FORT BLISS HEADQUARTERS

BUILDING

LIGHTING RETROFIT

Fort Bliss

El Paso, Texas

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

February, 1993

Prepared by:

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Marie Wakefield,
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ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP) for FORT BLISS HEADQUARTERS BUILDING

Fort Bliss
El Paso, Texas

I. NARRATIVE

A. Purpose

The purpose of this study is to analyze the use of high efficiency fluorescent lighting with energy efficient lamps and electronic ballast for the Headquarters Building (Bldg. #2) at Fort Bliss.

This report is prepared in accordance with the detailed scope of work Contract No. DACA63-91-D-0048, Delivery Order 0005. (See Appendix E for complete Scope of Work). The blast Life Cycle Cost in Design (LCCID) program with the ECIP option was used to determine the Life Cycle Cost (LCC) and Savings to Investment Ratio (SIR) for the analyzed retrofit for a 25 year study life.

B. Facility Description

This project consists of the Headquarters Building (Bldg. #2), which contains five wings with areas as follows:

Wing	Square Feet
A	46,595
B	15,487
C	66,570
D	66,570
E	66,570

This facility is generally three stories and includes general office space and a large auditorium.

C. Design Criteria

The following average maintained illumination levels taken from Table C-4 of the Corps of Engineers Standard Detail No. 40-06-04, dated February, 1991 and from the IES Lighting Handbook were used for this analysis:

Functional Areas	Footcandles
Offices	50
Cafeteria/Snack Bars	25
Toilets	20
Stairways	20
Corridors	10

D. Analysis of Energy Conservation Opportunities (ECO'S)

1. Existing Lighting

Ninety-five percent (95%) of the existing lighting for this facility remains as originally constructed in 1953. Previous retrofits have been performed on Rooms 68, 70, 265, and 266 in Wing D and Room 31 in Wing A. The existing lighting fixture types as well as the number of existing fixtures are tabulated and included in Appendix A and a general description of each is listed below.

a. Type A Fixture

The Type A fixture is a 1'x8', finned metal fixture with two (2) - 8' F96T12/SL lamps and a magnetic ballast. This fixture consumes 252 watts per ANSI C82.2-84 method of measurement. The coefficient of utilization for these fixtures is low in comparison to fixtures currently available. These fixtures are currently installed in the classrooms and office areas. The fixtures are surface mounted on the ceiling at approximately 12 feet above the floor.

b. Type B Fixture

The Type B fixture is utilized primarily in the corridors. The Type B fixture is similar to the Type A except it is four (4) feet in length and contains two (2) - 4' F40T12 CW lamps and a magnetic ballast. This fixture consumes 96 watts. These fixtures are bracket mounted approximately 8 feet above the floor.

c. Type C Fixture

The Type C fixture is utilized in the classrooms for lighting the chalkboard/map areas. The Type C fixture is a 4' fluorescent strip fixture with one (1) F40T12 CW lamp and a magnetic ballast. This fixture consumes 48 watts. These fixtures are surface mounted in a cove approximately 8 feet above the floor.

d. Type D Fixture

The Type D fixture is a round surface mounted incandescent fixture with two (2) 75 watt incandescent lamps and is primarily used in the stairway and toilet areas.

e. Type E Fixture

The Type E fixture is a round surface mounted incandescent fixture with two (2) 50 watt incandescent lamps and is primarily used in the stairway and toilet areas.

f. Type F Fixture

The Type F fixture is a pendant mounted incandescent fixture with one (1) 300 watt incandescent lamp and is primarily used in the supply areas, equipment areas, and a few offices.

g. Type G Fixture

The Type G fixture is a round surface mounted incandescent fixture with one (1) 100 watt incandescent lamps and is primarily used in the stairway and toilet areas.

h. Type H Fixture

The Type H fixture is a round surface mounted incandescent fixture with three (3) 75 watt incandescent lamps and is primarily used in the toilet areas.

i. Type J Fixture

The Type J fixture is a porcelain lampholder fixture and is utilized primarily in the washer units and has limited operating hours. For this reason, Type J fixtures are not recommended for retrofit consideration.

j. Type K Fixture

The Type K fixture is a concealed standard exterior outlet box with one (1) 100 watt incandescent lamps and is primarily used on the exterior of the building at the entrances.

k. Types L through R Fixtures

Type L through R fixtures are used primarily in the auditorium area. Due to the limited use of the auditorium, location of fixtures and the expense of retrofit due to the scaffolding required, this area is not recommended for retrofit.

l. Types XA and XB Fixtures

These incandescent exit light fixtures contain one (1) 25 watt lamp and are located at all of the building exits.

m. Previous Lighting Retrofits

(1) Wing A - Room 31

This room has had a see-through grid lay-in ceiling installed with six 8 foot, 4-lamp, fluorescent, surface mounted fixtures mounted on the ceiling. These fixtures consume 504 watts.

(2) Wing D - Rooms 68 and 70

These rooms consist of a lounge and a snack bar and have undergone a previous lighting retrofit. This retrofit

resulted in installing a lay-in ceiling and installing sixty-four 75-watt, incandescent, recessed "canned" lights.

(3) Wing D - Rooms 265 and 266

These rooms consist of an open office and a classroom, which has a lay-in ceiling and eighteen 2 x 4, 4-Lamp, fluorescent fixtures. These fixtures consume 192 watts. The resulting illumination level measured was 140 footcandles which far exceeds the 50 footcandle requirement for these rooms.

2. Proposed Retrofit Lighting

a. Type A Fixture

The proposed replacement for these fixtures is a wide body, 1'x8' wraparound fixture (similar to Lithonia Model No. 8T2LB240) with four (4) F40T12/RS/SS lamps in tandem and an electronic ballast (similar to a Valmont Opti-Miser ballast). This new fixture would only consume 116 watts and would be suspended at 10 feet above the floor.

The energy savings calculation for this fixture is shown in detail below. For all remaining fixture types, refer to the calculations listed in Appendix A.

Total Number of Fixtures = 1,328

$$\textit{Savings per Fixture} = 252 - 116 = 136 \textit{ watts}$$

$$\textit{KW Savings} = 1{,}328 \textit{ Fixtures} \times \frac{136 \textit{ watts}}{\textit{Fixture}} \times \frac{1 \textit{ KW}}{1{,}000 \textit{ watts}} = 180.6 \textit{ KW}$$

$$\textit{Demand Savings} = 180.6 \textit{ kW} \times \$21.50/\textit{KW} \times 12 \textit{ months/yr.} = \$46{,}597/\textit{yr.}$$

KWH Savings - 180.6 *KW x 9 hrs./day x 5 days/wk. x 50 wks./yr.* - 406,350 *KWH*

Usage Savings - 406,350 *KWH/yr. x* .0076 *$/KWH* - $3,088/*yr.*

Total Savings - Demand Savings + Usage Savings

Total Savings - $49,685/*yr.*

b. Type B Fixture

The proposed replacement for these fixtures is a wide body, 1'x4' wrap around fixture (similar to Lithonia Model No. 2LB 240) with two (2) F40T12/RS/SS lamps and an electronic ballast (similar to Valmont Opti-Miser ballast). This new fixture would consume 74 watts versus 96 watts for the existing fixture. This fixture would be surface mounted similar to the existing fixtures.

c. Type C Fixture

The proposed replacement for these fixtures is a single lamp, 4' fluorescent strip fixture (similar to Lithonia Model No. AS40) with one (1) F40T12/RS/SS lamp and an electronic ballast (similar to Valmont Opti-Miser ballast). This new fixture would consume 29 watts versus 48 watts for the existing fixture. This fixture would be surface mounted similar to the existing fixtures.

d. Type D Fixture

The proposed replacement for these fixtures is the 2-lamp wrap around surface mounted fixture proposed for replacement of Fixture Type B with the same lamps and ballast. This fixture would result in an increase in illumination levels, while reducing the electrical consumption by 76 watts/fixture.

e. Type E Fixture

The proposed replacement for these fixtures is the 2-lamp wrap around surface mounted fixture proposed for replacement of Fixture Type B with the same lamps and ballast types. This fixture would result in an increase in illumination levels, while reducing the electrical consumption by 26 watts/fixture.

f. Type F Fixture

The proposed replacement for these fixtures is the 2-lamp wrap around surface mounted fixture proposed for replacement of Fixture Type B with the same lamps and ballast types. This fixture would result in an increase in illumination levels, while reducing the electrical consumption by 226 watts/fixture.

g. Type G Fixture

The proposed replacement for these fixtures is the 2-lamp wrap around surface mounted fixture proposed for replacement of Fixture Type B with the same lamps and ballast types. This fixture would result in an increase in illumination levels, while reducing the electrical consumption by 26 watts/fixture.

h. Type H Fixture

The proposed replacement for these fixtures is the 2-lamp wrap around surface mounted fixture proposed for replacement of Fixture Type B with the same lamps and ballast types. This fixture would result in an increase in illumination levels, while reducing the electrical consumption by 151 watts/fixture.

i. Type K Fixture

The proposed replacement for the Type K fixture is replacing the 100 watt incandescent fixture with a 35 watt low pressure sodium fixture. The resulting savings would be 65 watts/fixture.

j. Types XA and XB Fixtures

The proposed replacement for these fixtures is an exit light (similar to Lithonia's Titan Series) with one (1) F7TT lamp. This fixture would result in savings of 16 watts/fixture.

k. Previous Lighting Retrofits

(1) Wing A - Room 31

The proposed retrofit lighting for this area is a 4-lamp lay-in fixture with F40T12/RS/SS lamps and an electronic ballast (Similar to Valmont's Opti-Miser). The resulting electrical demand savings for Room 31 is 1,864 watts.

(2) Wing D - Rooms 68 and 70

The proposed retrofit lighting for this area is a 4-lamp lay-in fixture with F40T12/RS/SS lamps and an electronic ballast (Similar to Valmont's Opit-Miser). The resulting electrical demand savings for these two rooms is 3,408 watts.

(3) Wing D - Rooms 265 and 266

The proposed retrofit lighting for this area is a 4-lamp lay-in fixture with F40T12/RS/SS lamps and an electronic ballast (Similar to Valmont's Opti-Miser). The resulting electrical demand savings for these two rooms is 2,296 watts.

E. Methodology

1. Calculations of the illumination levels for typical areas with the existing and retrofit fixtures were calculated using the zonal cavity approach to ensure that they meet or exceed the requirements of the Corps of Engineers Standard Detail No. 40-06-04 and the IES Lighting Handbook. These calculations are included in Appendix B.

2. The life cycle economic feasibility was calculated using the blast, Life Cycle Cost in Design (LCCID) program using the energy consumption calculated and included in Appendix F. Data sources for the LCCID feasibility study are as follows:

a. Construction Cost Estimate

The lighting probable construction cost estimates for the Headquarters Building area as follows:

	Investment
Existing Lighting	- 0 -
Retrofit Lighting	$387,942

Refer to Appendix B for the detailed probable cost estimate.

b. Replacement/Maintenance Cost Estimate

Existing System	$5,225/year
Retrofit System	$4,355/year*

** Begins after retrofit is in operation for 5 years due to all new lamps and ballasts.*

See Appendix C for calculations.

c. Final Salvage Value

The final salvage value for both systems is assumed to be $0.00.

d. Utility Rates

Electricity	Utility Cost	Site Cost
Demand	$21.50/KW	---
Usage	$.00764/KWH	$2.24/MBTU

The site cost was furnished by El Paso Electric and is extracted from the military reservation rate schedule attached in Appendix A. The site cost was obtained using a conversion factor of .003413 MBTU/KWH.

e. Refer to Appendix F for the ECIP Life Cycle Cost Analysis Summary calculations.

f. Conclusions

The lighting retrofit proposed in this study consisting of new light fixtures with energy saving lamps and electronic ballast is the recommended system. The retrofit system results in a discounted payback period of 6.6 years, a savings to investment ration (SIR) of 1.71 and an Adjusted Internal Rate of Return (AIRR) of 7.8% This retrofit will improve the lighting levels, save energy and will update the interior of the facility.

F. Criteria

1. ANSI C82.2-84
   Fluorescent Lamp Ballasts -
   Methods of Measurment

2. OCE Architectural and Engineering
   Instructions Design Criteria
   November 20, 1990

3. Memorandum CEHSC-FU-M
   Energy Conservation Investment Program (ECIP)
   Guidance
   November 4, 1992

4. TM 5-802-1
   Economic Studies for Military construction Design Applications
   December 1986

APPENDIX A - Utility Rate Schedules

EL PASO ELECTRIC COMPANY

SCHEDULE NO. 31
MILITARY RESERVATION SERVICE RATE

APPLICABILITY

Available to United States Army for Fort Bliss Main Post Area for a minimum contract capacity of 10,000 kilowatts. All service will be taken at the point of delivery designated by the Company.

TERRITORY

El Paso County, Texas

TYPE OF SERVICE

Service will be alternating current 60 hertz, three phase at the transmission voltage of 115,000 volts.

MONTHLY RATE

Demand Charge

$21.50 per kilowatt for the first 10,000 kilowatts or less of Demand ( )

$21.50 per kilowatt for all additional kilowatts of Demand ( )

Energy Charge

$0.00764 per kilowatt-hour for all kilowatt-hours ( )

MONTHLY MINIMUM

Demand charge for the Minimum Contract Capacity of 10,000 kilowatts or the applicable minimum demand charge, whichever is greater.

DETERMINATION OF DEMAND

Maximum demand will be defined as the highest measured thirty (30) minute average kilowatt load determined by measurement. The measured demand will be adjusted for billing when the metering adjustment clause is applicable. (T)

The demand used for billing shall never be less than 75% of the highest measured on-peak demand (adjusted for metering adjustment) established during billing months May through October in the twelve (12) month period ending with the current month, nor less than the minimum contract capacity, whichever is greater. The exception to this will occur when the 1/2 on-peak - 1/2 off-peak provision is invoked. At that time, the measured billing demand shall be used for the purpose of this paragraph.

When the demand established during the off-peak period exceeds the demand established during the on-peak period, the demand used for billing will be 1/2 the on-peak period demand plus 1/2 the off-peak period demand.

On-peak period shall be from 10:00 A.M. to 8:00 P.M. Mountain Standard Time for weekdays of Monday through Friday. Off-peak period shall be all other hours of the week not covered in the on-peak period.

EL PASO ELECTRIC COMPANY

SCHEDULE NO. 31
MILITARY RESERVATION SERVICE RATE

RATING PERIOD SELECTION OPTION

Upon written request by the customer and approval by the Company, a customer may shift his 10-hour peak period for billing purposes by two (2) hours around the normally defined on-peak period. The customer may exercise this option twice during a twelve (12) month billing period.

METERED ADJUSTMENT

A. El Paso Electric Company metering equipment is installed on the low voltage (14.4 KV) side of substation transformation, therefore, for billing purposes, (1) the metered kilowatt demands shall be increased by 1.035% and (2) the metered kilowatt-hour usages shall be increased by 0.825%. For purposes of this adjustment, the Ben Milam School kilowatt demand and kilowatt-hour usage shall be subtracted from the Fort Bliss kilowatt demand and kilowatt-hour usage before the adjustment.

B. Ben Milam School. Ben Milam School is located within the Fort Bliss Military Reservation but is a school of the El Paso Independent School District. Presently, Ben Milam School is serviced through Fort Bliss facilities. To compensate Fort Bliss for this usage, El Paso Electric Company shall deduct from Fort Bliss' demand billing Ben Milam's actual measured demand and energy each month.

POWER FACTOR ADJUSTMENT

If the power factor at the time of the highest measured thirty (30) minute interval kilowatt demand for the entire plant is below 90% lagging, a charge of $0.0700 per KVAR will be made for each KVAR by which customer's computed KVAR demand exceeds 48.432% of the measured kilowatt demand. If the power factor is greater than or equal to 90%, then no power factor adjustment will be made. (T)

FIXED FUEL FACTOR

The above rates are subject to the provisions of Company's Tariff Schedule No. 98 entitled Fixed Fuel Factor.

TERMS OF PAYMENT

The due date of the bill for utility service shall not be less than sixteen (16) days after issuance. A bill becomes delinquent if not received at the Company by the due date.

TERMS AND CONDITIONS

The Company's Rules and Regulations apply to service under this schedule. The Term of Contract under this schedule shall not be less than ten (10) years.

PUBLIC UTILITY COMMISSION OF TEXAS
APPROVED
MAR 09 '92 DOCKET 9945
CONTROL # 10963
TARIFF CLERK

El Paso Electric Company
P.O. Box 982
El Paso, Texas 79960
(915) 543-5711

January 20, 1993

Mr. Scott Clark
Carter & Burgess Engineering
1100 Macon St.
Ft. Worth, Texas 76102

Dear Scott:

As of the present time, El Paso Electric Company does not have any firm rebate programs in place with the exception of Thermal Energy Storage.

Presently, there are incentive (rebate) programs being developed by El Paso Electric Company and we should have more specifics on these around April, 1993. These rebates may be customized towards energy efficient lighting and energy efficient motors for example.

As soon as more details and specifics are known I will be happy to pass them on to you. But for now, T.E.S. is the only incentive program being offered by El Paso Electric Company.

I hope that the enclosed materials will satisfy your needs. If you should have any further questions please feel free to call me at (915) 543-5809.

Sincerely,

John D. Armstrong

John D. Armstrong
Commercial Utilization Specialist

Southern Union Gas

Requested Transmittal Time: _____

Transmitted by: _____

Date Aug 14 1992

GASFAX

To: Scott Chesl.

Company/Region: _____

FAX No. 817-877-5646. Phone No. _____

From: John Ruiz

Message:

Rate Schedule 1A. Cost of gas adj is expected to increase by .01 next month or 10¢/MCF.

This facsimile consists of 4 pages including this form letter.
If you do not receive all the pages of this transmission, PLEASE CONTACT OUR TELECOPIER OPERATOR IMMEDIATELY.

Southern Union Gas
West Texas Region – El Paso
P. O. Box 2040
El Paso, TX 79976–2040
(915) 544-6300
FAX: (915) 521-4560

SOUTHERN UNION GAS COMPANY
Rate Sheet EL PASO, TEXAS

SERVICE AREA _____

ORM 792-701 8-76

Texas Tariff - West Texas
Section 3
Rate Schedule No. E5

FORT BLISS RATE

APPLICABILITY

Applicable to the United States Government for all purposes at Fort Bliss, William Beaumont General Hospital, Biggs Field, Logan Heights, The First Cavalry Brigade Area, the Station Hospital, Permanent Troop Housing and Supporting Facilities and AFF Board No. 4 and Guided Missile Group and Training Facilities located east of Jeb Stuart Road.

RATE

During each monthly billing period the sum of items 1 and 2 below:

1. Cost of Service Charge:

   All Gas @ $.0258 per Ccf @ 14.9 PSIA.

2. Cost of Gas Charge: In addition to the Cost of Service set forth above, Ft. Bliss billing shall include an amount equal to the Cost of Gas per billing month as determined in accordance with Rate Schedule No. 1-1. Cost per Ccf will be determined at 14.9 PSIA and multiplied by total Ccf consumed during the billing month.

CONDITIONS

1. In case of shortage of natural gas supply, or any other emergency not due to fault of the contractor, deliveries of gas hereunder may be curtailed in accordance with contractor's program of curtailment applicable to its consumers in the City of El Paso and Environs.

2. Volume of gas shown by meter readings will be corrected to 14.9 pounds per square inch absolute. Atmospheric pressure is agreed to be 12.8 pounds.

3. Subject to existing contract.

Supersedes same sheet dated 08/01/90

AUTHORITY

Deliveries On and After
August 1, 1991

DATE EFFECTIVE

SOUTHERN UNION GAS COMPANY
Rate Sheet

SERVICE AREA El Paso

Texas Tariff - West Texas
Section 3
Rate Schedule No. 1A

FORM 752-701 8-78

ADJUSTMENTS TO BASIC RATE
City of El Paso, Texas and El Paso Environs

The following adjustments shall be applied to the price for each Ccf delivered to customers served by the West Texas Region in the El Paso County rate area (including the towns of Anthony, Vinton and Clint, Texas), under the basic rate schedules indicated below:

Basic Rate Schedules	Basic Rate Effective Date	Customer Class	Previous Adjustment	Change In Adjustment	Total Present Adjustment
10	01/15/92	Residential Service Rate	$ .1362	$ .0000	$ .1362
20	01/15/92	Commercial Service Rate	$ .1362	$ .0000	$ .1362
21	01/15/92	Commercial Air Conditioning Service	$ .1362	$ .0000	$ .1362
25	01/15/92	Public Authority Rate	$ .1362	$ .0000	$ .1362
26	01/15/92	Public Authority Air Conditioning Service	$ .1362	$ .0000	$ .1362
27	01/15/92	Municpal Water Pumping Rate	$ .1362	$ .0000	$ .1362
30	01/15/92	Irrigation Rate	$ .1362	$ .0000	$ .1362
40	01/15/92	Industrial Service Rate	$ .1362	$ .0000	$ .1362
41	01/15/92	Industrial Air Conditioning Service	$ .1362	$ .0000	$ .1362
1Z	04/01/91	Residential Service - El Paso Environs	$ .1362	$ .0000	$ .1362
2Z	04/01/91	Commercial Service Rate El Paso Environs	$ .1362	$ .0000	$ .1362
2A	04/01/91	Commercial Air Conditioning Environs	$ .1362	$ .0000	$ .1362

Supersedes Same Sheet Dated 04/29/92

Meters Read On and After
May 29, 1992

AUTHORITY

DATE EFFECTIVE

SOUTHERN UNION GAS COMPANY
Rate Sheet

SERVICE AREA El Paso

Texas Tariff - West Texas
Section 3
Rate Schedule No. 1A

RM 752-701 5-76

ADJUSTMENTS TO BASIC RATE
City of El Paso, Texas and El Paso Environs
(Continued)

2E	04/01/91	Public Authority Rate El Paso Environs	$ .1362	$ .0000	$ .1362
2F	04/01/91	Public Authority Air Conditioning Environs	$ .1362	$ .0000	$ .1362
2G	04/01/91	Municipal Water Pumping Rate-El Paso Environs	$ .1362	$ .0000	$ .1362
3Z	04/01/91	Irrigation Rate El Paso Environs	$ .1362	$ .0000	$ .1362
4Z	04/01/91	Industrial Service Rate-El Paso Environs	$ .1362	$ .0000	$ .1362
4A	04/01/91	Industrial Air Conditioning Environs	$ .1362	$ .0000	$ .1362
C1	08/07/86	Electrical Cogeneration Energy Conservation	$ .1362	$ .0000	$ .1362
E5	08/01/90	Fort Bliss	$ .1493	$ .0000	$ .1493

Supersedes same sheet dated 04/29/92

AUTHORITY

Meter Read On and After
May 29, 1992

DATE EFFECTIVE

APPENDIX B
Typical Area Illumination Calculations

ILLUMINATION LEVEL CALCULATIONS

*** ROOM LIGHTING CALCULATIONS ***	EXISTING	NEW 4' T12SS	EXISTING	NEW 4'T12SS	EXISTING	NEW 4 LAMP	NEW 4 LAMP	NEW 4 LAMP
ROOM NUMBER	1	2	3	4	5	6	7	8
ROOM ACTIVITY	CLASS	CLASS	CORRIDOR	CORRIDOR	RM 265/266	RM 265/266	ROOM 31	ROOM 68/70
REQUIRED FOOT CANDLES MAINTAIN	50	50	20	20	50	50	50	30
FIXTURE TYPE	A	NEW A	B	NEW B	PREV. RETRO.	R3	R1	R2
LAMP TYPE	F96T12/SL	F40T12/RS/SS	F40T12	F40T12/RS/SS	F40T12	F40T12/RS/SS	F40T12/RS/SS	F40T12/RS/SS
LUMENS PER LAMP	5800	2825	2800	2825	2800	2825	2825	2825
LAMPS PER FIXTURE	2	4	2	2	4	4	4	4
TOTAL FIXTURE INPUT WATTAGE	252	116	96	74	192	116	116	116
ROOM LENGTH (ROW AXIS)	26.0	26.0	203.0	203.0	26.0	26.0	26.0	26.0
ROOM WIDTH (COLUMN AXIS)	34.0	34.0	8.0	8.0	34.0	34.0	34.0	34.0
FIXTURE TO WORKING PLANE HEIGH	9.5	7.5	5.0	5.0	7.5	7.5	7.5	7.5
ROOM CAVITY RATIO	3.22	2.55	3.25	3.25	2.55	2.55	2.55	2.55
WALL REFLECTANCES (%)	50	50	50	50	50	50	50	50
CEILING REFLECTANCES (%)	80	80	80	80	80	80	80	80
FLOOR REFLECTANCES (%)	20	20	20	20	20	20	20	20
COEFFICIENT OF UTILIZATION	0.509	0.646	0.480	0.595	0.547	0.587	0.587	0.587
LAMP LUMEN DEPRECIATION	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
LAMP DIRT DEPRECIATION	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
# OF FIX TO PROVIDE ONE FT-CD	0.21	0.17	0.84	0.67	0.20	0.18	0.18	0.18
INITIAL NUMBER OF FIXTURES	10.38	8.39	16.74	13.39	9.99	9.23	9.23	5.54
==FINAL DESIGN CALCULATIONS==								
SQUARE FOOT PER FIXTURE	85.18	105.41	97.00	121.31	88.46	95.78	95.78	159.63
MINIMUM # OF FIXTURES TO BE USED	10	8	17	13	10	9	9	6
ACTUAL # OF FIXTURES USED	12	10	17	17	18	10	10	6
ACHIEVED FOOT CANDLES	57.81	59.62	20.31	25.40	90.06	54.17	54.17	32.50
WATTS PER SQUARE FOOT	3.42	1.31	1.00	0.77	3.91	1.31	1.31	0.79
TOTAL ROOM WATTS	**3024**	**1160**	**1632**	**1258**	**3456**	**1160**	**1160**	**696**

APPENDIX C - Miscellaneous Calculations

FORT BLISS EEAP

BUILDING/ FLOOR	FIXTURE TYPE *																	
	A	B	C	D	E	F	G	H	K	L	M	N	P	R	XA–B	R1	R2	R3
WING 'A'																		
BASEMENT	47	17	0	1	4	15	2								4	24		
1ST FLOOR	72	24	0	12	8	0	1	4	4						5			
2ND FLOOR	82	23	0	6	3	0	6								3			
3RD FLOOR	63	15	0	11	4	0	4		3						3			
WING 'B'																		
BASEMENT			0	35					17									
MAIN/BALCONY			0	16		4				72	3	17	10	79	21			
WING 'C'																		
BASEMENT	122	16	28	10	3	6	1		1						4			
1ST FLOOR	121	16	40	14	6	4	0		4						7			
2ND FLOOR	121	17	40	15	3	4	2		0						3			
WING 'D'																		
BASEMENT	92	23	8	11	3	6	0		1						3		64	
1ST FLOOR	126	17	40	13	5	0	1		3						3			
2ND FLOOR	109	18	40	14	3	4	2		0						3			18
WING 'E'																		
BASEMENT	124	17	8	9	6	1	0		1						3			
1ST FLOOR	124	16	32	13	6	1	1		4						4			
2ND FLOOR	125	20	20	14	2	0	3		0						3			
FIXTURE TOTALS	1328	239	256	194	56	45	23	4	38	72	3	17	10	79	69	24	64	18

*FIXTURE TYPE DESIGNATION TAKEN FROM ORIGINAL CONSTUCTION DOCUMENTS

EXISTING LIGHTING ENERGY USE

BUILDING/ FLOOR	FIXTURE TYPE																		
	A	B	C	D	E	F	G	H	K	L	M	N	P	R	XA–B	R1	R2	R3	TOTALS
FIXTURE TOTALS	1328	239	256	194	56	45	23	4	38	72	3	17	10	79	69	6	64	18	2521
WATTS/FIXTURE	252	96	48	150	100	300	100	225	100	166	249	77	100	200	25	504	75	192	
TOTAL KW	335	23	12	29	6	14	2	1	4	12	1	1	1	16	2	3	5	3	469
OPERATING HRS/ DAY	10	10	4	10	9	9	6	9	9	2	2	2	1	4	24	10	10	10	
TOTAL MWH	837	57	12	73	13	30	3	2	9	6	0	1	0	16	10	8	12	9	1098

RETROFIT LIGHTING ENERGY USE

BUILDING/ FLOOR	FIXTURE TYPE																		
	A	B	C	D	E	F	G	H	K	L	M	N	P	R	XA–B	R1	R2	R3	TOTALS
FIXTURE TOTALS	1328	239	256	194	56	45	23	4	38	72	3	17	10	79	69	10	12	10	2465
WATTS/FIXTURE	116	74	29	74	74	74	74	74	35	166	249	77	100	200	9	116	116	116	
TOTAL KW	154	18	7	14	4	3	2	0	1	12	1	1	1	16	1	1	1	1	239
OPERATING HRS/ DAY	10	10	4	10	9	9	6	9	9	2	2	2	1	4	24	10	10	10	
TOTAL MWH	385	44	7	36	9	7	3	1	3	6	0	1	0	16	4	3	3	3	532

RETROFIT LIGHTING ENERGY SAVINGS

BUILDING/ FLOOR	FIXTURE TYPE																	
	A	B	C	D	E	F	G	H	K	L*	M*	N*	P*	R*	XA–B	R1	R2	R3	TOTAL
KW SAVED	180.	5.2	4.8	14.	1.4	10.	0.5	0.6	2.4	0	0	0	0	0	1.10	1.8	3.4	2.2	229.4
KW $K SAVINGS	46.5	1.3	1.2	3.8	0.3	2.6	0.1	0.1	0.6	0	0	0	0	0	0.28	0.4	0.8	0.5	$59.20
MWH SAVED	451.	13.	4.8	36.	3.2	22.	0.8	1.3	5.5	0	0	0	0	0	6.62	4.6	8.5	5.7	565.9
MWH $K SAVINGS	3.4	0.1	0.0	0.3	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	$4.32
TOTAL SAVINGS $K	50.0	1.4	1.2	4.0	0.4	2.7	0.1	0.1	0.6	0	0	0	0	0	0.33	0.5	0.9	0.6	$63.52

* NOT CONSIDERED FOR RETROFIT DUE TO LIMITED USE, LOCATION AND PROHIBITIVE RETROFIT COSTS.

APPENDIX D - Probable Cost Estimate

COST ESTIMATING ANALYSIS PROJECT: LIGHTING RETROFIT HEADQUARTERS BUILDING LOCATION: FORT BLISS, TEXAS					INVITATION/CONTRACTOR CODE: 100%			DRAWING NO: ESTIMATOR: RBS			SHEET OF DATE PREPD: 21-Jan-93 CHECKED BY:
TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIALS		TOTAL
	NO/UN	UNIT	MH UN	HRS	UN PRICE	COST	UN PRICE	COST	UN PRICE	COST	COST
DEMOLITION											
TYPE A – FLUORESCENT, SURFACE MTD. 8'	1328	EA			11.17	14827.12	0.00	0.00	0.23	305.44	15132.56
TYPE B – FLUORESCENT, SURFACE MTD. 4'	239	EA			5.58	1334.22	0.00	0.00	0.23	54.97	1389.19
TYPE C – FLUORESCENT STRIP 4'	256	EA			3.92	1002.24	0.00	0.00	0.23	58.88	1061.12
TYPE D – INCANDESCENT, SURFACE MTD.	194	EA			5.58	1083.00	0.00	0.00	0.23	44.62	1127.63
TYPE E – INCANDESCENT, SURFACE MTD.	56	EA			5.58	312.62	0.00	0.00	0.23	12.88	325.50
TYPE F – INCANDESCENT, SURFACE MTD.	45	EA			5.58	251.21	0.00	0.00	0.23	10.35	261.56
TYPE G – INCANDESCENT, SURFACE MTD.	23	EA			5.58	128.40	0.00	0.00	0.23	5.29	133.69
TYPE H – INCANDESCENT, SURFACE MTD.	4	EA			5.58	22.33	0.00	0.00	0.23	0.92	23.25
TYPE K – REMOVE ONLY INCANDESCENT BULBS	38	EA			4.71	179.08	0.00	0.00	0.00	0.00	179.08
TYPE X – EXIT SIGNS	69	EA			9.79	675.34	0.00	0.00	0.00	0.00	675.34
TYPE R1 – INCANDESCENT, RECESSED "CAN" LIGHTS	64	EA			17.60	1126.59	0.00	0.00	0.00	0.00	1126.59
TYPE R2 – FLUORESCENT, 2X4, LAY-IN	18	EA			11.17	200.97	0.00	0.00	0.23	4.14	205.11
TYPE R3 – FLUORESCENT STRIP SURFACE MTD.	24	EA			17.60	422.47	0.00	0.00	0.23	5.52	427.99
ELECTRICIAN	16	HRS			26.10	417.60	0.00	0.00	0.00	0.00	417.60
SUBTOTAL						$21,983		$0		$503	$22,486
MEANS MODIFIED (93.3%)	1	EA									$20,980
SUB. O & P (15%)	1	EA									$3,147
GC O & P (15%)	1	EA									$3,619
CONTINGENCY	1	EA									$4,162
Total ELECTRICAL DEMOLITION Costs											**$31,907**

COST ESTIMATING ANALYSIS PROJECT: LIGHTING RETROFIT HEADQUARTERS BUILDING LOCATION: FORT BLISS, TEXAS					INVITATION/CONTRACTOR CODE: 100%			DRAWING NO: ESTIMATOR: RBS			SHEET OF DATE PREPD: 05-Oct-92 CHECKED BY: YOUNG
TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIALS		TOTAL
	NO/UN	UNIT	MH UN	HRS	UN PRICE	COST	UN PRICE	COST	UN PRICE	COST	COST
NEW WORK											
TYPE A – FLUORESCENT, SURFACE MTD. 8'	1328	EA			37.93	50373.70		0.00	100.00	132800.00	183174
TYPE B – FLUORESCENT, SURFACE MTD. 4'	239	EA			26.16	6251.76		0.00	51.00	12189.00	18441
TYPE C – FLUORESCENT STRIP 4'	256	EA			17.57	4498.94		0.00	36.00	9216.00	13715
TYPE D – FLUORESCENT, SURFACE MTD.	194	EA			26.16	5074.65		0.00	51.00	9894.00	14969
TYPE E – FLUORESCENT, SURFACE MTD.	56	EA			26.16	1464.85		0.00	51.00	2856.00	4321
TYPE F – FLUORESCENT, SURFACE MTD.	45	EA			26.16	1177.11		0.00	51.00	2295.00	3472
TYPE G – FLUORESCENT, SURFACE MTD.	23	EA			26.16	601.63		0.00	51.00	1173.00	1775
TYPE H – FLUORESCENT, SURFACE MTD.	4	EA			26.16	104.63		0.00	51.00	204.00	309
TYPE K – 35 WATT LOW PRES SODIUM FIXTURE	38	EA			11.00	418.00		0.00	42.01	1596.38	2014
TYPE X – FLUORESCENT EXIT SIGN	69	EA			29.70	2049.02		0.00	55.00	3795.00	5844
TYPE R1 – FLUORESCENT 2X4, LAY-IN	6	EA			33.65	201.93		0.00	77.00	462.00	664
TYPE R2 – FLUORESCENT, 2X4, LAY-IN	10	EA			33.65	336.55		0.00	77.00	770.00	1107
TYPE R3 – FLUORESCENT 2X4, LAY-IN	10	EA			33.65	336.55		0.00	77.00	770.00	1107
SUBTOTAL						72889.3		0		178020.38	250909.699
MEANS MODIFIED (93.3%)	1	EA									234099
SUB. O & P (15%)	1	EA									35115
GC O & P (15%)	1	EA									40382
CONTINGENCY	1	EA									46439
Total NEW ELECTRICAL WORK Costs											$356,035

APPENDIX E - Replacement Costs

REPLACEMENT COSTS

Retrofit System

Annual operating hours ≈ 2,250 hrs.
Average Fluor. Lamp Life ≈ 20,000 hrs.

∴ Assume no maintenance for first five years.

Year 6 through 15 replacement at 10% per year.

6,700 (4 foot lamps) x 10% Failure x $6.50/Lamp	=	$4,355
TOTAL	≈	**$4,355/yr**

Existing System

Years 1 through 15 replacement at 10% per year of fluorescents and 50% failure of incandescents/year.

2,750 (8 foot lamps) x 10% Failure x $12.00/Lamp	=	$3,300
775 (4 foot lamps) x 10% Failure x $5.50/Lamp	=	$426
TOTAL	≈	$3,725/yr
1000 (Incandescents) x 50% x $3.00/Lamp	=	$1,500
TOTAL		**$5,225/yr**

APPENDIX F - Life Cycle Cost Calculation

LCCID INPUT DATA

DESCRIPTION	EXISTING	RETROFIT
INITIAL INVESTMENT	BASE	$387,942.0
ENERGY:		
ELECT. USAGE (MBTU)	BASE	1935.2
NAT. GAS (MBTU)	N/A	N/A
DEMAND SAVINGS(KW)	BASE	2760
DEMAND SAVINGS($)	BASE	$59,200.0
M & R COST: YEARS 1 – 5	BASE	$5,225.0
YEARS 6–15	BASE	$870.0
SALVAGE VALUE	$0.0	$0.0

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT BLISS, TEXAS REGION NO. 3 PROJECT NO. 91109905F
PROJECT TITLE: FORT BLISS HEADQUARTERS BUILDING LIGHTING RETROFIT FISCAL YEAR 1993
DISCRETE PORTION NAME:
ANALYSIS DATE: 02/05/93 ECONOMIC LIFE 15 PREPARER S. P. CLARK

1. INVESTMENT COSTS:

A. CONSTRUCTION COST	$387,942		
B. SIOH	$21,337		
C. DESIGN COST	$23,277		
D. TOTAL COST (1A+1B+1C)	$432,555		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$0	
F. PUBLIC UTILITY COMPANY REBATE		$0	
G. TOTAL INVESTMENT (1D−1E−1F)			$432,555

2. ENERGY SAVINGS (+)/COST(−):

DATE OF NISTIR 85−3273−X USED FOR DISCOUNT FACTORS: OCTOBER 1992

ENERGY SOURCE	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$2.24	1935.2	$4,335	11.77	$51,021
B. DIST			$0	13.83	$0
C. RESID			$0	16.15	$0
D. NG			$0	15.34	$0
E. PPG			$0	11.12	$0
F. COAL			$0	12.82	$0
G. SOLAR			$0	11.12	$0
H. GEOTH			$0	11.12	$0
I. BIOMA			$0	11.12	$0
J. REFUS			$0	11.12	$0
K. WIND			$0	11.12	$0
L. OTHER			$0	11.12	$0
M. DEMAND SAVINGS			$59,200	11.12	$658,304
N. TOTAL		1935.2	$63,535		$709,325

3. NON ENERGY SAVINGS (+) OR COST (−):

A. ANNUAL RECURRING (+/−)	$0		
1. DISCOUNT FACTOR (TABLE A)			
2. DISCOUNTED SAVINGS/COST (3A X 3A1)			$0

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

B. NON RECURRING SAVINGS (+) OR COST(–)

	ITEM	SAVINGS(+) COST(–)(1)	YEAR OF OCCUR.(2)	DISCOUNT FACTOR(3)	DISCOUNTED SAV–INGS(+)COST(–)(4)
a.	RELAMPING	$5,225	1	0.96	$5,016
b.	RELAMPING	$5,225	2	0.92	$4,807
c.	RELAMPING	$5,225	3	0.89	$4,650
d.	RELAMPING	$5,225	4	0.85	$4,441
e.	RELAMPING	$5,225	5	0.82	$4,285
f.	RELAMPING	$870	6	0.79	$687
g.	RELAMPING	$870	7	0.76	$661
h.	RELAMPING	$870	8	0.73	$635
i.	RELAMPING	$870	9	0.7	$609
j.	RELAMPING	$870	10	0.68	$592
k.	RELAMPING	$870	11	0.65	$566
l.	RELAMPING	$870	12	0.62	$539
m.	RELAMPING	$870	13	0.6	$522
n.	RELAMPING	$870	14	0.58	$505
o.	RELAMPING	$870	15	0.56	$487
p.	TOTAL	$34,825			$29,002

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4) $29,002

4. SIMPLE PAYBACK 1G/(2N3+3A+(3Bp1/ECONOMIC LIFE)): 6.6 YEARS

5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C): $738,327

6. SAVINGS TO INVESTMENT RATIO (SIR) 5/1G: 1.71

7. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 7.8%

APPENDIX G - Scope of Work

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0187), Washington, DC 20503. Please DO NOT RETURN your form to either of these addresses. Send your completed form to the procurement official identified in item 6.

DUPLICATE ORIGINAL

1. CONTRACT/PURCH ORDER NO	2. DELIVERY ORDER NO	3. DATED	4. REQUISITION/PURCHASE NO	5. CERTIFIED FOR NATIONAL DEFENSE UNDER DMS REG
DACA63-91-D-0048	0005	AUG 6		DO

6. ISSUED BY	CODE	7. ADMINISTERED BY (If other than 6)	CODE	8. DELIVERY FOB
.S. ARMY ENGINEER DISTRICT, FORT WORTH P.O. BOX 17300 FORT WORTH, TEXAS 76102-0300				[X] DEST [ ] OTHER (See Schedule if other)

9. CONTRACTOR	CODE	FACILITY CODE	10. DELIVER TO FOB POINT BY (Date)	11. MARK IF BUSINESS
NAME AND ADDRESS CARTER AND BURGESS, INC. P. O. BOX 2973 FORT WORTH, TEXAS 76113-2973			SEE SCOPE OF WORK 12. DISCOUNT TERMS	[ ] SMALL N/A [ ] SMALL DISADVANTAGED [ ] WOMEN-OWNED
			13. MAIL INVOICES TO SEE BLOCK 6, ATTN: CESWF-ED-M	

14. SHIP TO	CODE	15. PAYMENT WILL BE MADE BY	CODE	MARK ALL PACKAGES AND PAPERS WITH CONTRACT OR ORDER NUMBER
SEE BLOCK 6		DISBURSING OFFICER U.S. ARMY ENGINEER DISTRICT, FORT WORTH P.O. BOX 17300 FORT WORTH, TEXAS 76102-0300		

16. TYPE OF ORDER — DELIVERY [X] PURCHASE [ ]

This delivery order is issued on another Government agency or in accordance with and subject to terms and conditions of above numbered contract.

Reference your ____ furnish the following on terms specified here:

ACCEPTANCE. THE CONTRACTOR HEREBY ACCEPTS THE OFFER REPRESENTED BY THE NUMBERED PURCHASE ORDER AS IT MAY PREVIOUSLY HAVE BEEN OR IS NOW MODIFIED, SUBJECT TO ALL OF THE TERMS AND CONDITIONS SET FORTH, AND AGREES TO PERFORM THE SAME.

NAME OF CONTRACTOR	SIGNATURE	TYPED NAME AND TITLE	DATE SIGNED

[ ] If this box is marked, supplier must sign Acceptance and return the following number of copies.

17. ACCOUNTING AND APPROPRIATION DATA/LOCAL USE

212 2020 08 8073 P722984 2572 284 EO3910048 S41443 (QE) QE20332200A0489 $15,342.00

ITEM NO.	19. SCHEDULE OF SUPPLIES/SERVICE	20. QUANTITY ORDERED/ ACCEPTED*	21. UNIT	22. UNIT PRICE	23. AMOUNT
1	ENERGY STUDY ON WATER STORAGE CAPACITY VS GAS ENGINE GENERATORS AND RETROFIT LIGHTING TO HEADQUARTERS BUILDING #2, FORT BLISS, TX See attached Scope of Work consisting of 3 Pages "Reviewed for legal sufficiency (AFARS 1-6901" WJD	JOB	-	-	$15,342.00 FUNDS ARE AVAILABLE JUL 28 1992 For R. T. Geiger, F&A Officer

* If quantity accepted by the Government is same as quantity ordered, indicate by X. If different, enter actual quantity accepted below quantity ordered and encircle.

24. UNITED STATES OF AMERICA — BY: MARVIN W. HARRISON, MAJOR, EN, CONTRACTING/ORDERING OFFICER

25. TOTAL $15,342.00

29. DIFFERENCES

30. INITIALS

26. QUANTITY IN COLUMN 20 HAS BEEN
[ ] INSPECTED [ ] RECEIVED [ ] ACCEPTED, AND CONFORMS TO THE CONTRACT EXCEPT AS NOTED

DATE ____ SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE

27. SHIP. NO. — [ ] PARTIAL [ ] FINAL

28. D.O. VOUCHER NO.

32. PAID BY

33. AMOUNT VERIFIED CORRECT FOR

31. PAYMENT [ ] COMPLETE [ ] PARTIAL [ ] FINAL

34. CHECK NUMBER

35. BILL OF LADING NO.

36. I certify this account is correct and proper for payment.

DATE ____ SIGNATURE AND TITLE OF CERTIFYING OFFICER

37. RECEIVED AT	38. RECEIVED BY	39. DATE RECEIVED	40. TOTAL CONTAINERS	41. S/R ACCOUNT NUMBER	42. S/R VOUCHER NO.

DD Form 1155, MAY 90 — *Previous editions are obsolete.* — 459/1

RECEIVED
CARTER & BURGESS, INC.
AUG 11 1992

RAK DJY R. Diver-cr.

DETAILED SCOPE OF WORK
CONTRACT NO. DACA63-91-D-0048
DELIVERY ORDER NO. 0005

1. The Architect-Engineer (A-E) shall furnish all services, material, supplies, plant, labor, equipment, investigations, studies, superintendence and travel as required in connection with the below identified project for studies in accordance with the original basic contract and this Detailed Scope of Work. Appendix "A" of the basic contract shall be followed for performance requirements for A-E services. Where this Detailed Scope of Work conflicts with Appendix "A", this Detailed Scope of Work shall govern.

INSTALLATION	PROJECT TITLE
Fort Bliss, TX	Energy Study on Water Storage Capacity vs. Gas Engine Generators and Retrofit Lighting to Headquarters Building #2

2. The work, design, related data and services required in accordance with this Delivery Order shall be accomplished within the limitation of cost on subject project stated above and scope of work described in paragraph 3. The schedule for delivery of data to the Contracting Officer is in calendar days as follows:

		INDEFINITE DELIVERY CONTRACT	DELIVERY SCHEDULE
a.	Preliminary Submittal(s) and Related Data or Studies (10 copies)	*	60 calendar days (after receipt of signed D.O.)
b.	Final Submittal(s) (10 copies)	*	60 calendar days after approval of the Preliminary Submittal

3. The items of work included in this delivery order shall be in accordance with criteria furnished at the Scoping Conference held at Fort Bliss, 13 June 1992. The services to be provided shall include, but not be limited to, the following:

a. Items of Work:

(1) Determine a method of peak electric demand shaving

(2) Provide additional ground storage capacity located at a higher elevation to allow the pumps to run at non-peak periods. The increased storage capacity would then be able to

serve the installation through gravity during the peak demand period as determined by El Paso Electric.

(3) Provide natural gas powered electric generators at each well pumping station. These generators would only run during the peak demand period.

(4) Analyze the natural gas generators, in lieu of diesel, due to environmental impact of diesel fuel storage.

(5) Analyze pump motor horsepowers and the proposed ground storage tanks, capacities and locations. (Pump motors and tanks to be identified by installation personnel.)

(6) Monitor the KW demand, KW demand meters were indicated as a request for recommendation in the analysis for each pumping station.

(7) The preferred method of peak shaving is utilizing the additional ground storage capacity. (Recommended by installation personnel.)

b. The headquarters building (Building #2) requires a complete lighting retrofit. Generally, this 3 story building includes general office space and a large auditorium. This building is comprised of the following components:

(1) Basement
(2) A Wing - 46595 Square feet
(3) B Wing - 15487 Square feet - 2 story auditorium
(4) C Wing - 66570 Square feet
(5) D Wing - 66570 Square feet
(6) E Wing - 66570 Square feet

(a) The scope of this study would include all exterior and interior lighting.

(b) The goal of this study is to recommend primarily fluorescent lighting with energy efficient ballast and lamps. Some incandescent lighting may be necessary in areas with specific requirements.

(c) Various remodelling have occurred over the years and several types of lights and ceilings exist.

(d) The average ceiling height is 12' to 14'.

c. Government Furnished Items.

(1) As-built drawings as available.

(2) Statistical data and related documents.

(3) Guide Specifications as required.

(4) Access to facilities for the as-built work.

d. Special Requirements - Distribution of submittal documents are as follows:

(1) Three copy of all documents shall be mailed to:

Commander
U.S. Army Engineer District, Fort Worth
819 Taylor Street/P.O. Box 17300
ATTN: CESWF-ED-M/Richard Champagne
Fort Worth, TX 76102-0300

(2) Seven copies of all documents shall be mailed to:

Commander
USAADCENFB
ATTN: ATZC-ISE-N(Mr. J. Mattis)
Fort Bliss, TX 79916-0058

CONTRACT NO. DACA63-91-D-0048

DELIVERY ORDER NO. 0005

PROJECT/LOCATION ENERGY STUDY ON WATER STORAGE CAPACITY VS GAS ENGINE GENERATORS AND RETROFIT LIGHTING TO HEADQUARTERS BUILDING #2, FORT BLISS, TX

CONTRACTOR: CARTER & BURGESS, INC.
P.O BOX 2973
FORT WORTH, TX 76113-2973

Request you acknowledge receipt hereof by completing the endorsement below and returning the original to:

U.S. ARMY ENGINEER DISTRICT, FORT WORTH
ATTN: CESWF-ED-M (CHAMPAGNE)
P.O. BOX 17300
FORT WORTH, TEXAS 76102-0300

ENDORSEMENT

Acceptance of the fee and terms of this Delivery Order is hereby denoted by my signature below.

This document was received (DATE) Aug 11, 1992

BY Russell A Kam

TITLE VICE PRESIDENT

GENERAL SCOPE OF WORK

FOR A

LIMITED ENERGY STUDY

Performed as part of the

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)
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SCOPE OF WORK
FOR A
LIMITED ENERGY STUDY

TABLE OF CONTENTS

1. BRIEF DESCRIPTION OF WORK: The Architect-Engineer (AE) shall:

1.1 Review the previously completed Energy Engineering Analysis Program (EEAP) study which applies to the specific building, system, or energy conservation opportunity (ECO) covered by this study.

1.2 Perform a limited site survey of specific buildings or areas to collect all data required to evaluate the specific ECOs included in this study.

1.3 Reevaluate the specific project or ECO from the previous study to determine its economic feasibility based on revised criteria, current site conditions and technical applicability.

1.4 Evaluate specific ECOs to determine their energy savings potential and economic feasibility.

1.5 Provide project documentation for recommended ECOs as detailed herein.

1.6 Prepare a comprehensive report to document all work performed, the results and all recommendations.

2. GENERAL

2.1 This study is limited to the evaluation of the specific buildings, systems, or ECOs listed in Annex A, DETAILED SCOPE OF WORK.

2.2 The information and analysis outlined herein are considered to be minimum requirements for adequate performance of this study.

2.3 For the buildings, systems or ECOs listed in Annex A, all methods of energy conservation which are reasonable and practical shall be considered, including improvements of operational methods and procedures as well as the physical facilities. All energy conservation opportunities which produce energy or dollar savings shall be documented in this report. Any energy conservation opportunity considered infeasible shall also be documented in the report with reasons for elimination.

2.4 The study shall consider the use of all energy sources applicable to each building, system, or ECO.

2.5 The "Energy Conservation Investment Program (ECIP) Guidance", described in letter from CEHSC-FU, dated 28 June 1991 and the latest revision from CEHSC-FU establishes criteria for ECIP

projects and shall be used for performing the economic analyses of all ECOs and projects. The program, Life Cycle Cost In Design (LCCID), has been developed for performing life cycle cost calculations in accordance with ECIP guidelines and is referenced in the ECIP Guidance. If any program other than LCCID is proposed for life cycle cost analysis, it must use the mode .
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of calculation specified in the ECIP Guidance. The output must be in the format of the ECIP LCCA summary sheet, and it must be submitted for approval to the Contracting Officer.

2.6 Computer modeling will be used to determine the energy savings of ECOs which would replace or significantly change an existing heating, ventilating, and air-conditioning (HVAC) system. The rquirement to use computer modeling applies only to heated and air-conditioned or air-conditioned-only buildings which exceed 8,000 square feet or heated-only buildings in excess of 20,000 square feet. Modeling will be done using a professionally recognized and proven computer program or programs that integrate architectural features with air-conditioning, heating, lighting and other energy-producing or consuming systems. These programs will be capable of simulating the features, systems, and thermal loads of the building under study. The program will use established weather data files and may perform calculations on a true hour-by-hour basis or may condense the weather files and the number of calculations into several "typical" days per month. The Detailed Scope of Work, Annex A, will list programs that are acceptable to the Contracting Officer. If the AE desires to use a different program, it must be submitted for approval with a sample run, an explanation of all input and output data, and a summary of program methodology and energy evaluation capabilities.

2.7 Energy conservation opportunities determined to be technically and economically feasible shall be developed into projects acceptable to installation personnel. This may involve combining similar ECOs into larger packages which will qualify for ECIP, MCA, or PCIP funding, and determining in coordination with installation personnel the appropriate packaging and implementation approach for all feasible ECOs.

2.7.1 Projects which qualify for ECIP funding shall be identified, separately listed, and prioritized by the Savings to Investment Ratio (SIR).

2.7.2 All feasible non-ECIP projects shall be ranked in order of highest to lowest SIR.

2.7.3 At some installations Energy Conservation and Management (ECAM) funding will be used instead of ECIP funding. The criteria for each program is the same. The Director of Engineering and Housing will indicate which program is used at this installation. This Scope of Work mentions only ECIP, however, ECAM is also meant.

3. PROJECT MANAGEMENT

3.1 Project Managers. The AE shall designate a project manager to serve as a point of contact and liaison for work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. The AE's designated project manager shall be approved by the Contracting Officer prior to commencement of work. This designated individual shall be
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responsible for coordination of work required under this contract. The Contracting Officer will designate a project manager to serve as the Government's point of contact and liaison for all work required under this contract. This individual will be the Government's representative.

3.2 Installation Assistance. The Commanding Officer or authorized representative at the installation will designate an individual to assist the AE in obtaining information and establishing contacts necessary to accomplish the work required under this contract. This individual will be the installation representative.

3.3 Public Disclosures. The AE shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.

3.4 Meetings. Meetings will be scheduled whenever requested by the AE or the Contracting Officer for the resolution of questions or problems encountered in the performance of the work. The AE's project manager and the Government's representative shall be required to attend and participate in all meetings pertinent to the work required under this contract as directed by the Contracting Officer. These meetings, if necessary, are in addition to the presentation and review conferences.

3.5 Site Visits, Inspections, and Investigations. The AE shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

3.6 Records

3.6.1 The AE shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the AE and/or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the records.

3.6.2 The AE shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The AE shall

forward to the Contracting Officer within ten calendar days, a reproducible copy of the record of request or receipt of material.

3.7 Interviews. The AE and the Government's representative shall conduct entry and exit interviews with the Director of Engineering and Housing before starting work at the installation
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and after completion of the field work. The Government's representative shall schedule the interviews at least one week in advance.

3.7.1 Entry. The entry interview shall describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview shall cover the following points:

a. Schedules.

b. Names of energy analysts who will be conducting the site survey.

c. Proposed working hours.

d. Support requirements from the Director of Engineering and Housing.

3.7.2 Exit. The exit interview shall briefly describe the items surveyed and probable areas of energy conservation. The interview shall also solicit input and advice from the Director of Engineering and Housing.

4. SERVICES AND MATERIALS. All services, materials (except those specifically enumerated to be furnished by the Government), plant, labor, supervision and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.

5. PROJECT DOCUMENTATION. All energy conservation opportunities which the AE has considered shall be included in one of the following categories and presented in the report as such:

5.1 ECIP Projects. To qualify as an ECIP project, an ECO, or several ECOs which have been combined, must have a construction cost estimate greater than $200,000, a Savings to Investment Ratio greater than one and a simple payback period of less than eight years. For ECAM projects, the $200,000 limitation may not apply; in such cases, the AE shall check with the installation for guidance. The overall project and each discrete part of the project shall have an SIR greater than one. All projects meeting the above criteria shall be arranged as specified in paragraph 2.7.1 and shall be provided with programming documentation. Programming documentation shall consist of a DD Form 1391, life cycle cost analysis (LCCA) summary sheet(s) (with necessary backup data to verify the numbers presented), and a Project Development Brochure (PDB). A life cycle cost analysis summary sheet shall be developed for each ECO and for the overall project when more than one ECO are combined. The energy savings for projects consisting of multi-

ple ECOs must take into account the synergistic effects of the individual ECOs. [For projects and ECOs reevaluated from previous studies, the backup data shall consist of copies of the original calculations and analysis, with new pages revising the original calculations and analysis. In addition, the backup data shall include as much of the following as is available: the increment
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of work under which the project or ECO was developed in the previous study, title(s) of the project(s), the energy to cost (E/C) ratio, the benefit to cost (B/C) ratio, the current working estimate (CWE), and the payback period. The purpose of this information is to provide a means to prevent duplication of projects in any future reports.]

5.2 Non-ECIP Projects. Projects which do not meet ECIP criteria with regard to cost estimate, payback period, or non-energy (75%) qualification test, but which have an SIR greater than one shall be documented. Projects or ECOs in this category shall be arranged as specified in paragraph 2.7.2 and shall be provided with the following documentation: the life cycle cost analysis (LCCA) summary sheet completely filled out, a description of the work to be accomplished, backup data for the LCCA, ie, energy savings calculations and cost estimate(s), and the simple payback period. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs. In addition these projects shall have the necessary documentation prepared, as required by the Government's representative, for one of the following categories:

a. Quick Return on Investment Program (QRIP). This program is for projects which have a total cost greater than $3,000 but less than $100,000 and a simple payback period of two years or less.

b. Productivity Enhancing Capital Investment Program (PE-CIP). This program is for projects which have a total cost of greater than $3,000 but lees than $100,000 and a simple payback period of four years or less.

c. OSD Productivity Investment Funding (OSD PIF). This program is for projects which have a total cost of more than $100,000 and a simple payback period of four years or less.

The above programs and the required documentation forms are all described in detail in AR 5-4, Change No. 1.

d. Regular Military Construction Army (MCA) Program. This program is for projects which have a total cost greater than $200,000 and a simple payback period of four to twenty-five years. Documentation shall consist of DD Form 1391 and a Project Development Brochure.

e. Low Cost/No Cost Projects. These are projects which the Director of Engineering and Housing (DEH) can perform using his resources. Documentation shall be as required by the DEH.

5.3 Nonfeasible ECOs. All ECOs which the AE has considered but which are not feasible, shall be documented in the report with reasons and justifications showing why they were rejected.

6. DETAILED SCOPE OF WORK. The Detailed Scope of Work is contained in Annex A.
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7. WORK TO BE ACCOMPLISHED.

7.1 Review Previous Studies. Review the previous EEAP study which applies to the specific building, system, or ECO covered by this study. This review should acquaint the AE with the work that has been performed previously. Much of the information the AE may need to develop the ECOs in this study may be contained in the previous study.

7.2 Perform a Limited Site Survey. The AE shall obtain all necessary data to evaluate the ECOs or projects by conducting a site survey. However, the AE is encouraged to use any data that may have been documented in a previous study. The AE shall document his site survey on forms developed for the survey, or standard forms, and submit these completed forms as part of the report. All test and/or measurement equipment shall be properly calibrated prior to its use.

7.3 Reevaluate Selected Projects. The AE shall reevaluate the projects and ECOs listed in Annex A. These are projects and ECOs that the previous study has identified but that have not been accomplished or only parts have been accomplished. If the project or ECO is acceptable as is, that is, there are no changes to the basic project or ECO, the energy savings shown in the previous project may be accepted as accurate but the energy cost and construction cost estimates shall be updated based on the most current data available. With the above information the project shall then be analyzed based on current ECIP criteria. If the project or ECO is basically acceptable but some of the buildings in the original project have been deleted or new buildings can be added, the necessary changes shall be made to the energy savings, the energy costs and construction costs shall be updated, and the revised project or ECO shall then be analyzed using current ECIP guidance. If the original project or ECO has had numerous changes made to it so that all of the numbers are suspected of being inaccurate, but the project or ECO is still considered feasible, the AE shall develop the project from the beginning and analyze it with the current ECIP guidance. These projects shall be separately listed in the report.

7.4 Evaluate Selected ECOs. The AE shall analyze the ECOs listed in Annex A. These ECOs shall be analyzed in detail to determine their feasibility. Savings to Investment Ratios (SIRs) shall be determined using current ECIP guidance. The AE shall provide all data and calculations needed to support the recommended ECO. All assumptions and engineering equations shall be clearly stated. Calculations shall be prepared showing how all numbers in the ECO were figured. Calculations shall be an orderly step-by-step progression from the first assumption to the final

number. Descriptions of the products, manufacturers catalog cuts, pertinent drawings and sketches shall also be included. A life cycle cost analysis summary sheet shall be prepared for each ECO and included as part of the supporting data.

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7.5 Combine ECOs into Recommended Projects. During the Interim Review Conference, as outlined in paragraph [7.6.1], the AE will be advised of the DEH's preferred packaging of recommended ECOs into projects for implementation. Some projects may be a combination of several ECOs, and others may contain only one. These projects will be evaluated and arranged as outlined in paragraphs 5.1, 5.2, and 5.3. Energy savings calculations shall take into account the synergistic effects of multiple ECOs within a project and the effects of one project upon another. The results of this effort will be reported in the Final Submittal per par [7.6.2].

7.6 Submittals, Presentations and Reviews. The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and shall be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. Names of the persons primarily responsible for the project shall be included. The AE shall give a formal presentation of the interim submittal to installation, command, and other Government personnel. Slides or view graphs showing the results of the study to date shall be used during the presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. A review conference will be conducted the same day, following the presentation. Each comment presented at the review conference will be discussed and resolved or action items assigned. It is anticipated that the presentation and review conference will require approximately one working day. The presentation and review conference will be at the installation on the date agreeable to the Director of Engineering and Housing, the AE and the Government's representative. The Contracting Officer may require a resubmittal of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended purpose.

7.6.1 Interim Submittal. An interim report shall be submitted for review after the field survey has been completed and an analysis has been performed on all of the ECOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. Calculations showing energy and dollar savings, SIR, and simple payback period of all the ECOs shall be included. The results of the ECO analyses shall be summarized by lists as follows:

a.All ECOs eliminated from consideration shall be grouped into one listing with reasons for their elimination as discussed in par 5.3.

b.All ECOs which were analysed shall be grouped into two listings, recommended and non-recommended, each arranged in order of descending SIR. These lists may be subdivided by building or area as appropriate for the study.

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The AE shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. At the Interim Submittal and Review Conference, the Government's and AE's representatives shall coordinate with the Director of Engineering and Housing to provide the AE with direction for packaging or combining ECOs for programming purposes and also indicate the fiscal year for which the programming or implementation documentation shall be prepared. The survey forms completed during this audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound in a standard three-ring binder which will allow repeated disassembly and reassembly of the material contained within.

7.6.2 Final Submittal. The AE shall prepare and submit the final report when all sections of the report are 100% complete and all comments from the interim submittal have been resolved. The AE shall submit the Scope of Work for the study and any modifications to the Scope of Work as an appendix to the submittal. The report shall contain a narrative summary of conclusions and recommendations, together with all raw and supporting data, methods used, and sources of information. The report shall integrate all aspects of the study. The recommended projects, as determined in accordance with paragraph 5, shall be presented in order of priority by SIR. The lists of ECOs specified in paragraph [7.6.1] shall also be included for continuity. The final report and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The final report shall be arranged to include:

a. An Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (See Annex B for minimum requirements).

b. The narrative report describing the problem to be studied, the approach to be used, and the results of this study.

c. Documentation for the recommended projects (includes LCCA Summary Sheets).

d. Appendices to include as a minimum:

1) Energy cost development and backup data

2) Detailed calculations

3) Cost estimates

4) Computer printouts (where applicable)

5) Scope of Work

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ANNEX A

GUIDE TO THE PREPARATION OF THE
DETAILED SCOPE OF WORK

1. This annex will contain the detailed scope of work for this energy study. The information presented below is to be used as a guide in preparing the detailed scope of work. This statement and the statements below should not appear in the final contract documents.

2. The generalized scope of work and the detailed scope of work must combine to form a clear and concise statement of the requirements for the study. They must be reviewed carefully and edited as necessary to eliminate mutual conflicts and to provide needed detail. For example:

a. In the generalized scope of work there are several references to previous studies and reevaluations of previously-recommended projects. The detailed scope of work should include the previous study in the list of government furnished documents and should cite the specific projects to be reevaluated. However, if there was no previous study, or if there are no previously-recommended projects to be reviewed, these references should be deleted from the generalized scope of work, the paragraphs should be renumbered, and references to numbered paragraphs should be revised as needed.

b. For studies involving boilers, chillers, or industrial equipment, project managers are encouraged to borrow material from the guides to the detailed scopes of work for Boiler / Chiller or Industrial Facility studies. These can be found in the EEAP Procedures Manual. Careful editing will be required when integrating this material.

c. Boilers smaller than 3.5 MBTU per hour, if they fall within the scope of the study, should be investigated. See paragraph 10 of this guide for additional guidance that should be added to the scope of work.

3. The project manager will schedule a meeting at the installation with the Director of Engineering and Housing (DEH) and the Energy Officer. This meeting should be scheduled after these individuals have received the general Scope of Work and have had an opportunity to review it and prepare their input for the detailed scope of work. The MACOM should be invited to this meeting. The above offices should be notified a minimum of three weeks in advance of this meeting. The purpose of this meeting will be to

inform the installation what this energy survey is to accomplish, to discuss the general Scope of Work, answer any questions pertaining to it, and to develop the detailed Scope of Work. The following information is necessary when developing the detailed Scope of Work; and the Director of Engineering and Housing should be prepared to provide it at this meeting:
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a. Buildings, areas, equipment, distribution systems, or industrial processes that should be included in this energy study. Separately identify temporary buildings. Provide building names and numbers, type of building, whether building is typical of any others, etc.

b. Specific energy conservation opportunities (ECOs) by building that should be investigated in this study.

c. Which projects or ECOs from the previous study should be reevaluated as part of this study and the extent of reevaluation required.

4. Each detailed Scope of Work will include, but not be limited to, the following:

a. The study requirements developed from paragraph 3 above.

b. The schedule for completion of the study including milestone dates or time allowed, measured in calendar days from the notice to proceed, for each submittal.

c. The number of copies of each submittal required and the complete mailing addresses of those who are to receive the submittals.

d. An itemized list of Government-furnished information to be provided to the AE. As a minimum, this list should include:

(1) Final reports of previously completed studies performed under the Energy Engineering Analysis Program (EEAP).

(2) Latest copies of other energy studies performed since the previous EEAP study.

(3) ETLs 1110-3-254, Use of Electric Power for Comfort Space Heating (if applicable), and 1110-3-282, Energy Conservation

(4) Architectural and Engineering Instructions.

(5) Energy Conservation Investment Program (ECIP) Guidance, dated 28 June 1991 and the latest revision with current energy prices and discount factors for life cycle cost analysis.

(6) TM 5-785, Engineering Weather Data, TM 5-800-2, General Criteria Preparation of Cost Estimates.

(7) AR 5-4, Change No. 1, Department of the Army Productivity Improvement Program.

(8) AR 415-15, 1 Jan84, Military Construction, Army (MCA) Program Development

(9) The latest MCP Index.

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5. When developing the detailed scope of work, the buildings, systems, and/or ECOs to be studied shall be limited to those which are compatible with the scope of the EEAP directive for the study.

6. When listing projects or ECOs from previous studies, new ECOs that need to be evaluated, or buildings or areas that need to be investigated, list each under one of the following headings:

a. Projects or ECOs from previous studies.

b. New ECOs (specific ECOs for specific buildings or systems).

As the work required for each of the above is different from the others, this list will indicate to the AE the amount of work required under a particular heading.

7. The detailed scope of work will list those buildings or facilities which will be included in the study. If temporary building(s) are to be included in this energy study with the intent of developing ECIP projects incorporating them, a letter is required stating that there is a continuing need for the building(s) for a ten year period after the retrofit or the life of the retrofit. The continuing need must be based on the installation's annual real property utilization survey (AR 405-70). This letter must be signed by the Base Commander and be ready no later than at the prenegotiation meeting or the temporary building(s) will be removed from the list of buildings to be included in the study. This letter is not required if temporary buildings are to be included in low cost/no cost or non-ECIP projects only.

8. The Director of Engineering and Housing should designate a coordinator to serve as the point of contact and liaison for all work required under this contract. This individual should be identified in the detailed scope of work.

9. If it is known that the buildings in this study will not be subject to the computer modeling requirements of paragraph 2.6 of the general scope of work, then paragraph 2.6 should be deleted. If it is possible that the buildings in this study will be subject to the computer modeling requirements of paragraph 2.6, then the simulation programs acceptable to the office doing the technical review should be listed in the detailed scope of work. Some acceptable simulation programs follow:

a. Building Loads and System Thermodynamics (BLAST) *

b. DOE 2.1B *

c. Carrier E20 or Hourly Analysis Program (HAP) **

d. Trane Air-Conditioning Economics (TRACE) **

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* Very accurate, but requires a lot of time for input; therefore it is rather expensive for straightforward projects.
** Adequate for load determination, equipment selection, and energy performance for most projects.

This list may be expanded, contracted, or revised to include programs with which the reviewers are familiar provided such programs comply with Chapter 28, "Energy Estimating Methods" of the ASHRAE Handbook of Fundamentals.

10. If small boilers (less than 3.5 MBtu per hour) are to be included in this Scope of Work, the following paragraphs should be added to the general Scope of Work:

"1.5 Determine the efficiency of the boilers by appropriate tests. Determine if efficiency can be improved or fuel saved by the repair, addition, or modification of equipment, control systems, or maintenance practices; and recommend improvements."

(Existing paragraphs 1.5 and 1.6 will have to be renumbered.)

"7.3 Determine Boiler Efficiency. The efficiency of the boilers shall be determined by field testing. The AE shall provide equipment and perform the tests to establish the efficiency of the boilers. The tests are intended to determine the efficiency of the boilers as they are actually being operated. The combustion efficiency may be determined from an Orsat analysis of the flue gases. Based on the results of the tests, any indicated areas of improvement or equipment modifications shall be fully analyzed. The analysis shall evaluate boiler loading profiles versus boiler capacity and shall establish boiler efficiency and boiler operating baselines. The Government will furnish fuel, utilities and other consumables and provide personnel as needed to operate the boilers during the test. All test and measurement equipment shall be properly calibrated prior to its use."

(Existing paragraphs 7.3 through 7.6 will have to be renumbered.)

11. The following is provided and should be included in the detailed Scope of Work for the AE's benefit: "A computer program titled Life Cycle Costing in Design (LCCID) is available from the BLAST Support Office in Urbana, Illinois for a nominal fee. This computer program can be used for performing the economic calculations for ECIP and non-ECIP ECOs. The AE is encouraged to obtain and use this computer program. The BLAST Support Office can be contacted at 144 Mechanical Engineering Building, 1206 West Green Street, Urbana, Illinois 61801. The telephone number is (217) 333-3977 or (800) 842-5278."

ANNEX B

EXECUTIVE SUMMARY GUIDELINE

1. Introduction.

2. Building Data (types, number of similar buildings, sizes, etc.)

3. Present Energy Consumption of Buildings or Systems Studied.

   o Total Annual Energy Used.

   o Source Energy Consumption.

   Electricity - KWH, Dollars, BTU
   Fuel Oil - GALS, Dollars, BTU
   Natural Gas - THERMS, Dollars, BTU
   Propane - GALS, Dollars, BTU
   Other - QTY, Dollars, BTU

4. Reevaluated Projects Results.

5. Energy Conservation Analysis.

   o ECOs Investigated.

   o ECOs Recommended.

   o ECOs Rejected. (Provide economics or reasons)

   o ECIP Projects Developed. (Provide list)*

   o Non-ECIP Projects Developed. (Provide list)*

   o Operational or Policy Change Recommendations.

   * Include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date.

6. Energy and Cost Savings.

   o Total Potential Energy and Cost Savings.

   o Percentage of Energy Conserved.

- o Energy Use and Cost Before and After the Energy Conservation Opportunities are Implemented.

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ANNEX C

REQUIRED DD FORM 1391 DATA

To facilitate ECIP project approval, the following supplemental data shall be provided:

a. In title block clearly identify projects as "ECIP."

b. Complete description of each item of work to be accomplished including quantity, square footage, etc.

c. A comprehensive list of buildings, zones, or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.).

d. List references, and assumptions, and provide calculations to support dollar and energy savings, and indicate any added costs.

(1) If a specific building, zone, or area is used for sample calculations, identify building, zone or area, category, orientation, square footage, floor area, window and wall area for each exposure.

(2) Identify weather data source.

(3) Identify infiltration assumptions before and after improvements.

(4) Include source of expertise and demonstrate savings claimed. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.

e. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operation and future expected efficiency. If full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of the complete existing installation is required to make accurate determinations of required retrofit actions.

f. Lighting retrofit projects must identify number and type of fixtures, and wattage of each fixture being deleted and installed. New lighting shall be only of the level to meet current criteria. Lamp changes in existing fixtures is not considered an ECIP type project.

g. An ECIP life cycle cost analysis summary sheet as shown in the ECIP Guidance shall be provided for the complete project and for each discrete part included in the project. The SIR is applicable to all segments of the project. Supporting documentation consisting of basic engineering and economic calculations showing how savings were determined shall be included.

h. The DD Form 1391 face sheet shall include, for the complete project, the annual dollar and MBTU savings, SIR, simple amortization period and a statement attesting that all buildings and retrofit actions will be in active use throughout the amortization period.

i. The calendar year in which the cost was calculated shall be clearly shown on the DD Form 1391.

j. For each temporary building included in a project, separate documentation is required showing (1) a minimum 10-year continuing need, based on the installation's annual real property utilization survey, for active building retention after retrofit, (2) the specific retrofit action applicable and (3) an economic analysis supporting the specific retrofit.

k. Nonappropriated funded facilities will not be included in an ECIP project without an accompanying statement certifying that utility costs are not reimbursable.

l. Any requirements required by ECIP guidance dated 25 April 1988 and any revisions thereto. Note that unescalated costs/savings are to be used in the economic analyses.

m. The five digit category number for all ECIP projects except for Family Housing is 80000. The category code number for Family Housing projects is 71100.

APPENDIX H
Symbols, Abbreviations and Conversion Factors

SYMBOLS AND ABBREVIATIONS

KW	- Kilowatt (1,000 watts)
KWH	- Kilowatt-Hour (1,000 watt-hours)
CF	- Cubic Feet
KCF	- 1,000 Cubic Feet
MCF	- 1,000,000 Cubic Feet
BTU	- British Thermal Unit
KBTU	- 1,000 BTUs
MBTU	- 1,000,000 BTUs

CONVERSION FACTORS

1 KWH	= .003413 MBTU
1 KCF	= 1.031 MBTU

APPENDIX I - DD Form 1391

1.COMPONENT	FY 1995 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) PROJECT DATA	2. DATE
Army		February 1993 100% EEAP

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Bliss, El Paso, Texas	Headquarters Building (Building #2) Lighting Retrofit

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
	80000		432

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Headquarters Building Lighting Retrofit	SF	262,000	1.48	388,000
Subtotal				388,000
Contingency (5%)				19,400
Total Contract Cost				407,400
SIOH (6.0%)				24,444
Total Request				431,844
Total Request Rounded				432,000

10. DESCRIPTION OF PROPOSED CONSTRUCTION: The lighting retrofit of the Headquarters Building consists of replacing existing light fixtures with new light fixtures with energy saving lamps and electronic ballast. The retrofit system results in a discounted payback period of 6.6 years, a savings to investment ration (SIR) of 1.71 and an Adjusted Internal Rate of Return (AIRR) of 7.8% This retrofit will improve the lighting levels, save energy and will update the interior of the facility.

11. REQUIREMENTS: Refer to attached for additional information.

I. Facility Description

This project consists of the Headquarters Building (Bldg. #2), which contains five wings with areas as follows:

Wing	Square Feet
A	46,595
B	15,487
C	66,570
D	66,570
E	66,570

This facility is generally three stories and includes general office space and a large auditorium.

II. Design Criteria

The following average maintained illumination levels taken from Table C-4 of the Corps of Engineers Standard Detail No. 40-06-04, dated February, 1991 and from the IES Lighting Handbook were used for this analysis:

Functional Areas	Footcandles
Offices	50
Cafeteria/Snack Bars	25
Toilets	20
Stairways	20
Corridors	10

III. Analysis of Energy Conservation Opportunities (ECO'S)

A. Existing Lighting

Ninety-five percent (95%) of the existing lighting for this facility remains as originally constructed in 1953. Previous retrofits have been performed on Rooms 68, 70, 265, and 266 in Wing D and Room 31 in Wing A. The existing lighting fixture types as well as the number of existing fixtures are tabulated and attached and a general description of each is listed below.

1. Type A Fixture

The Type A fixture is a 1'x8', finned metal fixture with two (2) -8' F96T12/SL lamps and a magnetic ballast. This fixture consumes 252 watts per ANSI C82.2-84 method of measurement. The coefficient of utilization for these fixtures is low in comparison to fixtures currently available. These fixtures are currently installed in the classrooms and office areas. The fixtures are surface mounted on the ceiling at approximately 12 feet above the floor.

2. Type B Fixture

The Type B fixture is utilized primarily in the corridors. The Type B fixture is similar to the Type A except it is four (4) feet in length and contains two (2) - 4' F40T12 CW lamps and a magnetic ballast. This fixture consumes 96 watts. These fixtures are bracket mounted approximately 8 feet above the floor.

3. Type C Fixture

The Type C fixture is utilized in the classrooms for lighting the chalkboard/map areas. The Type C fixture is a 4' fluorescent strip fixture with one (1) F40T12 CW lamp and a magnetic ballast. This fixture consumes 48 watts. These fixtures are surface mounted in a cove approximately 8 feet above the floor.

4. Type D Fixture

The Type D fixture is a round surface mounted incandescent fixture with two (2) 75 watt incandescent lamps and is primarily used in the stairway and toilet areas.

5. Type E Fixture

The Type E fixture is a round surface mounted incandescent fixture with two (2) 50 watt incandescent lamps and is primarily used in the stairway and toilet areas.

6. Type F Fixture

The Type F fixture is a pendant mounted incandescent fixture with one (1) 300 watt incandescent lamp and is primarily used in the supply areas, equipment areas, and a few offices.

7. Type G Fixture

The Type G fixture is a round surface mounted incandescent fixture with one (1) 100 watt incandescent lamps and is primarily used in the stairway and toilet areas.

8. Type H Fixture

The Type H fixture is a round surface mounted incandescent fixture with three (3) 75 watt incandescent lamps and is primarily used in the toilet areas.

9. Type J Fixture

The Type J fixture is a porcelain lampholder fixture and is utilized primarily in the washer units and has limited operating hours. For this reason, Type J fixtures are not recommended for retrofit consideration.

10. Type K Fixture

The Type K fixture is a concealed standard exterior outlet box with one (1) 100 watt incandescent lamps and is primarily used on the exterior of the building at the entrances.

11. Types L through R Fixtures

Type L through R fixtures are used primarily in the auditorium area. Due to the limited use of the auditorium, location of fixtures and the expense of retrofit due to the scaffolding required, this area is not recommended for retrofit.

12. Types XA and XB Fixtures

These incandescent exit light fixtures contain one (1) 25 watt lamp and are located at all of the building exits.

13. Previous Lighting Retrofits

a. Wing A - Room 31

This room has had a see-through grid lay-in ceiling installed with six 8 foot, 4-lamp, fluorescent, surface mounted fixtures mounted on the ceiling. These fixtures consume 504 watts.

b. Wing D - Rooms 68 and 70

These rooms consist of a lounge and a snack bar and have undergone a previous lighting retrofit. This retrofit resulted in installing a lay-in ceiling and installing sixty-four 75-watt, incandescent, recessed "canned" lights.

c. Wing D - Rooms 265 and 266

These rooms consist of an open office and a classroom, which has a lay-in ceiling and eighteen 2 x 4, 4-Lamp, fluorescent fixtures. These fixtures consume 192 watts. The resulting

illumination level measured was 140 footcandles which far exceeds the 50 footcandle requirement for these rooms.

B. Proposed Retrofit Lighting

The detailed energy savings calculations are attached.

1. Type A Fixture

The proposed replacement for these fixtures is a wide body, 1'x8' wraparound fixture (similar to Lithonia Model No. 8T2LB240) with four (4) F40T12/RS/SS lamps in tandem and an electronic ballast (similar to a Valmont Opti-Miser ballast). This new fixture would only consume 116 watts and would be suspended at 10 feet above the floor.

2. Type B Fixture

The proposed replacement for these fixtures is a wide body, 1'x4' wrap around fixture (similar to Lithonia Model No. 2LB 240) with two (2) F40T12/RS/SS lamps and an electronic ballast (similar to Valmont Opti-Miser ballast). This new fixture would consume 74 watts versus 96 watts for the existing fixture. This fixture would be surface mounted similar to the existing fixtures.

3. Type C Fixture

The proposed replacement for these fixtures is a single lamp, 4' fluorescent strip fixture (similar to Lithonia Model No. AS40) with one (1) F40T12/RS/SS lamp and an electronic ballast (similar to Valmont Opti-Miser ballast). This new fixture would consume 29 watts versus 48 watts for the existing fixture. This fixture would be surface mounted similar to the existing fixtures.

4. Type D Fixture

The proposed replacement for these fixtures is the 2-lamp wrap around surface mounted fixture proposed for replacement of Fixture Type B with the same lamps and ballast. This fixture would result in an increase in illumination levels, while reducing the electrical consumption by 76 watts/fixture.

5. Type E Fixture

The proposed replacement for these fixtures is the 2-lamp wrap around surface mounted fixture proposed for replacement of Fixture Type B with the same lamps and ballast types. This fixture would result in an increase in illumination levels, while reducing the electrical consumption by 26 watts/fixture.

6. Type F Fixture

The proposed replacement for these fixtures is the 2-lamp wrap around surface mounted fixture proposed for replacement of Fixture Type B with the same lamps and ballast types. This fixture would result in an increase in illumination levels, while reducing the electrical consumption by 226 watts/fixture.

7. Type G Fixture

The proposed replacement for these fixtures is the 2-lamp wrap around surface mounted fixture proposed for replacement of Fixture Type B with the same lamps and ballast types. This fixture would result in an increase in illumination levels, while reducing the electrical consumption by 26 watts/fixture.

8. Type H Fixture

The proposed replacement for these fixtures is the 2-lamp wrap around surface mounted fixture proposed for replacement of Fixture Type B with the same lamps and ballast types. This fixture would result in an increase in illumination levels, while reducing the electrical consumption by 151 watts/fixture.

9. Type K Fixture

The proposed replacement for the Type K fixture is replacing the 100 watt incandescent fixture with a 35 watt low pressure sodium fixture. The resulting savings would be 65 watts/fixture.

10. Types XA and XB Fixtures

The proposed replacement for these fixtures is an exit light (similar to Lithonia's Titan Series) with one (1) F7TT lamp. This fixture would result in savings of 16 watts/fixture.

11. Previous Lighting Retrofits

a. Wing A - Room 31

The proposed retrofit lighting for this area is a 4-lamp lay-in fixture with F40T12/RS/SS lamps and an electronic ballast (Similar to Valmont's Opti-Miser). The resulting electrical demand savings for Room 31 is 1,864 watts.

b. Wing D - Rooms 68 and 70

The proposed retrofit lighting for this area is a 4-lamp lay-in fixture with F40T12/RS/SS lamps and an electronic ballast (Similar to Valmont's Opit-Miser). The resulting electrical demand savings for these two rooms is 3,408 watts.

c. Wing D - Rooms 265 and 266

The proposed retrofit lighting for this area is a 4-lamp lay-in fixture with F40T12/RS/SS lamps and an electronic ballast (Similar to Valmont's Opti-Miser). The resulting electrical demand savings for these two rooms is 2,296 watts.

IV. Criteria

A. ANSI C82.2-84
Fluorescent Lamp Ballasts -
Methods of Measurment

B. OCE Architectural and Engineering
Instructions Design Criteria
November 20, 1990

C. Memorandum CEHSC-FU-M
Energy Conservation Investment Program (ECIP)
Guidance
November 4, 1992

D. TM 5-802-1
Economic Studies for Military construction Design Applications
December 1986

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT BLISS, TEXAS REGION NO. 3 PROJECT NO. 91109905F
PROJECT TITLE: FORT BLISS HEADQUARTERS BUILDING LIGHTING RETROFIT FISCAL YEAR 1993
DISCRETE PORTION NAME:
ANALYSIS DATE: 02/05/93 ECONOMIC LIFE 15 PREPARER S. P. CLARK

1. INVESTMENT COSTS:

A. CONSTRUCTION COST	$387,942		
B. SIOH	$21,337		
C. DESIGN COST	$23,277		
D. TOTAL COST (1A+1B+1C)	$432,555		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$0	
F. PUBLIC UTILITY COMPANY REBATE		$0	
G. TOTAL INVESTMENT (1D−1E−1F)			$432,555

2. ENERGY SAVINGS (+)/COST(−):

DATE OF NISTIR 85−3273−X USED FOR DISCOUNT FACTORS: OCTOBER 1992

ENERGY SOURCE	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$2.24	1935.2	$4,335	11.77	$51,021
B. DIST			$0	13.83	$0
C. RESID			$0	16.15	$0
D. NG			$0	15.34	$0
E. PPG			$0	11.12	$0
F. COAL			$0	12.82	$0
G. SOLAR			$0	11.12	$0
H. GEOTH			$0	11.12	$0
I. BIOMA			$0	11.12	$0
J. REFUS			$0	11.12	$0
K. WIND			$0	11.12	$0
L. OTHER			$0	11.12	$0
M. DEMAND SAVINGS			$59,200	11.12	$658,304
N. TOTAL		1935.2	$63,535		$709,325

3. NON ENERGY SAVINGS (+) OR COST (−):

A. ANNUAL RECURRING (+/−)	$0	
1. DISCOUNT FACTOR (TABLE A)		
2. DISCOUNTED SAVINGS/COST (3A X 3A1)		$0

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

B. NON RECURRING SAVINGS (+) OR COST(−)

	ITEM	SAVINGS(+) COST(−)(1)	YEAR OF OCCUR.(2)	DISCOUNT FACTOR(3)	DISCOUNTED SAV-INGS(+)COST(−)(4)
a.	RELAMPING	$5,225	1	0.96	$5,016
b.	RELAMPING	$5,225	2	0.92	$4,807
c.	RELAMPING	$5,225	3	0.89	$4,650
d.	RELAMPING	$5,225	4	0.85	$4,441
e.	RELAMPING	$5,225	5	0.82	$4,285
f.	RELAMPING	$870	6	0.79	$687
g.	RELAMPING	$870	7	0.76	$661
h.	RELAMPING	$870	8	0.73	$635
i.	RELAMPING	$870	9	0.7	$609
j.	RELAMPING	$870	10	0.68	$592
k.	RELAMPING	$870	11	0.65	$566
l.	RELAMPING	$870	12	0.62	$539
m.	RELAMPING	$870	13	0.6	$522
n.	RELAMPING	$870	14	0.58	$505
o.	RELAMPING	$870	15	0.56	$487
p.	TOTAL	$34,825			$29,002

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (3A2 + 3Bp4) $29,002

4. SIMPLE PAYBACK 1G/(2N3+3A+(3Bp1/ECONOMIC LIFE)): 6.6 YEARS

5. TOTAL NET DISCOUNTED SAVINGS (2N5+3C): $738,327

6. SAVINGS TO INVESTMENT RATIO (SIR) 5/1G: 1.71

7. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 7.8%

COST ESTIMATING ANALYSIS PROJECT: LIGHTING RETROFIT HEADQUARTERS BUILDING LOCATION: FORT BLISS, TEXAS					INVITATION/CONTRACTOR CODE: 100%			DRAWING NO: ESTIMATOR: RBS			SHEET OF DATE PREPD: 21-Jan-93 CHECKED BY:
TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIALS		TOTAL
	NO/UN	UNIT	MH UN	HRS	UN PRICE	COST	UN PRICE	COST	UN PRICE	COST	COST
DEMOLITION											
TYPE A – FLUORESCENT, SURFACE MTD. 8'	1328	EA			11.17	14827.12	0.00	0.00	0.23	305.44	15132.56
TYPE B – FLUORESCENT, SURFACE MTD. 4'	239	EA			5.58	1334.22	0.00	0.00	0.23	54.97	1389.19
TYPE C – FLUORESCENT STRIP 4'	256	EA			3.92	1002.24	0.00	0.00	0.23	58.88	1061.12
TYPE D – INCANDESCENT, SURFACE MTD.	194	EA			5.58	1083.00	0.00	0.00	0.23	44.62	1127.63
TYPE E – INCANDESCENT, SURFACE MTD.	56	EA			5.58	312.62	0.00	0.00	0.23	12.88	325.50
TYPE F – INCANDESCENT, SURFACE MTD.	45	EA			5.58	251.21	0.00	0.00	0.23	10.35	261.56
TYPE G – INCANDESCENT, SURFACE MTD.	23	EA			5.58	128.40	0.00	0.00	0.23	5.29	133.69
TYPE H – INCANDESCENT, SURFACE MTD.	4	EA			5.58	22.33	0.00	0.00	0.23	0.92	23.25
TYPE K – REMOVE ONLY INCANDESCENT BULBS	38	EA			4.71	179.08	0.00	0.00	0.00	0.00	179.08
TYPE X – EXIT SIGNS	69	EA			9.79	675.34	0.00	0.00	0.00	0.00	675.34
TYPE R1 – INCANDESCENT, RECESSED "CAN" LIGHTS	64	EA			17.60	1126.59	0.00	0.00	0.00	0.00	1126.59
TYPE R2 – FLUORESCENT, 2X4, LAY-IN	18	EA			11.17	200.97	0.00	0.00	0.23	4.14	205.11
TYPE R3 – FLUORESCENT STRIP SURFACE MTD.	24	EA			17.60	422.47	0.00	0.00	0.23	5.52	427.99
ELECTRICIAN	16	HRS			26.10	417.60	0.00	0.00	0.00	0.00	417.60
SUBTOTAL						$21,983		$0		$503	$22,486
MEANS MODIFIED (93.3%)	1	EA									$20,980
SUB. O & P (15%)	1	EA									$3,147
GC O & P (15%)	1	EA									$3,619
CONTINGENCY	1	EA									$4,162
Total ELECTRICAL DEMOLITION Costs											**$31,907**

COST ESTIMATING ANALYSIS
PROJECT: LIGHTING RETROFIT
HEADQUARTERS BUILDING
LOCATION: FORT BLISS, TEXAS

INVITATION/CONTRACTOR CODE: 100%

DRAWING NO:

ESTIMATOR: RBS

SHEET OF

DATE PREPD: 05-Oct-92

CHECKED BY: YOUNG

TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIALS		TOTAL
	NO/UN	UNIT	MH UN	HRS	UN PRICE	COST	UN PRICE	COST	UN PRICE	COST	COST
NEW WORK											
TYPE A – FLUORESCENT, SURFACE MTD. 8'	1328	EA			37.93	50373.70		0.00	100.00	132800.00	183174
TYPE B – FLUORESCENT, SURFACE MTD. 4'	239	EA			26.16	6251.76		0.00	51.00	12189.00	18441
TYPE C – FLUORESCENT STRIP 4'	256	EA			17.57	4498.94		0.00	36.00	9216.00	13715
TYPE D – FLUORESCENT, SURFACE MTD.	194	EA			26.16	5074.65		0.00	51.00	9894.00	14969
TYPE E – FLUORESCENT, SURFACE MTD.	56	EA			26.16	1464.85		0.00	51.00	2856.00	4321
TYPE F – FLUORESCENT, SURFACE MTD.	45	EA			26.16	1177.11		0.00	51.00	2295.00	3472
TYPE G – FLUORESCENT, SURFACE MTD.	23	EA			26.16	601.63		0.00	51.00	1173.00	1775
TYPE H – FLUORESCENT, SURFACE MTD.	4	EA			26.16	104.63		0.00	51.00	204.00	309
TYPE K – 35 WATT LOW PRES SODIUM FIXTURE	38	EA			11.00	418.00		0.00	42.01	1596.38	2014
TYPE X – FLUORESCENT EXIT SIGN	69	EA			29.70	2049.02		0.00	55.00	3795.00	5844
TYPE R1 – FLUORESCENT 2X4, LAY-IN	6	EA			33.65	201.93		0.00	77.00	462.00	664
TYPE R2 – FLUORESCENT, 2X4, LAY-IN	10	EA			33.65	336.55		0.00	77.00	770.00	1107
TYPE R3 – FLUORESCENT 2X4, LAY-IN	10	EA			33.65	336.55		0.00	77.00	770.00	1107
SUBTOTAL						72889.3		0		178020.38	250909.699
MEANS MODIFIED (93.3%)	1	EA									234099
SUB. O & P (15%)	1	EA									35115
GC O & P (15%)	1	EA									40382
CONTINGENCY	1	EA									46439
Total NEW ELECTRICAL WORK Costs											$356,035

FORT BLISS EEAP

BUILDING/ FLOOR	FIXTURE TYPE *																	
	A	B	C	D	E	F	G	H	K	L	M	N	P	R	XA-B	R1	R2	R3
WING 'A'																		
BASEMENT	47	17	0	1	4	15	2								4	24		
1ST FLOOR	72	24	0	12	8	0	1	4	4						5			
2ND FLOOR	82	23	0	6	3	0	6								3			
3RD FLOOR	63	15	0	11	4	0	4		3						3			
WING 'B'																		
BASEMENT			0	35					17									
MAIN/BALCONY			0	16		4				72	3	17	10	79	21			
WING 'C'																		
BASEMENT	122	16	28	10	3	6	1		1						4			
1ST FLOOR	121	16	40	14	6	4	0		4						7			
2ND FLOOR	121	17	40	15	3	4	2		0						3			
WING 'D'																		
BASEMENT	92	23	8	11	3	6	0		1						3		64	
1ST FLOOR	126	17	40	13	5	0	1		3						3			
2ND FLOOR	109	18	40	14	3	4	2		0						3			18
WING 'E'																		
BASEMENT	124	17	8	9	6	1	0		1						3			
1ST FLOOR	124	16	32	13	6	1	1		4						4			
2ND FLOOR	125	20	20	14	2	0	3		0						3			
FIXTURE TOTALS	1328	239	256	194	56	45	23	4	38	72	3	17	10	79	69	24	64	18

*FIXTURE TYPE DESIGNATION TAKEN FROM ORIGINAL CONSTUCTION DOCUMENTS

EXISTING LIGHTING ENERGY USE

BUILDING/ FLOOR	FIXTURE TYPE																		
	A	B	C	D	E	F	G	H	K	L	M	N	P	R	XA–B	R1	R2	R3	TOTALS
FIXTURE TOTALS	1328	239	256	194	56	45	23	4	38	72	3	17	10	79	69	6	64	18	2521
WATTS/FIXTURE	252	96	48	150	100	300	100	225	100	166	249	77	100	200	25	504	75	192	
TOTAL KW	335	23	12	29	6	14	2	1	4	12	1	1	1	16	2	3	5	3	469
OPERATING HRS/ DAY	10	10	4	10	9	9	6	9	9	2	2	2	1	4	24	10	10	10	
TOTAL MWH	837	57	12	73	13	30	3	2	9	6	0	1	0	16	10	8	12	9	1098

RETROFIT LIGHTING ENERGY USE

BUILDING/ FLOOR	FIXTURE TYPE																		
	A	B	C	D	E	F	G	H	K	L	M	N	P	R	XA–B	R1	R2	R3	TOTALS
FIXTURE TOTALS	1328	239	256	194	56	45	23	4	38	72	3	17	10	79	69	10	12	10	2465
WATTS/FIXTURE	116	74	29	74	74	74	74	74	35	166	249	77	100	200	9	116	116	116	
TOTAL KW	154	18	7	14	4	3	2	0	1	12	1	1	1	16	1	1	1	1	239
OPERATING HRS/ DAY	10	10	4	10	9	9	6	9	9	2	2	2	1	4	24	10	10	10	
TOTAL MWH	385	44	7	36	9	7	3	1	3	6	0	1	0	16	4	3	3	3	532

RETROFIT LIGHTING ENERGY SAVINGS

BUILDING/ FLOOR	FIXTURE TYPE																	
	A	B	C	D	E	F	G	H	K	L*	M*	N*	P*	R*	XA–B	R1	R2	R3	TOTAL
KW SAVED	180.	5.2	4.8	14.	1.4	10.	0.5	0.6	2.4	0	0	0	0	0	1.10	1.8	3.4	2.2	229.4
KW $K SAVINGS	46.5	1.3	1.2	3.8	0.3	2.6	0.1	0.1	0.6	0	0	0	0	0	0.28	0.4	0.8	0.5	$59.20
MWH SAVED	451.	13.	4.8	36.	3.2	22.	0.8	1.3	5.5	0	0	0	0	0	6.62	4.6	8.5	5.7	565.9
MWH $K SAVINGS	3.4	0.1	0.0	0.3	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	$4.32
TOTAL SAVINGS $K	50.0	1.4	1.2	4.0	0.4	2.7	0.1	0.1	0.6	0	0	0	0	0	0.33	0.5	0.9	0.6	$63.52

* NOT CONSIDERED FOR RETROFIT DUE TO LIMITED USE, LOCATION AND PROHIBITIVE RETROFIT COSTS.