improvements Fiscal Year FY96
Discrete Portion: Fixture Retrofit G2 - Compact Fluorescent TRI 20W for Incandescent Lamp Fixtures Preparer: KELLER & GANNON
Analysis Date: January 1995 Economic Life: 15 Years

1. Investment Costs

A. Construction Costs	$87		
B. SIOH	$5		
C. Design Cost	$5		
D. Total Cost (1A+1B+1C)	$97		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$35	
G. Total Investment (1D-1E-1F)			$62

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	15.52		$220	12.02	$2,642
B. Dist		0.00		$0		$0
C. LPG		0.00		$0		$0
D. Natural Gas	$4.51	0.00		$0	14.17	
E. Demand Saved	$127.84	2.37	kW	$303	12.02	$3,642
F. Total		15.52		$523		$6,284

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$278		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$3,313

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $3,313

4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$800	
5. Simple Payback (1G/4):	0.08	Years
6. Total Net Discounted Savings (2F5+3C):	$9,598	
7. Savings to Investment Ratio (SIR) (6/1G):	153.60	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Fort Huachuca, Arizona	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements		Fiscal Year FY96
Discrete Portion:	Fixture Retrofit G3 - Compact Fluorescent TT 7W for Incandescent Lamp Fixtures		Preparer: KELLER & GANNON
Analysis Date:	January 1995	Economic Life: 15	Years

1. Investment Costs			
A. Construction Costs	$1,242		
B. SIOH	$75		
C. Design Cost	$75		
D. Total Cost (1A+1B+1C)	$1,391		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$225	
G. Total Investment (1D-1E-1F)			$1,166

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	15.32		$217	12.02	$2,608
B. Dist		0.00		$0		$0
C. LPG		0.00		$0		$0
D. Natural Gas	$4.51	0.00		$0	14.17	
E. Demand Saved	$127.84	2.36	kW	$302	12.02	$3,630
F. Total		15.32		$519		$6,239

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$246		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$2,936

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$2,936	
4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$765	
5. Simple Payback (1G/4):	1.52	Years
6. Total Net Discounted Savings (2F5+3C):	$9,175	
7. Savings to Investment Ratio (SIR) (6/1G):	7.87	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Fort Huachuca, Arizona	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements		Fiscal Year FY96
Discrete Portion:	Fixture Retrofit G4 - Compact Fluorescent DTT 13W for Ceiling Mounted Incandescent Lamp Fixtures		Preparer: KELLER & GANNON
Analysis Date:	January 1995	Economic Life: 15 Years	

1. Investment Costs			
A. Construction Costs	$988		
B. SIOH	$59		
C. Design Cost	$59		
D. Total Cost (1A + 1B + 1C)	$1,106		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$230	
G. Total Investment (1D-1E-1F)			$876

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	12.92		$183	12.02	$2,201
B. Dist		0.00		$0		$0
C. LPG		0.00		$0		$0
D. Natural Gas	$4.51	0.00		$0	14.17	
E. Demand Saved	$127.84	2.06	kW	$263	12.02	$3,160
F. Total		12.92		$446		$5,360

3. Non Energy Savings (+) or Cost (-):			
A. Annual Recurring (+/-)	$147		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$1,757

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2 + 3Bd4)	$1,757	
4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$593	
5. Simple Payback (1G/4):	1.48	Years
6. Total Net Discounted Savings (2F5 + 3C):	$7,117	
7. Savings to Investment Ratio (SIR) (6/1G):	8.12	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Fort Huachuca, Arizona	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements		Fiscal Year FY96
Discrete Portion:	Fixture Retrofit G5 - Compact Fluorescent TRI 23W for Incandescent Lamp Fixtures		Preparer: KELLER & GANNON
Analysis Date:	January 1995	Economic Life: 15 Years	

1. Investment Costs

A. Construction Costs	$932		
B. SIOH	$56		
C. Design Cost	$56		
D. Total Cost (1A+1B+1C)	$1,044		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$150	
G. Total Investment (1D-1E-1F)			$894

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	16.95		$240	12.02	$2,885
B. Dist		0.00		$0		$0
C. LPG		0.00		$0		$0
D. Natural Gas	$4.51	0.00		$0	14.17	
E. Demand Saved	$127.84	2.31	kW	$295	12.02	$3,550
F. Total		16.95		$535		$6,435

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($88)		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			($1,049)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	($1,049)	
4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$448	
5. Simple Payback (1G/4):	2.00	Years
6. Total Net Discounted Savings (2F5+3C):	$5,386	
7. Savings to Investment Ratio (SIR) (6/1G):	6.02	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Fort Huachuca, Arizona | Region No. 4 | Project No.
Project Title: ECIP Facility Energy Improvements | Fiscal Year FY96
Discrete Portion: Fixture Retrofit H1 - Compact Fluorescent 17W for Incandescent Table Lamps | Preparer: KELLER & GANNON
Analysis Date: January 1995 | Economic Life: 15 Years

1. Investment Costs			
A. Construction Costs	$5,465		
B. SIOH	$328		
C. Design Cost	$328		
D. Total Cost (1A+1B+1C)	$6,121		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$1,245	
G. Total Investment (1D-1E-1F)			$4,876

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	79.81		$1,131	12.02	$13,590
B. Dist		0.00		$0		$0
C. LPG		0.00		$0		$0
D. Natural Gas	$4.51	0.00		$0	14.17	
E. Demand Saved	$127.84	10.71	kW	$1,369	12.02	$16,453
F. Total		79.81		$2,499		$30,043

3. Non Energy Savings (+) or Cost (-):			
A. Annual Recurring (+/-)	$994		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$11,868

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4) $11,868

4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$3,493	
5. Simple Payback (1G/4):	1.40	Years
6. Total Net Discounted Savings (2F5+3C):	$41,911	
7. Savings to Investment Ratio (SIR) (6/1G):	8.60	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Fort Huachuca, Arizona	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements		Fiscal Year FY96
Discrete Portion:	Fixture Retrofit J1 - 150W High Pressure Sodium Lamp and Ballast Retrofit in 250W MV Lamp Fixtures		Preparer: KELLER & GANNON
Analysis Date:	January 1995	Economic Life: 15	Years

1. Investment Costs			
A. Construction Costs	$6,150		
B. SIOH	$369		
C. Design Cost	$369		
D. Total Cost (1A+1B+1C)	$6,888		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$320	
G. Total Investment (1D-1E-1F)			$6,568

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	18.59		$263	12.02	$3,166
B. Dist		0.00		$0		$0
C. LPG		0.00		$0		$0
D. Natural Gas	$4.51	0.00		$0	14.17	
E. Demand Saved	$127.84	3.20	kW	$409	12.02	$4,919
F. Total		18.59		$673		$8,085

3. Non Energy Savings (+) or Cost (-):			
A. Annual Recurring (+/-)	$54		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$639

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$639	
4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$726	
5. Simple Payback (1G/4):	9.05	Years
6. Total Net Discounted Savings (2F5+3C):	$8,724	
7. Savings to Investment Ratio (SIR) (6/1G):	1.33	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Fort Huachuca, Arizona	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements		Fiscal Year FY96
Discrete Portion:	Fixture Retrofit J2 - 200W High Pressure Sodium Lamp and Ballast Retrofit in 400W MV Lamp Fixtures		Preparer: KELLER & GANNON
Analysis Date:	January 1995	Economic Life: 15 Years	

1. Investment Costs			
A. Construction Costs	$8,496		
B. SIOH	$510		
C. Design Cost	$510		
D. Total Cost (1A+1B+1C)	$9,516		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$1,129	
G. Total Investment (1D-1E-1F)			$8,387

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	80.12		$1,135	12.02	$13,643
B. Dist		0.00		$0		$0
C. LPG		0.00		$0		$0
D. Natural Gas	$4.51	0.00		$0	14.17	
E. Demand Saved	$127.84	11.29	kW	$1,443	12.02	$17,342
F. Total		80.12		$2,578		$30,985

3. Non Energy Savings (+) or Cost (-):			
A. Annual Recurring (+/-)	$159		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$1,894

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$1,894	
4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$2,736	
5. Simple Payback (1G/4):	3.06	Years
6. Total Net Discounted Savings (2F5+3C):	$32,880	
7. Savings to Investment Ratio (SIR) (6/1G):	3.92	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Fort Huachuca, Arizona	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements		Fiscal Year FY96
Discrete Portion:	Controls Retrofit K1 - Ceiling Mounted Passive Infrared Occupancy Sensors to Control Lighting		Preparer: KELLER & GANNON
Analysis Date:	January 1995	Economic Life: 15 Years	

1. Investment Costs			
A. Construction Costs	$72,674		
B. SIOH	$4,360		
C. Design Cost	$4,360		
D. Total Cost (1A+1B+1C)	$81,395		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$1,784	
G. Total Investment (1D-1E-1F)			$79,611

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	556		$7,877	12.02	$94,679
B. Dist		0.00		$0		$0
C. LPG		0.00		$0		$0
D. Natural Gas	$4.51	0.00		$0	14.17	
E. Demand Saved	$127.84	0	kW	$0	12.02	$0
F. Total		556		$7,877		$94,679

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$1,676		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$20,007

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$20,007	
4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$9,552	
5. Simple Payback (1G/4):	8.33	Years
6. Total Net Discounted Savings (2F5+3C):	$114,686	
7. Savings to Investment Ratio (SIR) (6/1G):	1.44	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Fort Huachuca, Arizona	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements		Fiscal Year FY96
Discrete Portion:	Controls Retrofit K3 - Wall Switch Type Passive Infrared Type Occupancy Sensors to Control Lighting in Relatively Small Rooms		Preparer: KELLER & GANNON
Analysis Date:	January 1995	Economic Life: 15	Years

1. Investment Costs			
A. Construction Costs	$16,605		
B. SIOH	$996		
C. Design Cost	$996		
D. Total Cost (1A+1B+1C)	$18,597		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$768	
G. Total Investment (1D-1E-1F)			$17,829

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$14.17	119.9		$1,699	12.02	$20,421
B. Dist		0.00		$0		$0
C. LPG		0.00		$0		$0
D. Natural Gas	$4.51	0.00		$0	14.17	
E. Demand Saved	$127.84	0	kW	$0	12.02	$0
F. Total		119.9		$1,699		$20,421

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$416		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$4,972

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$4,972	
4. First Year Dollar Savings (3F3 + 3A + (3Bd1/Economic Life)):	$2,115	
5. Simple Payback (1G/4):	8.43	Years
6. Total Net Discounted Savings (2F5+3C):	$25,393	
7. Savings to Investment Ratio (SIR) (6/1G):	1.42	

CONSTRUCTION COST ESTIMATE					Date Prepared: January 1995		Sheet: 1 of 6
Project: ECIP Facility Energy Improvements					Project No.		Basis for Estimate
Location: Fort Huachuca, Arizona							Code A (no design competed)
Engineer-Architect: Keller & Gannon							
Drawing No.: **Lighting ECO Unit Costs**			Estimator: **BIH**			Checked By: **RCL**	
Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
A. Exit Light LED Retrofit							
LED Retrofit Kit: 120V=6240-01-381-1957; or LED Retrofit Kit: 277V=6240-01-381-2061	1	EA	$5.29	$5.29	$31.50	$31.50	$36.79
Arizona Transaction Privilege Tax	3.75%	%		-		$1.18	$1.18
Subtotal							$37.97
Contractor OH & Profit	25.0%	%					$9.49
Subtotal							$47.46
Bond	1.5%	%					$0.71
Subtotal							$48.17
Estimating Contingency	10.0%	%					$4.82
Total Probable Construction Cost	**Not including $9.00 rebate per fixture**						**$52.99**
B2. F30T12, 2 Lamp Fixtures: Replace Existing Lamps and Ballasts							
Electronic Ballast:120V=6250-01-377-6272; or Electronic Ballast:277V=6250-01-378-8760 or Equal	1	EA	$5.29	$5.29	$20.00	$20.00	$25.29
Lamps: F25T8 Philips 32298-2	2	EA	Included		$4.22	$8.43	$8.43
Subtotal				$5.29		$28.43	$33.72
Arizona Transaction Privilege Tax	3.75%	%		-		$1.07	$1.07
Subtotal							$34.78
Contractor OH & Profit	25.0%	%					$8.70
Subtotal							$43.48
Bond	1.5%	%					$0.65
Subtotal							$44.13
Estimating Contingency	10.0%	%					$4.41
Total Probable Construction Cost	**Not including $10.00 rebate per fixture**						**$48.54**
D1. F34T12 & F40T12, 1 Lamp Fixtures: Replace Lamps and Ballasts							
Electronic Ballast: 6250-01-353-7722	1	EA	$4.70	$4.70	$25.00	$25.00	$29.70
F32T8 Lamp: 6240-01-344-9943 or 9508	1	EA	Included		$2.83	$2.83	$2.83
Subtotal				$4.70		$27.83	$32.53
Arizona Transaction Privilege Tax	3.75%	%		-		$1.04	$1.04
Subtotal							$33.57
Contractor OH & Profit	25.0%	%					$8.39
Subtotal							$41.97
Bond	1.5%	%					$0.63
Subtotal							$42.60
Estimating Contingency	10.0%	%					$4.26
Total Probable Construction Cost	**Not including $9.00 rebate per fixture**						**$46.86**

Note: Labor costs are based on a prime contractor rate of $21.15/hour including burden for electricians.

CONSTRUCTION COST ESTIMATE					Date Prepared: January 1995		Sheet: 2 of 6
Project: ECIP Facility Energy Improvements					Project No.		Basis for Estimate
Location: Fort Huachuca, Arizona							Code A (no design competed)
Engineer-Architect: Keller & Gannon							
Drawing No.: **Lighting ECO Unit Costs**			Estimator: **BIH**			Checked By: **RCL**	
Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
D2. F34T12 & F40T12, 2 Lamp Fixtures: Replace Lamps and Ballasts							
Electronic Ballast:120V=6250-01-379-1917; or Electronic Ballast:277V=6250-01-379-3041	1	EA	$5.29	$5.29	$25.00	$25.00	$30.29
F32T8 Lamp: 6240-01-344-9943 or 9508	2	EA	Included		$2.83	$5.66	$5.66
Subtotal				$5.29		$30.66	$35.95
Arizona Transaction Privilege Tax	3.75%	%		-		$1.15	$1.15
Subtotal							$37.10
Contractor OH & Profit	25.0%	%					$9.27
Subtotal							$46.37
Bond	1.5%	%					$0.70
Subtotal							$47.07
Estimating Contingency	10.0%	%					$4.71
Total Probable Construction Cost	**Not including $10.00 rebate per fixture**						**$51.77**
D5. F34T12 & F40T12, 4 Lamp Fixtures: Delamp to 3 Lamps and Ballasts							
Electronic Ballast:120V=6250-01-364-2997; or 277V=6250-01-364-2998	1	EA	$7.05	$7.05	$36.44	$36.44	$43.49
F32T8 Lamp: 6240-01-344-9943 or 9508	3	EA	Included		$2.83	$8.49	$8.49
Reflector Retrofit for Delamping: R302-348T8 SSB 2'x4' for 3xF32T8	1	EA	$4.23	$4.23	$49.00	$49.00	$53.23
Subtotal				$7.05		$44.93	$51.98
Arizona Transaction Privilege Tax	3.75%	%		-		$1.68	$1.68
Subtotal							$53.66
Contractor OH & Profit	25.0%	%					$13.41
Subtotal							$67.07
Bond	1.5%	%					$1.01
Subtotal							$68.08
Estimating Contingency	10.0%	%					$6.81
Total Probable Construction Cost	**Not including $19.00 rebate per fixture**						**$74.89**
E1. F48T12HO, 2 Lamp Fixtures: Replace Existing Ballasts with Electronic Ballasts							
or Electronic Ballast: 277V=6250-01-383-4540	1	EA	$4.70	$4.70	$25.00	$25.00	$29.70
Subtotal				$4.70		$25.00	$29.70
Arizona Transaction Privilege Tax	3.75%	%		-		$0.94	$0.94
Subtotal							$30.64
Contractor OH & Profit	25.0%	%					$7.66
Subtotal							$38.30
Bond	1.5%	%					$0.57
Subtotal							$38.87
Estimating Contingency	10.0%	%					$3.89
Total Probable Construction Cost	**Not including $4.00 rebate per fixture**						**$42.76**

Note: Labor costs are based on a prime contractor rate of $21.15/hour including burden for electricians.

CONSTRUCTION COST ESTIMATE					Date Prepared: January 1995		Sheet: 3 of 6
Project: ECIP Facility Energy Improvements					Project No.		Basis for Estimate
Location: Fort Huachuca, Arizona							Code A (no design competed)
Engineer-Architect: Keller & Gannon							
Drawing No.: **Lighting ECO Unit Costs**			Estimator: **BIH**			Checked By: **RCL**	
Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
F1. F96T12, 2 Lamp Fixtures: Replace Lamps and Ballasts							
Electronic Ballast:120V=6250-01-377-7376; or:277V=6250-01-381-4453	1	EA	$7.05	$7.05	$35.00	$35.00	$42.05
F96T8 Lamp: 120V=6240-01-382-0105; or: 277V=6240-01-382-0108	2	EA	Included		$10.28	$20.55	$20.55
Subtotal				$7.05		$55.55	$62.60
Arizona Transaction Privilege Tax	3.75%	%		-		$2.08	$2.08
Subtotal							$64.68
Contractor OH & Profit	25.0%	%					$16.17
Subtotal							$80.85
Bond	1.5%	%					$1.21
Subtotal							$82.07
Estimating Contingency	10.0%	%					$8.21
Total Probable Construction Cost	**Not including $10.00 rebate per fixture**						**$90.27**
F2. F96T12, 4 Lamp Fixtures: Replace Lamps and Ballasts							
Electronic Ballast: Same as above	2	EA	$7.05	$14.10	$35.00	$70.00	$84.10
F96T8 Lamp: Same as above	4	EA	Included		$10.28	$41.10	$41.10
Subtotal				$14.10		$111.10	$125.20
Arizona Transaction Privilege Tax	3.75%	%		-		$4.17	$4.17
Subtotal							$129.37
Contractor OH & Profit	25.0%	%					$32.34
Subtotal							$161.71
Bond	1.5%	%					$2.43
Subtotal							$164.14
Estimating Contingency	10.0%	%					$16.41
Total Probable Construction Cost	**Not including $20.00 rebate per fixture**						**$180.55**
G1. Incandescent 60W Downlight: Replace Lamp with Compact Fluorescent Lamp							
Adaptor Base: 6250-01-381-6840	1	EA	$1.76	$1.76	$5.79	$5.79	$7.55
DTT 13W, 2700K CRI 82 Compact Fluorescent Lamp: 6240-01-345-2252	1	EA	$1.76	$1.76	$5.19	$5.19	$6.95
Subtotal				$3.53		$10.98	$14.50
Arizona Transaction Privilege Tax	3.75%	%		-		$0.41	$0.41
Subtotal			**Not an ECIP Project**				$14.91
Contractor OH & Profit	25.0%	%	Replacements are Screw-In, **or**				$3.73
Subtotal			Fixture modifying "Permatwist"				$18.64
Bond	1.5%	%	fittings are available at similar cost				$0.28
Subtotal			for ECIP Projects				$18.92
Estimating Contingency	10.0%	%					$1.89
Total Probable Construction Cost	**Not including $5.00 rebate per fixture**						**$20.81**

Note: Labor costs are based on a prime contractor rate of $21.15/hour including burden for electricians.

CONSTRUCTION COST ESTIMATE					Date Prepared: January 1995		Sheet: 4 of 6
Project: ECIP Facility Energy Improvements				Project No.	Basis for Estimate: Code A (no design competed)		
Location: Fort Huachuca, Arizona							
Engineer-Architect: Keller & Gannon							
Drawing No.: **Lighting ECO Unit Costs**		Estimator: **BIH**			Checked By: **RCL**		
Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
G2. Incandescent 75W Downlight: Replace Lamp with Compact Fluorescent Lamp							
TRI 20W, 2700K CRI 82 Compact Fluor. Lamp / Adaptor: 6240-01-345-2252	1	EA	$3.53	$3.53	$5.19	$5.19	$8.72
Subtotal				$3.53		$5.19	$8.72
Arizona Transaction Privilege Tax	3.75%	%		-		$0.19	$0.19
Subtotal			**Not an ECIP Project**				$8.91
Contractor OH & Profit	25.0%	%	Replacements are Screw-In, **or**				$2.23
Subtotal			Fixture modifying "Permatwist"				$11.14
Bond	1.5%	%	fittings are available at similar cost				$0.17
Subtotal			for ECIP Projects				$11.30
Estimating Contingency	10.0%	%					$1.13
Total Probable Construction Cost	**Not including $5.00 rebate per fixture**						**$12.43**
G3. Incand. 40W Ceiling or Wall-Mount Fixture: Replacement Compact Fluorescent							
Adaptor Base: 6250-01-381-7189	1	EA	$1.76	$1.76	$5.55	$5.55	$7.32
TT 7W, 4100K CRI 85 Compact Fluorescent Lamp: 6240-01-352-0434	1	EA	$1.76	$1.76	$2.49	$2.49	$4.25
Subtotal				$3.53		$8.04	$11.57
Arizona Transaction Privilege Tax	3.75%	%		-		$0.30	$0.30
Subtotal			**Not an ECIP Project**				$11.87
Contractor OH & Profit	25.0%	%	Replacements are Screw-In, **or**				$2.97
Subtotal			Fixture modifying "Permatwist"				$14.84
Bond	1.5%	%	fittings are available at similar cost				$0.22
Subtotal			for ECIP Projects				$15.06
Estimating Contingency	10.0%	%					$1.51
Total Probable Construction Cost	**Not including $3.00 rebate per fixture**						**$16.57**
G4. Incand. 60W Ceiling or Wall-Mount Fixture: Replacement Compact Fluorescent							
Adaptor Base: 6250-01-381-6840	1	EA	$1.76	$1.76	$5.55	$5.55	$7.32
DTT 13W, 3500K CRI 82 Compact Fluorescent Lamp: 6240-01-352-0438	1	EA	$1.76	$1.76	$5.88	$5.88	$7.64
Subtotal				$3.53		$11.43	$14.96
Arizona Transaction Privilege Tax	3.75%	%		-		$0.43	$0.43
Subtotal			**Not an ECIP Project**				$15.39
Contractor OH & Profit	25.0%	%	Replacements are Screw-In, **or**				$3.85
Subtotal			Fixture modifying "Permatwist"				$19.23
Bond	1.5%	%	fittings are available at similar cost				$0.29
Subtotal			for ECIP Projects				$19.52
Estimating Contingency	10.0%	%					$1.95
Total Probable Construction Cost	**Not including $5.00 rebate per fixture**						**$21.47**

Note: Labor costs are based on a prime contractor rate of $21.15/hour including burden for electricians.

CONSTRUCTION COST ESTIMATE					Date Prepared: January 1995		Sheet: 5 of 6
Project: ECIP Facility Energy Improvements					Project No.		Basis for Estimate: Code A (no design competed)
Location: Fort Huachuca, Arizona							
Engineer-Architect: Keller & Gannon							
Drawing No.: **Lighting ECO Unit Costs**			Estimator: **BIH**			Checked By: **RCL**	
Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
G5. Incandescent 100W Ceiling Fixture: Replace Lamp with Compact Fluorescent							
TRI 23W, 2700K CRI 82 Compact Fluor. Lamp / Adaptor: 6240-01-367-5734	1	EA	$3.53	$3.53	$18.07	$18.07	$21.59
Subtotal				$3.53		$18.07	$21.59
Arizona Transaction Privilege Tax	3.75%	%		-		$0.68	$0.68
Subtotal			**Not an ECIP Project**				$22.27
Contractor OH & Profit	25.0%	%	Replacements are Screw-In, **or**				$5.57
Subtotal			Fixture modifying "Permatwist"				$27.84
Bond	1.5%	%	fittings are available at similar cost				$0.42
Subtotal			for ECIP Projects				$28.26
Estimating Contingency	10.0%	%					$2.83
Total Probable Construction Cost	**Not including $5.00 rebate per fixture**						**$31.08**
H1. Incandescent 60W & 75W Table Lamps: Replacement Compact Fluorescents							
17W Compact Fluorescent Covered Lamp: 6240-01-368-6966	1	EA	$3.53	$3.53	$11.76	$11.76	$15.29
Subtotal				$3.53		$11.76	$15.29
Arizona Transaction Privilege Tax	3.75%	%		-		$0.44	$0.44
Subtotal			**Not an ECIP Project**				$15.73
Contractor OH & Profit	25.0%	%	Replacements are Screw-In, **or**				$3.93
Subtotal			Fixture modifying "Permatwist"				$19.66
Bond	1.5%	%	fittings are available at similar cost				$0.29
Subtotal			for ECIP Projects				$19.95
Estimating Contingency	10.0%	%					$2.00
Total Probable Construction Cost	**Not including $5.00 rebate per fixture**						**$21.95**
J1. 250W MV Pendant-Mount Fixture: Replace Lamp & Ballast with HPS							
Ballast, 150W S-55: 6250-01-352-8004	1	EA	$19.04	$19.04	$91.34	$91.34	$110.38
HPS Lamp 150W ANSI S-55 B-17 Coated: 6240-01-142-8452	1	EA	$6.35	$6.35	$12.91	$12.91	$19.26
Subtotal				$25.38		$104.25	$129.63
Arizona Transaction Privilege Tax	3.75%	%		-		$3.91	$3.91
Subtotal							$133.54
Contractor OH & Profit	25.0%	%					$33.38
Subtotal							$166.92
Bond	1.5%	%					$2.50
Subtotal							$169.43
Estimating Contingency	10.0%	%					$16.94
Total Probable Construction Cost	**Less $100 rebate per kW saved.**						**$186.37**

Note: Labor costs are based on a prime contractor rate of $21.15/hour including burden for electricians.

CONSTRUCTION COST ESTIMATE					Date Prepared: January 1995		Sheet: 6 of 6
Project: ECIP Facility Energy Improvements					Project No.		Basis for Estimate: Code A (no design competed)
Location: Fort Huachuca, Arizona							
Engineer-Architect: Keller & Gannon							
Drawing No.: **Lighting ECO Unit Costs**			Estimator: **BIH**			Checked By: **RCL**	
Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
J2. 400W MV Pendant-Mount Fixture: Replace Lamp & Ballast with HPS							
Ballast, 200W S-66: 6250-01-348-5325	1	EA	$19.46	$19.46	$67.35	$67.35	$86.81
HPS Lamp 200W ANSI S-66 ED-18 Coated: 6240-01-178-9113	1	EA	$6.35	$6.35	$16.44	$16.44	$22.79
Subtotal				$25.80		$83.79	$109.59
Arizona Transaction Privilege Tax	3.75%	%		-		$3.14	$3.14
Subtotal							$112.74
Contractor OH & Profit	25.0%	%					$28.18
Subtotal							$140.92
Bond	1.5%	%					$2.11
Subtotal							$143.03
Estimating Contingency	10.0%	%					$14.30
Total Probable Construction Cost	**Less $100 rebate per kW saved.**						**$157.34**
K1. Occupancy Sensor Control: Ceiling Mounted PIR Sensor							
Occupancy Sensor: PIR or Ultra Sonic	1	EA	$24.17	$24.17	$86.00	$86.00	$110.17
Sensor Transformer Pack	1	EA	$16.92	$16.92	$30.00	$30.00	$46.92
Wiremold Raceway & 3/C #18 Wire	25	LF	$1.58	$39.57	$0.65	$16.25	$55.82
Subtotal				$39.57		$132.25	$212.92
Arizona Transaction Privilege Tax	3.75%	%		-		$4.96	$4.96
Subtotal							$217.88
Contractor OH & Profit	25.0%	%					$54.47
Subtotal							$272.35
Bond	1.5%	%					$4.09
Subtotal							$276.43
Estimating Contingency	10.0%	%					$27.64
Total Probable Construction Cost (not including rebates)	**For 2 to 4 Fixtures $4.00 rebate per sensor** **For 5+ Fixtures $8.00 rebate per sensor**						**$304.07**
K3. Occupancy Sensor Control: Automatic Wall Switch PIR Sensor							
Occupancy Sensor: PIR or Ultra Sonic	1	EA	$7.04	$7.04	$64.00	$64.00	$71.04
Subtotal				$7.04		$64.00	$71.04
Arizona Transaction Privilege Tax	3.75%	%		-		$2.40	$2.40
Subtotal							$73.44
Contractor OH & Profit	25.0%	%					$18.36
Subtotal							$91.80
Bond	1.5%	%					$1.38
Subtotal							$93.18
Estimating Contingency	10.0%	%					$9.32
Total Probable Construction Cost (not including rebates)	**For 2 to 4 Fixtures $4.00 rebate per sensor** **For 5+ Fixtures $8.00 rebate per sensor**						**$102.50**

Note: Labor costs are based on a prime contractor rate of $21.15/hour including burden for electricians.