ENERGY EN ANALYSIS	
A	Т
FORT LEAVENW	/ORTH, KANSAS
FINAL SU	BMITTAL
BUILDING 111	SURVEY - BELL HALL SUMMARY
CONTRACT NUMBER	
	KANSAS CITY DISTRICT CORPS OF ENGINEERS

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## Introduction:

Bell Hall (Building No. 111) at Ft. Leavenworth, constructed in 1957, has undergone one major addition completed in 1986. Bell Hall is primarily used for officer training, which was its original intent. Over the years, equipment loads within the facility have increased, mainly due to increased computer usage. The original construction of this facility did not anticipate the additional computer load and the present mechanical and electrical systems are undersized. The systems are not capable of providing cooling all year; which is a requirement for the new computers. Since it's implementation, the HVAC systems have had problems maintaining environmental control. Saving energy and improving environmental control at the same time for this facility will be a difficult task. Many of the systems don't maintain the minimum temperature and ventilation levels in the building and are shut down most of the time. Modifying these systems to use less energy will require construction modifications to allow proper operation. This increased the cost of the ECO's and made reasonable paybacks difficult to achieve.

## <u>Scope:</u>

Under Base Contract No. DACA41-86-C-0061, an energy audit and engineering study Bell Hall Building No. 111 was performed. The scope included the following:

- A. Measure supply, exhaust and return air volumes for each air supply system in the building.
- B. Review and observe HVAC system controls.
- C. Perform a field audit of facility's lighting levels, miscellaneous equipment loads and occupant quantities.
- D. Verify lighting and occupant schedules through field observation and personal interview.
- E. Provide adequate documentation of field investigation

#### Introduction

Page 1

notes.

- F. Develop a computer simulation of the buildings base energy consumption using daily and hourly simulation procedures.
- G. Determine possible methods of energy conservation and simulate energy conservation methods using an hourly computer simulation program, and compare results to the base line model.
- H. Determine probable construction costs for each energy conservation method and perform a life cycle cost analysis of the project using the information gathered.

Note: The electrical / lighting portion of this project was performed and the ECO's have already been implemented under another contract.

## Work Accomplished:

The field survey on Bell Hall at Ft. Leavenworth was started in September of 1986. It included measuring 29 air supply systems, counting all facility lighting, measuring miscellaneous electrical loads, recording zone temperatures, measuring exhaust volumes, measuring boiler combustion efficiency, measuring chillers operating parameters, counting occupants, observing typical facility operation and interviewing occupants and operating personnel. All data collected through this investigation was then entered into a computer database for manipulation.

From the field data, building plans, and previous energy studies we simulated the facility's energy consumption on the PCDOE computer program. Once the base energy consumption of the facility was developed we made additional computer simulation runs for each Energy Conservation Opportunity (ECO). We then determined energy savings and prepared preliminary probable construction cost estimates for each of the ECO's. The savings investment ratio (SIR) was computed

Introduction

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for each ECO. ECO description data, probable construction cost, energy savings and economic analysis are included in Volume I, Section II of this submittal. All computer simulation results are included in Volume II of this submittal.

## Building Data

The facility's HVAC system consists of 5 multizone air supply systems, 24 unit ventilators, 1 built up VAV system, 2 packaged single zone DX systems, 6 packaged thru the wall air conditioners, 13 single zone heating and cooling supply systems, 3 make-up air ventilation systems and 240 two-pipe fan coil units. The unit ventilators, multizone air supply systems, built-up VAV system and 2 of the constant volume air supply systems have economizer capability. The fan coil units are two-pipe with one coil which is used for both heating and cooling The Classrooms, Eisenhower Auditorium and Marshall Auditorium have perimeter radiation systems for perimeter heating. These systems are only active when the boiler is operating.

The central heating/cooling plant consist of 3 boilers, 2 chillers, 1 cooling tower and 14 base mounted pumps. Since piping arrangement is a 2-pipe system, the central plant is either providing heating or cooling but is not capable of providing simultaneous heating and cooling. Reference figures No. 1 and 2 for the flow schematics of the heating and cooling at Bell Hall.

## Classrooms (Original Facility):

The unit ventilators serve the classrooms in the original part of the facility. They provide ventilation and economizer air in the winter and provide cooling and ventilation air in the summer. The units are manually switched from summer to winter operations by a summer/winter switch located in the boiler room of Bell Hall. In the winter, the economizers on the unit ventilators are activated to allow for winter cooling. The economizer does not look at the room temperature to see if cooling is

#### Introduction

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required. Therefore, if no cooling air is required, the air is reheated to room temperature by the unit ventilator coil which wastes energy. This control sequence was analyzed in detail under ECO-M7.

## Office Wing:

The office wing in the original facility is served from the two-pipe fan coil system for heating and cooling. Ventilation air is provided by a roof-top air handling unit (RTU-3) and is intended to operate all year. However, RTU-3 is out of service and is not allowed to operate in cold temperature due to coil freeze-up. Inspection so this unit indicates that it is badly damaged and needs to be replaced. In addition, unit's pipe insulation is damaged from previous repairs.

# Facility Maintenance:

Presently the facility has one maintenance engineer on temporary assignment from 7:30 a.m. to 4:30 p.m. Prior to the installation of the building automation system Bell Hall had three, full time maintenance engineers. These positions were eliminated. None of the air systems in Bell Hall have clean usable filters. Some of the air systems did not even have filters. Based on the condition of air filters and other items requiring periodic maintenance, we recommend the post consider increasing the maintenance operations staff assigned to the building.

# **BELL HALL BUILDING 111**

# **EXISTING ANNUAL ENERGY CONSUMPTION**

	ELECTRICITY	
КМН	DOLLARS	MBTU
8,725,854	\$461,611	29,781

NATURAL GAS								
THERMS	THERMS DOLLARS MBTU							
2.78E-07	\$87,550	27,794						

ΤΟΤΑ	L
DOLLARS	MBTU
\$549,160	57,575

#### ENERGY CONSERVATION ANALYSIS

# ALL ECOS INVESTIGATED -- BELL HALL BLDG 111

ECO	DESCRIPTION	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST⁺	SIMPLE PAYBACK YEARS	SIR
HEATING	VENTILATION AND AIR CONDITION	VING					
M1	Convert existing multi-zone air handling units to VAV	6015.0	\$34,842	\$320,775	\$352,853	10.1	1.09
M2	Convert office and classrooms to 4-pipe system with VAV	13983.0	\$63,500	\$3,495,843	\$3,845,427	60.6	0.19
МЗ	Convert existing 2-pipe system to 4-pipe	7448.0	\$30,800	\$1,720,729	\$1,892,802	61.5	0.19
M4	Modified Class Room ventilators outdoor air control sequence	21405.0	\$107,363	\$77,873	\$85,660	0.8	14.40
M5	Condenser water temperature reset	219.0	\$3,395	\$14,621	\$16,083	4.7	1.93
M6	Provide fan shoutdown during night and off peak hours	6573.0	\$42,178	\$32,168	\$35,385	0.8	12.79
M7	Boiler Oxygen Trim Control						
M8	Provide new heat recovery chiller	3302.0	\$9,600	\$2,150,586	\$2,365,645	246.4	0.05
M9	Convert to primary/secondary pumping system	2274.0	\$38,680	\$314,356	\$345,792	8.9	1.01
M10	Reduce cooling tower fan power	186.0	\$2,883	\$22,359	\$24,595	8.5	1.07
BUILDING						· · · · · · · · · · · · · · · · · · ·	
A1	Install Double Pane Windows	343.0	\$1,600	\$51,461	\$56,607	35.4	0.47
A2	New roof (existing building)	1399.0	\$8,600	\$135,508	\$149,059	17.3	0.86
A3	Reduce qty of dock doors and provide dock seals	271.0	\$1,100	\$32,313	\$35,545	32.3	0.55
A4	Reduce Solar Load with solar films	1942.0	\$16,788	\$144,891	\$159,380	9.5	1.43
A5	Air Curtains	340.0	\$1,330	\$18,472	\$20,319	15.3	1.21
A6	Wall Insulation w/ reduction in window area (option a)	1541.0	\$16,800	\$1,517,272	\$1,668,999	99.3	0.13
A6	Wall Insulation w/ reduction in window area (option b)	1541.0	\$16,800	\$552,000	\$607,200	36.1	0.35

#### ECOs RECOMMENDED -- BELL HALL BLDG 111

ECO	DESCRIPTION	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
HEATING	VENTILATION AND AIR CONDITIO	NING					
M1	Convert existing multi-zone air handling units to VAV	6015.0	\$34,842	\$320,775	\$352,853	10.1	1.09
M4	Modified Class Room ventilators outdoor air control sequence	21405.0	\$107,363	\$77,873	\$85,660	0.8	14.40
M5	Condenser water temperature reset	219.0	\$3,395	\$14,621	\$16,083	4.7	1.93
M6	Provide fan shoutdown during night and off peak hours	6573.0	\$42,178	\$32,168	\$35,385	0.8	12.79
M9	Convert to primary/secondary pumping system	2274.0	\$38,680	\$314,356	\$345,792	8.9	1.01
M10	Reduce cooling tower fan power	186.0	\$2,883	\$22,359	\$24,595	8.5	1.07

#### BUILDING ENVELOPE

A4	Reduce Solar Load with solar films	1942.0	\$16,788	\$144,891	\$159,380	9.5	1.43
A5	Air Curtains	340.0	\$1,330	\$18,472	\$20,319	15.3	

#### ENERGY CONSERVATION ANALYSIS

#### ECOs REJECTED -- BELL HALL BLDG 111

ECO	DESCRIPTION	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS (\$)		TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR	
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## HEATING VENTILATION AND AIR CONDITIONING

M8	Provide new heat recovery chiller	3302.0	\$9,600	\$2,150,586	\$2,365,645	246.4	0.05
M7	Boiler Oxygen Trim Control						
МЗ	Convert existing 2-pipe system to 4-pipe	7448.0	\$30,800	\$1,720,729	\$1,892,802	61.5	0.19
M2	Convert office and classrooms to 4-pipe system with VAV	13983.0	\$63,500	\$3,495,843	\$3,845,427	60.6	0.19

#### BUILDING ENVELOPE

A1	Install Double Pane Windows	343.0	\$1,600	\$51,461	\$56,607	35.4	0.47
A2	New roof (existing building)	1399.0	\$8,600	\$135,508	\$149,059	17.3	0.86
A3	Reduce qty of dock doors and provide dock seals	271.0	\$1,100	\$32,313	\$35,545	32.3	0.55
A6	Wall Insulation w/ reduction in window area (option a)	1541.0	\$16,800	\$1,517,272	\$1,668,999	99.3	0.13
A6	Wall Insulation w/ reduction in window area (option b)	1541.0	\$16,800	\$552,000	\$607,200	36.1	0.35

## ENERGY CONSERVATION ANALYSIS Bell Hall

Non-ECIP Projects						
PROJECT GROUP		ENERGY	ENERGY	PROJECT	SIMPLE	
BELL HALL BLDG 111	ECO	SAVINGS	SAVINGS	COST	PAYBACK	SIR
		MBTU/YR	\$	\$	YRS	
GROUP 1						
Modify O.A. Controls						
Class Room Ventilators	ECO-M4	21405.0	\$107,363	\$85,660	0.8	14.56
Condenser Water Temp Rese	ECO-M5	219.0	\$3,395	\$16,083	4.7	1.93
	500 140	100.0	<b>A</b> A <b>A</b> AA	<b>604505</b>	0.5	1.07
Modulate Cooling Tower Fans	ECO-M10	186.0	\$2,883	\$24,595	8.5	1.07
Fon Chutdown Night	FCO MC	6572.0	¢40 170	\$35,385		12.79
Fan Shutdown - Night	ECO-M6	6573.0	\$42,178	\$30,365	0.8	12.79
GROUP 1 TOTALS		28383.0	\$155,819	\$161,723	1.0	10.78
		20000.0	\$100,010	<b>\$101,720</b>	1.0	10.70
		·				
GROUP 2						
Install Solar Film	ECO-A4	1942.0	\$16,788	\$159,380	9.5	1.43
Air Curtains at Dock Doors	ECO-A5	340.0	\$1,330	\$20,319	15.3	1.21

ECIP Projects						
GROUP 3						
Convert Multi-Zone AHU to Variable Air Volume	ECO-M1	6015.0	\$34,842	\$352,853	10.1	1.09
Convert to Primary Secondary System	ECO-M9	2274.0	\$38,680	\$345,792	8.9	1.01
GROUP 3 TOTALS		8289.0	\$73,522	\$698,645	9.5	1.05

2282.0

\$18,118

\$179,699

9.9

1.03

GROUP 2 TOTALS

**BELL HALL BUILDING 111** 

#### **ENERGY AND COST SAVINGS**

## TOTAL POTENTIAL ENERGY AND COST SAVINGS

	ENERGY	ENERGY
	SAVINGS	SAVINGS
	MBTU/YR	\$/YR
GROUP 1	28,383	\$155,819
GROUP 2	2,282	\$18,118
GROUP 3	8,289	\$72,522
TOTAL	38,954	\$246,459

#### PERCENTAGE OF ENERGY CONSERVED

POTENTIAL ENERGY SAVINGS, MBTU	38,954
EXISTING ENERGY CONSUMPTION, MBTU	57,575
PERCENT ENERGY CONSERVED	67.7%

## ENERGY USE AND COST

	<b>ENERGY</b>	ENERGY
	MBTU/YR	\$/YR
BEFORE ECO IMPLEMENTATION	57,575	\$549,160
AFTER ECO IMPLEMENTATION	18,621	\$302,701

## ENERGY CONSERVATION ANALYSIS Bell Hall

Non-ECIP Projects						<u> </u>
PROJECT GROUP		ENERGY	ENERGY	PROJECT	SIMPLE	
BELL HALL BLDG 111	ECO	SAVINGS	SAVINGS	COST	PAYBACK	SIR
		MBTU/YR	\$	\$	YRS	
GROUP 1						
Modify O.A. Controls						
Class Room Ventilators	ECO-M4	21405.0	\$107,363	\$85,660	0.8	14.56
						1.93
Condenser Water Temp Rese	ECO-M5	219.0	\$3,395	\$16,083	4.7	1.93
Madulata Casting Towar Fac		100.0	\$2,883	\$24,595	8.5	1.07
Modulate Cooling Tower Fans	ECO-IVITU	186.0	\$2,003	\$24,393	0.5	1.07
Fan Shutdown - Night	ECO-M6	6573.0	\$42,178	\$35,385	0.8	12.79
	200100	0070.0	φ.2,110	<i></i>		
GROUP 1 TOTALS		28383.0	\$155,819	\$161,723	1.0	10.78
			,			

# FORT LEAVENWORTH - BELL HALL BUILDING 111

## ENERGY CONSERVATION OPPORTUNITY: ECO-M4

## PURPOSE:

This Energy Conservation Opportunity simulation (ECO-M4) analyzes the energy savings that may be realized by modifying the ventilation air handling unit controls. The modifications will allow for the proper operation of the existing economizer system.

## SCOPE:

This E.C.O. simulation (ECO-M4) will modify the controls to the existing classroom ventilation units to permit an effective economizer control operation. The modifications will include control modifications and a change in the sequence of operation for each unit ventilator. The control modifications will modulate the outside air and return air dampers during the cooler seasons of the year, based on the outside air temperature and the room air temperature conditions. The control valve(s) for the heating coil(s) will remain inoperative or closed unless the outside air conditions are below freezing. The control valve will be cracked open only when the outside air temperature drops below a determined set-point to prevent coil freezing. The room heating requirements will be satisfied by the existing fin tube radiation system.

Reference Figure No. 1. Modifications to the existing unit ventilators will require new temperature sensors, sequencing relays, and controllers to operate the face and bypass dampers and to operate the outside air and return air dampers. The existing dampers, damper motors, and room thermostats will remain as installed except for minor calibrations.

## MODELING TECHNIQUES:

The changes made to our base model for this simulation inlude the following:

ECO-M4

PAGE 1

 Classroom unit ventilators were changed from the modified VAVS (re: Modeling Techniques, Section I) system to single zone heating and cooling system (SZRH).

# SUMMARY:

The probable project cost is \$85,700. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run (ECO-M4) are approximately 21,400 MBTU per year and \$110,400 per year.

The simple payback for this simulation is 0.7 years.

The savings to investment ratio (S.I.R.) for this simulation is 14.56.





PAGE 2

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Page 3

CONSTRUCTION COST ESTI	DATE PREF	ARED 16-Feb-87		SHEET (	ÇF 2		
PROJECT						1	<u></u>
BELL HALL ENERGY STUDY							
LOCATION FORT LEAVENWORTH, KAN	SAS			×		(NO DESIGN (PRELIMINA)	I COMPLETE
ARCHITECT/ENGINEER	545					(FINAL DESI	RT DESIGN)
CLARK, RICHARDSON & BIS	KUP				OTHER	(SPECIFY)	
DECRIPTION		ESTIMA	TOR			CHECKED B	
		I VIIIY I	LABO	J.B.	1 14	I	G.S. TOTAL
SUMMARY: ECO-M4		UNIT	PER	TOTAL	PER	TOTAL	COST
		MEAS.	UNIT		UNIT		
DEMOLITION WORK TOTAL:				\$0		\$0	
NEW WORK TOTAL:				\$38,500		\$12,500	\$51,0
SUBTOTAL:				\$38,500		\$12,500	\$51,00
CONTINGENCY			10.00%	\$3,850	10.00%	\$1,250	\$5,10
SUBTOTAL				\$42,350		\$13,750	\$56,10
COMP., TAX. SOC. SEC., INS.			13.50%	\$5,717	3.50%	\$481	\$6,19
SUBTOTAL				\$48,067		\$14,231	\$62,29
OVERHEAD AND PROFIT			25.00%	\$12,017	25.00%	\$3,558	\$15,57
CONSTRUCTION COSTS:							\$77,87
							577,07
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CONSTRUCTION COST ESTIMA	12		DATE PREF	16-Feb-87	,	SHEET	QF 2 2
PROJECT	BASIS FOR ESTIMATE						
BELL HALL ENERGY STUDY							
LOCATION				X		(NO DESIGI	N COMPLETE
FORT LEAVENWORTH, KANSA	<u>s</u>			ļ		(PRELIMINA	RY DESIGN)
						(FINAL DES	GN)
CLARK, RICHARDSON & BISKU DECRIPTION	P	ESTIM	ATOR	1	UIHER	(SPECIFY)	Y
ECO-M4 (CLASS ROOMS)			Alon	J.B.			G.S.
	QUA	YTTY	LABO	DR	MA	TERIAL	TOTAL
(SUMMARY)	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	COST
DEMOLITION:				\$0		\$0	
CONSTRUCTION:	1						
VENTILATION UNIT CONTROL MOD.	24	EA	\$1,500.00	\$36,000	\$500.00	\$12,000	\$48,0
OBILIZATION	1	LS	\$2,500.00	\$2,500	\$500.00	\$500	\$3,0
						<u>.</u>	lae
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LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FTLVBDLM ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) INSTALLATION & LOCATION: FT LEAVENWORTH REGIO PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS LCCID 1.001 REGION NO. 7

FISCAL YEAR 1987	DISCRETE PORTION NAME: ECOM4	
ANALYSIS DATE: 05-31-89	ECONOMIC LIFE 15 YEARS	PREPARED BY: CRB

1. INVESTMENT

•			
	A. CONSTRUCTION COST	\$	77873.
	B. SIOH	\$	7787.
	C. DESIGN COST	\$	3894.
	D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	80599.
	E. SALVAGE VALUE COST	-\$	0.
	F. TOTAL INVESTMENT (1D-1E)	\$	80599.

2. ENERGY SAVINGS (+) / COST (-) ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

	FUEL		UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)		NNUAL \$ AVINGS(3)	DISCOUNT FACTOR(4)	-	DISCOUNTED SAVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	00 00 00 <del>00</del>	15.50 .00 .00 3.15 .00	3234. 0. 0. 18170. 0.	\$\$ \$\$ \$\$ \$\$	50127. 0. 0. 57236. 0.	8.59 11.28 12.01 12.76 10.17		430591. 0. 0. 730325. 0.
	F. TOTAL			21404.	\$	107363.		\$	1160916.
3.	NON ENERGY	SA	VINGS(+) / CO	DST(-)					
	A. ANNUAL R		JRRING (+/-) FACTOR (TA			9.11		\$	0.
				COST (3A X 3A	1)	5.11		\$	0.
	C. TOTAL NO	N E	NERGY DISCO	OUNTED SAVIN	GS(+	)/COST(-) (3	A2+3BD4)	\$	0.
	(1) 25% MA A IF 3D B IF 3D C IF 3D	AX N 01 IS 01 IS 01B	NON ENERGY 5 = OR > 3C G 5 < 3C CALC IS = > 1 GO T	SIR = (2F5+3D)	.33) 1)/1F)	=	\$ 383102.		
4.	FIRST YEAR D	OLI	_AR SAVINGS	2F3+3A+(3B1D	V(YEA	ARS ECONO	AIC LIFE))	\$	107363.
5.	TOTAL NET DI	sco	DUNTED SAV	INGS (2F5+3C)				\$	1160916.
6.	DISCOUNTED (IF < 1 PROJEC			JALIFY)	(S	ilR)=(5 / 1F)=	14.40		

FORT LEAVENWORTH - BELL HALL BUILDING 111

# ENERGY CONSERVATION OPPORTUNITY: ECO-M5

## PURPOSE:

This Energy Conservation Opportunity simulation (ECO-M5) analyzes the energy savings that may be realized by allowing the chiller condenser water temperature to be controlled during low ambient wet bulb conditions.

## SCOPE:

This E.C.O. simulation (ECO-M5) modifies the existing boiler room condenser piping loop. The modifications will allow the control of the condenser water temperature for optimum chiller operation. The construction work will include new pipe installation, existing pipe modifications, and control modifications.

Reference Figure No. 1 for the boiler room equipment layout and pipe modifications.

## MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

- 1. The minimum condenser water temperature shown on line 2,340 (re: Volume II, Section I) was changed from 85° F. to 65° F.
- 2. The tower water temperature control was changed from "FIXED" to "FLOAT" on line 2,344.



ECO-M5

# SUMMARY:

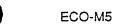
The probable project cost is \$14,650. This project cost is the construction cost plus 10% SIOH

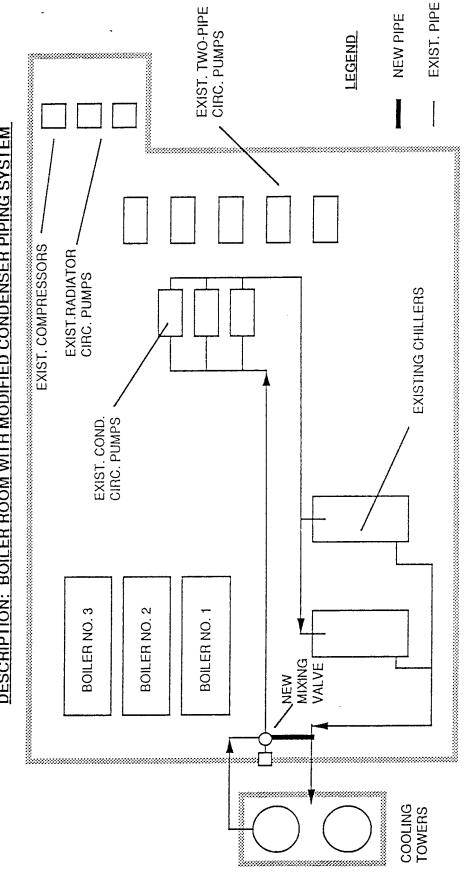
The energy savings realized by this E.C.O. run (ECO-M5) are approximately 220 MBTU per year and \$3,400 per year.

The simple payback for this simulation is 4.3 years.

The savings to investment ratio (S.I.R.) for this simulation is 1.93.







DESCRIPTION: BOILER ROOM WITH MODIFIED CONDENSER PIPING SYSTEM

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FIGURE NO. 1

ECO-M5

CONSTRUCTION COST ESTIMATE	2		DATE PREP	ARED 16-Feb-87		SHEET 1	OF 2
PROJECT	<u></u>	L		BASIS FOR E		<u> </u>	<u>5</u>
BELL HALL ENERGY STUDY							
OCATION		. —	. '	×	CODEA (N	NO DESIGN PRELIMINAF	
FORT LEAVENWORTH, KANSAS				<u> </u>		INAL DESIG	SN)
CLARK, RICHARDSON & BISKUP					OTHER (S	PECIFY)	
DECRIPTION		ESTIMA	TOR			CHECKED I	BY G.S.
	0114	NTITY I	IA	J.B. BOR	MAT	ERIAL	TOTAL
SUMMARY: ECO-M5	NO.	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	COST
DEMOLITION WORK TOTAL:				\$0		so	
NEW WORK TOTAL:				\$6,004		\$3.690	\$9,6
SUBTOTAL:				\$6.004		\$3.690	\$9,6
CONTINGENCY			10.00%	\$600	10.00%	\$369	\$9
SUBTOTAL				\$6,604		\$4.059	\$10,6
COMP., TAX. SOC. SEC., INS.			13.50%		3.50%	\$142	\$1,0
SUBTOTAL				\$7,496		\$4,201	\$11.6
OVERHEAD AND PROFIT	-		25.00%	\$1,874	25.00%	\$1,050	\$2,9
TOTAL PROJECT COSTS:							\$14,6

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CONSTRUCTION COST ESTIMATE			DATE PREP	ARED 16-Feb-87		SHEET 2	OF 2
				BASIS FOR E		۷	2
ROJECT				BASIS FUR E	STIVIATE		
BELL HALL ENERGY STUDY							
DCATION				×		NO DESIGN	
FORT LEAVENWORTH, KANSAS				L		PRELIMINAR	T DESIGN
RCHITECT/ENGINEER					CODEC	FINAL DESIG	N)
CLARK, RICHARDSON & BISKUP				l	OTHER (S	SPECIFY)	
ECRIPTION		ESTIM/	ATOR			CHECKED B	
ECO-M5 (BOILER ROOM)				J.B.			3. <u>S.</u>
	QUA	NTITY	LA	BOR	MA <sup>-</sup>	TERIAL	TOTAL
(SUMMARY)	NO.	UNIT	PER	TOTAL	PER	TOTAL	COST
(====== (======= (========	UNITS		UNIT		UNIT		
EMOLITION:		11.2.1.0.	<u>.</u>				
	0			\$0		sol	
	<u> </u>						
ONSTRUCTION:		I			¢50.00	6000	60
EMP. GAUGES	4	EA	\$7.00	\$28	\$50.00	\$200	\$2
			.		<b>A</b> · = -		
RESS. GAUGES	4	EA	\$6.50	\$26	\$15.00	\$60	\$
ONTROL MODIFICATIONS	1	LS	\$3,200.00	\$3,200	\$2,600.00	\$2,600	\$5,8
OBILIZATION	т	LS	\$2,750.00	\$2,750	\$830.00	\$830	\$3,5
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PREVIOUS EDITION MAY BE USED

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LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FTLVBDLM ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.001 INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS REGION NO. 7 PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOM5 ANALYSIS DATE: 07-21-87 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

l.	INVE	STMENT	
	A. C	CONSTRUCTION COST	\$ 14621.
	B. S.	IOH	\$ 1462.
	C. DI	ESIGN COST	\$ 731.
	D. El	NERGY CREDIT CALC (1A+1B+1C)X.9	\$ 15133.
	E. SA	ALVAGE VALUE COST	\$ 0.
	F. TO	OTAL INVESTMENT (1D-1E)	\$ 15133.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUE	EI.	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	NUAL \$ VINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
Α.	ELECT	\$ 15.50	219.	\$ 3395.	8.59	29159.
в.	DIST	\$ .00	Ο.	\$ Ο.	11.28	Ο.
с.	RESID	\$ .00	Ο.	\$ Ο.	12.01	Ο.
D.	NAT G	\$ 3.15	Ο.	\$ Ο.	12.76	0.
E.	COAL	\$ .00	0.	\$ 0.	10.17	0.
F.	TOTAL		219.	\$ 3395.		\$ 29159.

3. NON ENERGY SAVINGS (+) / COST (-)

Α.	ANNUAL RECURRING (+/-) (1) DISCOUNT FACTOR (TABLE A)	0 11	\$ Ο.
	(2) DISCOUNTED SAVING/COST (3A X 3A1)	9.11	\$ ο.
c.	TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (	3A2+3BD4)	\$ ο.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 9622.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY</pre>

4.	FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$	3395.
5.	TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$	29159.
6.	DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.93	

(IF < 1 PROJECT DOES NOT QUALIFY)

# FORT LEAVENWORTH - BELL HALL BUILDING 111

# ENERGY CONSERVATION OPPORTUNITY: ECO-M10

## PURPOSE:

This Energy Conservation Opportunity simulation (ECO-M10) analyzes the energy savings that may be realized by allowing the cooling tower fans to operate with variable speed controllers.

#### SCOPE:

This E.C.O. simulation (ECO-M10) installs cooling tower fan variable speed controllers. The modification will require installation of the variable speed controller units in the existing boiler room and the electrical modifications to accommodate the controller installation. The construction work will include modifications to the Building Automation System software to monitor and control the variable speed controller unit.

#### MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

 PC-DOE command "TWO-SPEED=TOWER-FAN-CONTROL" was inserted at Line No. 2,346 (re: Volume II, Section I)



# SUMMARY:

The probable project cost is \$24,595. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run (ECO-M10) are approximately 200 MBTU per year and \$2,900 per year.

The simple payback for this simulation is 7.7 years.

The savings to investment ratio (S.I.R.) for this simulation is 1.07.



CONSTRUCTION COST ESTIMATE	=		DATE PREP	ARED 16-Feb-87		SHEET 1	OF 2
PROJECT		1		BASIS FOR ES		1	<u> </u>
BELL HALL ENERGY STUDY				-			
LOCATION				X	CODE A	NO DESIGN C	OMPLET
FORT LEAVENWORTH, KANSAS						PRELIMINAR	
ARCHITECT/ENGINEER CLARK, RICHARDSON & BISKUP					OTHER (S	(FINAL DESIG	N)
DECRIPTION		ESTIMA	TOR	1		CHECKED B	Y
				J.B.			G.S.
		NTITY		BOR		TERIAL	ΤΟΤΑ
SUMMARY: ECO-M10	NO. UNITS	UNIT MEAS		TOTAL	PER	TOTAL	COST
DEMOLITION WORK TOTAL:				\$450		\$0	S.
				\$6,075		\$8,556	\$14.6
NEW WORK TOTAL:							
SUBTOTAL				\$6,525		\$8,556	\$15.0
CONTINGENCY			10.00%	\$653	10.00%	\$856	\$1.5
SUBTOTAL		-		\$7,178		\$9,411	\$16,5
COMP., TAX. SOC. SEC., INS.			13.50%	\$969	3.50%	\$329	\$1,2
SUBTOTAL				\$8,146		\$9,740	\$17,8
OVERHEAD AND PROFIT			25.00%	\$2,037	25.00%	\$2,435	\$4,4
			20100.00				
							\$22,3
			1				
	1	1			1		

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	E		DATE PREP	16-Feb-87		SHEET 2	0F 2
PROJECT				BASIS FOR ES	STIMATE		
BELL HALL ENERGY STUDY LOCATION FORT LEAVENWORTH, KANSAS ARCHITECT/ENGINEER	X	CODEB	(NO DESIGN COMPLETE (PRELIMINARY DESIGN) (FINAL DESIGN)				
CARK, RICHARDSON & BISKUP DRAWING NO.		ESTIM	ATOR		UTIEN (	CHECKED B	( G.S.
ECO-M10 (BOILER)	QUA		LA	J.B. BOR	MA	TERIAL	TOTAL
(SUMMARY)	NO. UNITS	UNIT MEAS.		TOTAL	PER UNIT	TOTAL	COST
DEMOLITION: DISCONNECT EXISTING ELEC. SERVICE	1	LS	\$450.00	\$450		\$0	\$45
CONSTRUCTION: PROVIDE/INSTALL SPEED CONTROLLER	1	LS	\$1,750.00	\$1,750	\$6,225.00	\$6,225	\$7,97
ELEC. RECONNECT	1	LS	\$125.00	\$125	\$350.00	\$350	\$47
CONTROLS FOR CONTROLLER	11	LS	\$925.00	\$925	\$1,350.00	\$1,350	\$2,27
SYSTEM TEST AND BALANCE	1	LS	\$1,950.00	\$1,950	\$280.50	\$281	\$2,23
MOBILITZATION	1	LS	\$1,325,00	\$1,325	\$350.00	\$350	\$1,67
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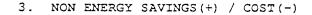
LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FTLVEDLM ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.001 INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS REGION NO. 7 PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOM10 ANALYSIS DATE: 07-21-87 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

1.	INVESTMENT		
	A. CONSTRUCTION COST	\$	22359.
	B. SIOH	\$	2236.
	C. DESIGN COST	\$	1118.
	D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	23142.
	E. SALVAGE VALUE COST	-\$	Ο.
	F. TOTAL INVESTMENT (1D-1E)	\$	23142.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUE	L	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)		TUAL \$ VINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)		
А.	ELECT	\$ 15.50	186.	Ş	2883.	8.59	24765.		
в.	DIST	\$ .00	0.	\$	Ο.	11.28	Ο.		
с.	RESID	\$.00	Ο.	\$	Ο.	12.01	Ο.		
D.	NAT G	\$ 3.15	Ο.	\$	Ο.	12.76	Ο.		
Ε.	COAL	\$.00	0.	\$	0.	10.17	0.		
F.	TOTAL		186.	\$	2883.		\$ 24765.		



А.	ANNUAL RECURRING (+/-)		\$	Ο.
	<ul><li>(1) DISCOUNT FACTOR (TABLE A)</li><li>(2) DISCOUNTED SAVING/COST (3A X 3A1)</li></ul>	9.11	S	n
			÷	•.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4) \$ 0.

- D. PROJECT NON ENERGY QUALIFICATION TEST
  (1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 8172.
  A IF 3D1 IS = OR > 3C GO TO ITEM 4
  B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=
  C IF 3D1B IS = > 1 GO TO ITEM 4
  D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY</pre>
- 4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 2883.
  5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 24765.
- 6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.07 (IF < 1 PROJECT DOES NOT QUALIFY)</pre>

· Page 5

# FORT LEAVENWORTH - BELL HALL BUILDING 111

# ENERGY CONSERVATION OPPORTUNITY: ECO-M6

## PURPOSE:

This Energy Conservation Opportunity simulation (ECO-M6) analyzes the energy savings that may be realized by turning off air handling units and mechanical equipment during the unoccupied periods of the day.

## SCOPE:

This E.C.O. simulation (ECO-M6) will use the existing Building Automation Energy System to turn off existing mechanical equipment and air handling units during the unoccupied periods of the day. The equipment in this simulation includes the following:

- 1. Ventilation units in the class room areas
- 2. Ventilation units in the office areas of the general building and Johnson Wing
- 3. Ventilation units in the library and Marshall areas
- 4. Mechanical pumps for the chilled water and heating systems
- 5. Chiller units and associated tower fans and condenser pumps

This work may be accomplished by using the existing building automation system. The existing automation system presently has the capability to monitor and operate the existing mechanical equipment. To accomplish the shut down and start-up characteristics of this simulation, modifications to the building automation system software would be required. The installation of additional control sensors and components to accomplish this simulation will be minimal

PAGE 1

compared to the overall project cost of upgrading the existing building automation system.

## MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

- 1. Schedules named "FAN" and "FAN2" (Re: Volume I, Section I) on lines 1,612 and 1,614 were changed from continuous operation to a computer control operation. The fan schedules changed for the fans would de-energize at 10:00 p.m. and restart at 5:00 a.m. on weekdays and de-energize at 6:00 p.m. and restart at 6:00 a.m. on weekends and holidays.
- 2. Set fan cycling to allow fans to cycle on to maintain a minimum of 55 ° F. (AR -1127) during unoccupied periods.

## SUMMARY:

The probable project cost is \$35,385. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run (ECO-M6) are approximately 6,600 MBTU per year and \$43,000 per year.

The simple payback for this simulation is 0.7 years.

The savings to investment ratio (S.I.R.) for this simulation is 12.79.



ECO-M6

CONSTRUCTION COST ESTIMATI	=		DATE PREP.	16-Feb-87		1	OF 2
PROJECT		1		BASIS FOR E		· · · · · · · · · · · · · · · · · · ·	
BELL HALL ENERGY STUDY LOCATION FORT LEAVENWORTH, KANSAS				X	CODE A	(NO DESIGN (PRELIMINAF	
ARCHITECT/ENGINEER CLARK, RICHARDSON & BISKUP					CODE C	(FINAL DESIC (SPECIFY)	GN)
DECRIPTION		ESTIMA		J.B.		CHECKED B	G.S.
SUMMARY: ECO-M6	NO.	NTITY UNIT MEAS.	LAI PER UNIT	BOR TOTAL	PER UNIT	ATERIAL TOTAL	TOTAL COST
DEMOLITION WORK TOTAL:				\$0		\$0	<u>s</u>
NEW WORK TOTAL:	_			\$8,430		\$13,360	\$21,79
SUBTOTAL				\$8,430		\$13,360	\$21,79
CONTINGENCY			10.00%	\$843	10.00%	\$1,336	\$2,17
SUBTOTAL				\$9,273		\$14,695	\$23.96
COMP., TAX SOC. SEC., INS.			13.50%	\$1,252	3.50%	\$514	\$1,76
SUBTOTAL		ļļ		\$10,525		\$15,210	\$25.73
OVERHEAD AND PROFIT			25.00%	\$2,631	25.00%	\$3,802	\$6,43
CONSTRUCTION COSTS:							\$32,16
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CONSTRUCTION COST ESTIMATE			DATE PREP		······		OF
PROJECT				16-Feb-87 BASIS FOR E	STIMATE	2	2
BELL HALL ENERGY STUDY							
LOCATION				X		(NO DESIGN (PRELIMINAF	
FORT LEAVENWORTH, KANSAS						(FINAL DESIC	SN)
CLARK, RICHARDSON & BISKUP					OTHER	(SPECIFY)	
DECRIPTION		ESTIM	ATOR	10		CHECKED BY	
ECO-M6			IA	J.B. BOR	M	ATERIAL	G.S. TOTAL
(SUMMARY)	NO.	UNIT MEAS.		TOTAL	PER UNIT	TOTAL	COST
DEMOLITION:							
NONE CONSTRUCTION:				\$0		\$0	<u> </u>
CONTROL MOD. TO AUTOMATION SYSTEM	1	LS	\$7,930.00	\$7,930	\$13,200	\$13,200	\$21,13
MOBILIZATION	1	LS	\$500.00	\$500	\$160.00	\$160	\$66
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LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FTLVBDLM ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.001 INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS REGION NO. 7 PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOM6 ANALYSIS DATE: 07-21-87 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

IN	VESIMENT		
Α.	CONSTRUCTION COST	\$	32168.
в.	SIOH	\$	3217.
c.	DESIGN COST	Ş	1608.
D.	ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	33294.
Ε.	SALVAGE VALUE COST	-\$	Ο.
F.	TOTAL INVESTMENT (1D-1E)	\$	33294.
	A. B. C. D. E.	INVESTMENT A. CONSTRUCTION COST B. SIOH C. DESIGN COST D. ENERGY CREDIT CALC (1A+1B+1C)X.9 E. SALVAGE VALUE COST F. TOTAL INVESTMENT (1D-1E)	A. CONSTRUCTION COST\$B. SIOH\$C. DESIGN COST\$D. ENERGY CREDIT CALC (1A+1B+1C)X.9\$E. SALVAGE VALUE COST-\$

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUE	L	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR (2)		NUAL \$ VINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
А.	ELECT	\$ 15.50	1739.	\$	26955.	8.59	231539.
в.	DIST	\$.00	Ο.	Ş	Ο.	11.28	0.
c.	RESID	\$ .00	0.	\$	Ο.	12.01	0.
D.	NAT G	\$ 3.15	4833.	\$	15224.	12.76	194258.
Ξ.	COAL	\$ .00	0.	\$	0.	10.17	Ο.
F.	TOTAL		6572.	\$	42178.		\$ 425797.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	Ο.
(1) DISCOUNT FACTOR (TABLE A) (2) DISCOUNTED SAVING/COST (3A X 3A1)	9.11	¢	0
(2) DISCOUNTED SAVING/COST (SA A SAT)		Ŷ	υ.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4) \$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 140513.
 A IF 3D1 IS = OR > 3C GO TO ITEM 4
 B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=
 C IF 3D1B IS = > 1 GO TO ITEM 4
 D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY</pre>

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 42178.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 425797.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 12.79 (IF < 1 PROJECT DOES NOT QUALIFY)</pre>

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LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BHGROUP ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.001 INSTALLATION & LOCATION: FT LEAVENWORTH REGION NO. 7 PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987DISCRETE PORTION NAME: GROUP1ANALYSIS DATE:05-31-89ECONOMIC LIFE 15 YEARSPREPARED BY: CRB

1.	INVESTMENT		
	A. CONSTRUCTION COST	\$	147021.
	B. SIOH	\$	14702.
	C. DESIGN COST	\$	7351.
	D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	152167.
	E. SALVAGE VALUE COST	-\$	0.
	F. TOTAL INVESTMENT (1D-1E)	\$	152167.

2. ENERGY SAVINGS (+) / COST (-) ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

	FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)		NNUAL \$ AVINGS(3)	DISCOUNT FACTOR(4)	SCOUNTED AVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ 15.50 \$ .00 \$ .00 \$ 3.15 \$ .00	5378. 0. 0. 23003. 0.	\$ <del>\$ \$ \$ \$</del> \$	83359. 0. 0. 72459. 0.	8.59 11.28 12.01 12.76 10.17	716054. 0. 0. 924583. 0.
	F. TOTAL		28381.	\$	155818.		\$ 1640636.
3.	NON ENERGY	/ SAVINGS(+) / C	OST(-)				
		ECURRING (+/-) UNT FACTOR (TA			9.11		\$ 0.
		UNTED SAVING/		1)	0.11		\$ 0.
	C. TOTAL NO	N ENERGY DISC	OUNTED SAVIN	GS(+	)/COST(-) (3	A2+3BD4)	\$ 0.
	(1) 25% M/ A IF 30 B IF 30 C IF 30	NON ENERGY QI AX NON ENERGY D1 IS = OR > 3C G D1 IS < 3C CALC D1B IS = > 1 GO T D1B IS < 1 PROJE	' CALC (2F5 X GO TO ITEM 4 SIR = (2F5+3D O ITEM 4	.33) 1)/1F)	=	\$ 541410.	
4.	FIRST YEAR [	OOLLAR SAVINGS	S 2F3+3A+(3B1E	)/(YEA	ARS ECONO	MIC LIFE))	\$ 155818.
5.	TOTAL NET D	ISCOUNTED SAV	'INGS (2F5+3C)				\$ 1640636.
6.		SAVINGS RATIO		(S	ilR)=(5 / 1F)=	10.78	

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													Fo	or us	e of th	is form	n, see AR 4								
	6	Τ	DO	CU	MEN	٧T	NU	МВ	ER		BUILDING/F	ACILITY		-	DATE										
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XIFA				1	_1	_1					P <sub>1</sub> 0 <sub>1</sub> 1 <sub>1</sub> 1 <sub>1</sub>		9	10	0 <sub>1</sub> 0	015		<b></b>	1_1_	LL	1_1		* +	VA	
	NGE		DO	cui	MEN	IT.	NUI	MB	ER		BUILDING/F	ACILITY	1	BL	<b>NEDIN</b>	IG/FA	CILITY	L	BUILD	ING/	FACI	LITY	<u></u>	BU	ILDI
TRANS CODE	CHAN	RE		N	SER IUM	18E	R			TYPE	NUMBER	SUFFIX			UMBE		SUFFIX		NUM			SUF			имв
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X F B	с				1		1							1_1	<u>1</u> J	_ <b>i A</b>						1		_1_1	
<b>Group 1</b> AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED EVA4 - Modify the classroom ventilator controls to allow economizer operation when the outside air is cool ehough to provide air conditioning, thus reducing the use of chilled water during moderate outdoor temperatures. ECO M5 - Modify the condenser water piping and controls to allow operation of the central chillers with a lower condenser water temperature. This will improve the efficiency of the chillers when outdoor conditions are lower than the design temperatures, thus saving electrical energy during a large portion of the operating hours. ECO M10 - Modify the cooling tower fans and controls to allow the fans to modulate according to the load with variable speed controllers. This will allow more precise control of the condenser water temperature helping to improve chiller efficiency and will also save fan horsepower because of the modulation. ECO M6 - Reprogram the building automation system and install additional sensors and components to allow the air system fans to be shut off during unoccupied periods. This will save fan horsepower when no ventilation is																									
requirec	·· -				<b>·</b> -						REQ	UESTER IN	IFO	RM/	TION										
NAME											ORGANIZATI	ON				TELE	PHONE N	э.	SIGNA	TUR	E				

			FORWARD FOR APP	PROVAL			
то	RECOMMENDED ACTION	ENV NO	VIRONMENTAL IMPACT	ESTIMATED	COST	WORK TO BE	FROM
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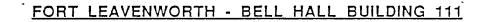
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#### ENERGY CONSERVATION ANALYSIS Bell Hall

Non-ECIP Projects						
PROJECT GROUP BELL HALL BLDG 111	ECO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
GROUP 2						
Install Solar Film	ECO-A4	1942.0	\$16,788	\$159,380	9.5	1.43
Air Curtains at Dock Doors	ECO-A5	340.0	\$1,330	\$20,319	15.3	1.21
GROUP 2 TOTALS		2282.0	\$18,118	\$179,699	9.9	1.03



# ENERGY CONSERVATION OPPORTUNITY: ECO-A4

#### PURPOSE:

This Energy Conservation Opportunity simulation (ECO-A4) analyzes the energy savings of installing solar shading on existing windows.

#### SCOPE:

The E.C.O. simulation (ECO-A4) installs solar shading on all existing windows.



### MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

- Comparison of savings for installing solar shading on existing windows which are presently unshaded.
- The heat transfer characteristics for each window was compared in order to justify the additional cost of the solar shading.

Page 1

# SUMMARY:

The probable project cost is \$159,380. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run are approximately 1,942 MBTU per year and \$17,000 per year.

Page 2

The simple payback for this simulation is 9.5 years.

The savings to investment ratio (S.I.R.) for this simulation is 1.43.

		DATE PREPARED 1/20/87				SHEET 1	OF 1	
PROJECT		<u></u>	•	BASIS FOR	ESTIMATE			
BELL HALL INSTALL SOLAR LOCATION FORT LEAVENWORTH, KS	SHADING		· <u></u>	x	CODE	A (NO DESIG B (PRELIMIN)	ARY DESIGN	ED) )
ARCHITECT/ENGINEER HOLLIS & MILLER / CRB					CODE	C (FINAL DESIGN) (SPECIFY)		
DRAWING NO.		ESTIM	ATOR	1		CHECKED BY		
				BOR		TERIAL	Тот	
SUMMARY: ECO-A4	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL		TOTAL	CO5	ST
SOLAR SHADING ON EXISTING WINDOWS	250	EA	\$75.00	\$18,750	\$325.00	\$81,250		\$100.000
							[ 	<u> </u>
SUBTOTAL:				\$18,750		\$81,250	\$	100.000
CONTINGENCY			10.00%	\$1,875	10.00%	\$8,125		\$10.000
SUBTOTAL				\$20,625		\$89,375	\$	110,000
COMP., TAX. SOC. SEC., INS.			13.50%	\$2,784	3.50%	\$3,128		\$5,913
SUBTOTAL				\$23,409		\$92,503	\$	115,913
OVERHEAD AND PROFIT			25.00%	\$5,852	25.00%	\$23,126		\$28,978
CONSTRUCTION COSTS:				\$29,262		\$115,629	\$	144.891
			<u> </u>					

PREVIOUS EDITION MAY BE USED

STUDY: FTLVEVBDL LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.001 INSTALLATION & LOCATION: FT LEAVENWORTH **REGION NO.** 7 PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOA4 ANALYSIS DATE: 07-21-87 ECONOMIC LIFE 25 YEARS PREPARED BY: CRB

1.	INVESTMENT		
	A. CONSTRUCTION COST	\$	144891.
	B. SIOH	\$	14489.
	C. DESIGN COST	\$	7245.
	D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	149962.
	E. SALVAGE VALUE COST	-\$	0.
	F. TOTAL INVESTMENT (1D-1E)	\$	149962.

2. ENERGY SAVINGS (+) / COST (-) ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

	FUEL	UNIT COST \$/MBTU(1)			NNUAL \$ AVINGS(3)	DISCOUNT FACTOR(4)	SCOUNTED AVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ 15.50 \$ .00 \$ .00 \$ 3.15 \$ .00	864. 0. 0. 1078. 0.	<del>6) 6) 6) 6) 6)</del>	13392. 0. 0. 3396. 0.	11.05 16.73 17.67 19.36 13.47	147982. 0. 0. 65741. 0.
	F. TOTAL		1942.	\$	16788.		\$ 213722.
3.	NON ENERGY	Y SAVINGS(+) / C	OST(-)				
		ECURRING (+/-) UNT FACTOR (T			11.65		\$ 0.
			COST (3A X 3A	.1)	11.65		\$ 0.
	C. TOTAL NO	N ENERGY DISC	OUNTED SAVIN	IGS(+)	)/COST(-) (3	3A2+3BD4)	\$ 0.
	(1) 25% M/ A IF 30 B IF 30 C IF 30	AX NON ENERG D1 IS = OR > 3C ( D1 IS < 3C CALC D1B IS = > 1 GO	SIR = (2F5+3D	.33) 1)/1F)	=	\$ 70528.	
4.			S 2F3+3A+(3B1[				\$ 16788.
5.		ISCOUNTED SA				//	\$ 213722.
6.	DISCOUNTED	SAVINGS RATIO	)	(S	IR)=(5 / 1F)=	1.43	

Page Y

# FORT LEAVENWORTH - BELL HALL BUILDING 111

# ENERGY CONSERVATION OPPORTUNITY: ECO-A5

# PURPOSE:

This Energy Conservation Opportunity simulation (ECO-A5) analyzes the energy savings of installing air curtains on existing dock doors.

#### SCOPE:

The E.C.O. simulation (ECO-A5) installs air curtains on the existing dock doors.



# MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

- Comparison of savings for installing air curtains on existing dock doors which presently do not have air curtains.
- 2. The heat transfer characteristics for each door was compared in order to justify the additional cost of air curtains.

Drice - 1



# SUMMARY:

The probable project cost is \$20,319. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run (ECO-A1) are approximately 340 MBTU per year and \$1,400 per year.

The simple payback for this simulation is 13.2 years.

The savings to investment ratio (S.I.R.) for this simulation is 1.12.

Page 2

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CONSTRUCTION COST ES	ΤΙΜΑΤΕ		DATE PREP	ARED 1/20/87			SHEET OF	
PROJECT			L	BASIS FOR E	STIMATE		• • • • • • • • • • • • • • • • • • • •	
BELL HALL INSTALL AIR	CURTAINS							
LOCATION				x	CODE A (I	NO DESIGN (	COMPLETED)	
FORT LEAVENWORTH, K	S				CODE B (I	PRELIMINAR	Y DESIGN)	
ARCHITECT/ENGINEER					CODE C (	FINAL DESIG	N)	
HOLLIS & MILLER / CRB					OTHER (S			
DRAWING NO.		ESTIMAT	OR			CHECKED BY		
			JB				GS	
	QUAN			BOR		TERIAL	TOTAL	
SUMMARY: ECO-A5	NO.	UNIT	PER	TOTAL	PER	TOTAL	COST	
	UNITS	MEAS.			UNIT			
AIR CURTAINS ON EXISTING								
DOCK DOORS	48	LF	\$95.00	\$4,560	\$155	\$7,432	\$11,9	
MISCELANEOUS ELECTRICAL							4-	
CONNECTIONS	4	EA	\$70.00	\$280	\$60	\$240	\$5.	
SUBTOTAL:				\$4,840		\$7,672	\$12.5	
CONTINGENCY			10%	\$484	10%	\$767	\$1,2	
CONTINGENCY					10,0			
SUBTOTAL				\$5,324		\$8,440	\$13.7	
COMP., TAX. SOC. SEC., INS.			13.50%	\$719	3.50%	\$295	\$1,0	
SUBTOTAL				\$6,043		\$8,735	\$14,7	
OVERHEAD AND PROFIT			25.00%	\$1,511	25.00%	\$2,184	\$3,69	
CONSTRUCTION COSTS:				\$7.553		\$10,919	\$18,47	
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#### PREVIOUS EDITION MAY BE USED

Page 3

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.001 INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS REGION NO. 7 PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOA5 ANALYSIS DATE: 07-21-87 ECONOMIC LIFE 25 YEARS PREPARED BY: CRB

٦	INVESTMENT		
<b>.</b> .	A. CONSTRUCTION COST	\$	18472.
	B. SIOH	\$	1847.
	C. DESIGN COST	\$	924.
	D. ENERGY CREDIT CALC (1A+1B+1C)X.9	Ś	19119.
		- S	0.
	E. SALVAGE VALUE COST	ç	19119.
	F. TOTAL INVESTMENT (1D-1E)	Ŷ	±2±±2.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUE	L	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)		TUAL \$ VINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A.	ELECT	\$ 15.50	21.	\$	326.	11.05	3597.
в.	DIST	ş.00	0.	\$	0.	16.73	0.
c.	RESID	s .00	Ο.	\$	Ο.	17.67	Ο.
D.	NAT G	s 3.15	319.	Ş	1005.	19.36	19454.
Ξ.	COAL	\$ .00	Ο.	\$	0.	13.47	Ο.
F.	TOTAL		340.	\$	1330.		\$ 23051.

3. NON ENERGY SAVINGS(+) / COST(-)

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Α.	ANNUAL RECURRING (+/-)		\$	0.
	(1) DISCOUNT FACTOR (TABLE A)	1.65	~	^
	(2) DISCOUNTED SAVING/COST (3A X 3A1)		Ş	υ.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4) \$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 7607.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY</pre>

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 1330.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 23051.
6. DISCOUNTED SAVINGS PATIO (SIR)=(5 / 1F)= 1.21

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= (IF < 1 PROJECT DOES NOT QUALIFY)

Page 4

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BHGROUP ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.001 INSTALLATION & LOCATION: FT LEAVENWORTH REGION NO. 7 PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

**DISCRETE PORTION NAME: GROUP2** FISCAL YEAR 1987 PREPARED BY: CRB ANALYSIS DATE: 05-31-89 ECONOMIC LIFE 15 YEARS

1. INVESTMENT A. CONSTRUCTION COST \$ 163363. B. SIOH \$ 16336. \$ \$ C. DESIGN COST D. ENERGY CREDIT CALC (1A+1B+1C)X.9 169081. E. SALVAGE VALUE COST -\$ F. TOTAL INVESTMENT (1D-1E) 169081. \$

8168.

0.

2. ENERGY SAVINGS (+) / COST (-) ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

	FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)		NNUAL \$ AVINGS(3)	DISCOUNT FACTOR(4)		ISCOUNTED AVINGS(5)	
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ 15.50 \$ .00 \$ .00 \$ 3.15 \$ .00	885. 0. 0. 1397. 0.	\$ <del>\$ \$</del> \$ \$	13718. 0. 0. 4401. 0.	8.59 11.28 12.01 12.76 10.17		117833. 0. 0. 56151. 0.	
	F. TOTAL		2282.	\$	18118.		\$	173984.	
3.	NON ENERGY	( SAVINGS(+) / C	OST(-)						
		ECURRING (+/-)			0.11		\$	0.	
		(1) DISCOUNT FACTOR (TABLE A) 9.11 (2) DISCOUNTED SAVING/COST (3A X 3A1)							
	C. TOTAL NO	N ENERGY DISC	OUNTED SAVIN	IGS(+)	/COST(-) (3	3A2+3BD4)	\$	0.	
	(1) 25% MA A IF 3D B IF 3D C IF 3D	NON ENERGY QI AX NON ENERGY D1 IS = OR > 3C G D1 IS < 3C CALC D1B IS = > 1 GO T D1B IS < 1 PROJE	' CALC (2F5 X 30 TO ITEM 4 SIR = (2F5+3D 'O ITEM 4	.33) 1)/1F):		\$ 57415.			
4.	FIRST YEAR D	OOLLAR SAVING	S 2F3+3A+(3B1[	)/(YEA	RS ECONO	MIC LIFE))	\$	18118.	
5.	TOTAL NET DI	ISCOUNTED SAV	(INGS (2F5+3C)				\$	173984.	
6.		SAVINGS RATIC CT DOES NOT Q		(S	IR)=(5 / 1F)=	1.03			

FACILITIES ENGINEERING WORK REQUES For use of this form, see AR 420-17 and DA Pam 420-6; the proponent a DOCUMENT NUMBER BUILDING/FACILITY DATE CHANG TRANS OTHER FUND CITATION TYPE REQ SERIAL ' SUFFIX DA NUMBER YR MO CODE F NUMBER ID 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 2 3 4 5 6 9,00,60,5 P 10 10 1 1 1 1 2 AIH VIAICI - t XFA BUILDING/FACILITY BUILDING/FACILITY BUILDIN BUILDING/FACILITY CHANGE DOCUMENT NUMBER TRANS TYPE REQ SERIAL SUFFIX NUMBE SUFFIX NUMBER CODE NUMBER SUFFIX NUMBER ř NUMBER ID 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 XIF B C DESCRIPTION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED call solar film on windows to reduce solar heat gain. Currently this is a major complaint area, because many of the windows are non-operable and on moderate temperature days, (approx. 75°F) the air conditioning is not operating at full capacity and the heat from solar gain causes overheating problems in many offices. Install air curtains on loading dock to reduce infiltration while trucks are unloading. Air curtains also help keep insects and truck exhaust fumes out of the building while the dock doors are open. REQUESTER INFORMATION TELEPHONE NO. SIGNATURE ORGANIZATION NAME

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#### ENERGY CONSERVATION ANALYSIS Bell Hall

ECIP Projects						
PROJECT GROUP BELL HALL BLDG 111	ECO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
GROUP 3						
Convert Multi-Zone AHU to Variable Air Volume	ECO-M1	6015.0	\$34,842	\$352,853	10.1	1.09
Convert to Primary Secondary System	ECO-M9	2274.0	\$38,680	\$345,792	8.9	1.01
GROUP 3 TOTALS		8289.0	\$73,522	\$698,645	9.5	1.05

# FORT LEAVENWORTH - BELL HALL BUILDING 111

#### ENERGY CONSERVATION OPPORTUNITY: ECO-M1

#### PURPOSE:

The purpose of this Energy Conservation Opportunity run (ECO-M1) is to analyze the energy savings that may be realized by converting the existing multi-zone ventilation units into variable air volume units.

#### SCOPE:

This E.C.O. simulation (ECO-M1) modifies all of the existing multi-zone ventilation units in the following areas:

- 1. Basement Office Area
- 2. Library Area
- 3. Archive Area
- 4. Eisenhower Auditorium Area
- 5. Bookstore and Barber Shop Area

The modifications will convert the existing units from a multi-zone system to a variable air volume system. The conversion includes ductwork modifications, minor piping modifications, control modifications and the installation of a variable speed controller assembly on each air handler unit.

The new ductwork modifications will retain the existing supply and return mains, but new variable air volume control boxes and new supply air diffusers will need to be installed. The conversion of the ventilation units will include controls for the variable air volume boxes and controls to operate the new variable speed controller unit on each supply air fan. The modifications will require testing and balancing the air systems to assure proper operation.

Reference Figure No. 1 for the floor plan of the multi-zone areas that are being modified into variable air volume systems. Reference Figures No. 2 through 4 for sketches of the ductwork layout in the Archive, Basement and Library Areas.

# MODELING TECHNIQUE:

The changes made to our base model for this simulation included the following:

- The multi-zone system types were changed from MZS to VAVS. This modification was made to all 5 multi-zone systems
- 2. Speed control option was added under SYSTEM-FANS Keyword Command to simulate the variable frequency drives

# SUMMARY:

The probable project cost is \$352,853. This project cost is the construction cost plus 10% SIOH.

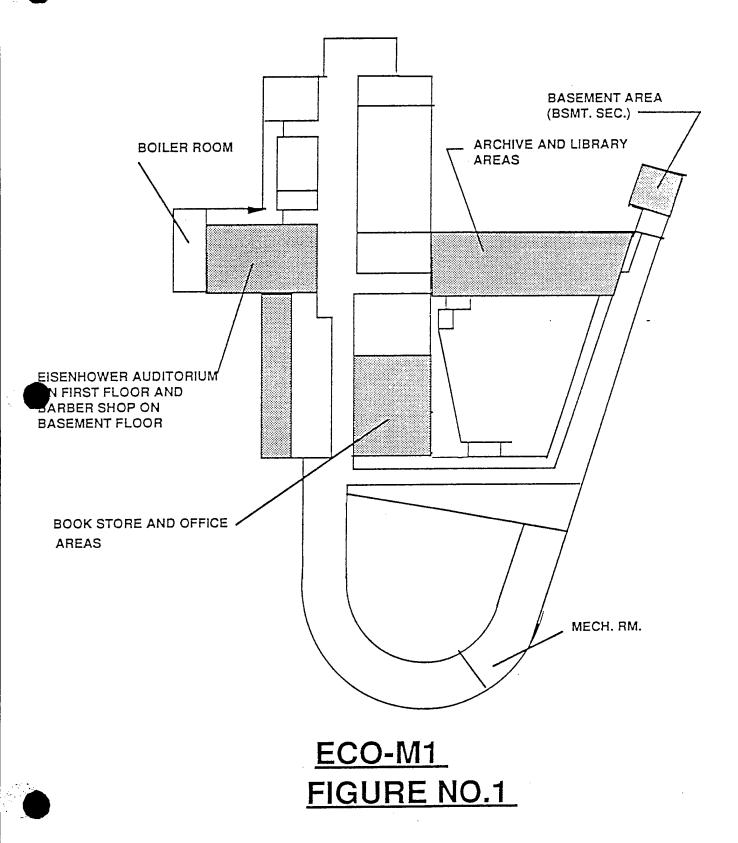
The energy savings realized by this E.C.O. run (ECO-M1) are approximately 6,000 MBTU per year and \$35,700 per year.

The simple payback for this simulation is 9.0 years.

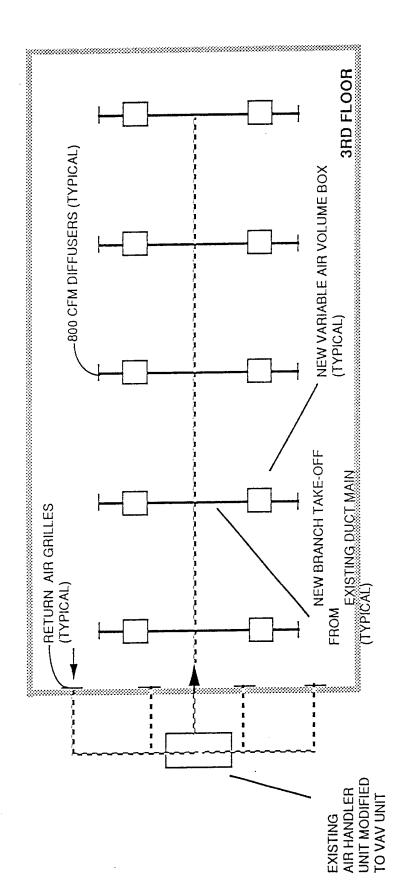
The savings to investment ratio (S.I.R.) for this simulation is 1.09.



# DESCRIPTION: FLOOR PLAN OF EXISTING MULTI-ZONE AREAS



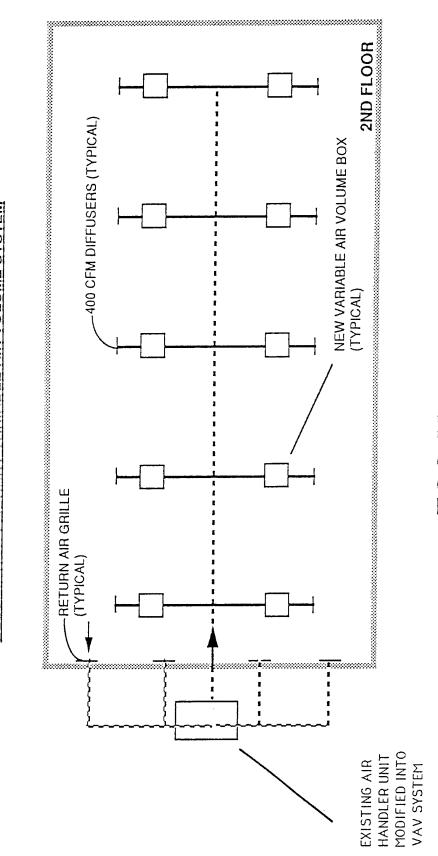
# ECO-M1 FIGURE NO. 2



DESCRIPTION : ARCHIVE AREA VARIABLE AIR VOLUME SYSTEM

Page 5

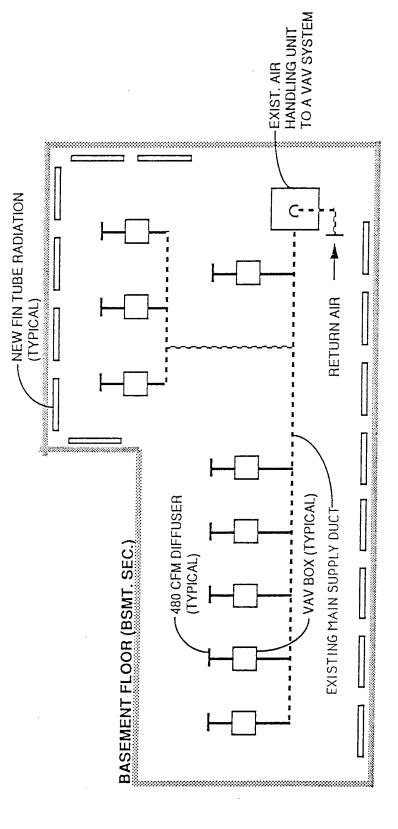
**DESCRIPTION : LIBRARY VARIABLE AIR VOLUME SYSTEM** 



Page 6

ECO-M1 FIGURE NO. 3





# ECO-M1 FIGURE NO. 4

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CONSTRUCTION COST ESTIMA	ATE		DATE PRE			SHEET	, OF
PROJECT				16-Feb-87 BASIS FOR E		11	5
BELL HALL ENERGY STUDY	<u></u>			]			• • · · • •
LOCATION FORT LEAVENWORTH, KANSA	AS			X			COMPLETED
ARCHITECT/ENGINEER					CODEC	FINAL DESIG	
CLARK, RICHARDSON & BISKI DECRIPTION	JP	ESTIM	ATOR	<u>l</u>	OTHER (S	CHECKED	BY
				J.B. BOR	MAT	 ERIAL	G.S. TOTAL
SUMMARY: ECO-M1	NO.	UNIT MEAS.		TOTAL		TOTAL	COST
DEMOLITION WORK TOTAL:	_			\$623		\$136	\$760
NEW WORK TOTAL:				\$106,613		\$107,668	\$214,281
SUBTOTAL:				\$107,237		\$107,804	\$215.041
CONTINGENCY			10%	\$10.724	10%	\$10,780	\$21,504
SUBTOTAL		ļ		\$117,960		\$118.584	\$236,545
COMP., TAX. SOC. SEC., INS.			13.50%	\$15,925	3.50%	\$4,150	\$20.075
SUBTOTAL				\$133,885		\$122,735	\$256.620
OVERHEAD AND PROFIT			25.00%	\$33,471	25.00%	\$30,684	\$64,155
CONSTRUCTION COSTS:				\$167,356		\$153,418	\$320,775
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CONSTRUCTION COST ESTIMA	TE		DATE PRE		,	SHEET	OF 5	
PROJECT			<u>I</u>	16-Feb-87 BASIS FOR		12	5	
BELL HALL ENERGY STUDY				X	CODE A (	NO DESIGN	COMPLETED	
FORT LEAVENWORTH, KANSA ARCHITECT/ENGINEER	S		· · · · · · · · · · · · · · · · · · ·			PRELIMINAF FINAL DESIC	RY DESIGN)	
CLARK, RICHARDSON & BISKU DESCRIPTION	P	TESTIM	4700		OTHER (S	SPECIFY)		
ECO-M1(LIBRARY/ARCHIVES)	11(LIBRARY/ARCHIVES)				, <u> </u>	CHECKED BY G.S.		
(SUMMARY)	NO.			OR TOTAL	PER MATE	ERIAL	COST	
DEMOLITION:	UNITS	MEAS.	UNIT		UNIT			
20" X 6" S.A. GRILLES	24	EA	\$0.85	S20	\$0.15	\$4	\$2	
CONSTRUCTION: 20" X 8" S.A. 3RD FLR.	1000	LF	\$3.09	\$3.090	\$15.06	\$15,060	\$18,150	
VAV BOXES 3RD FLR.	18	EA	\$380.00	\$6,840	\$350.00	\$6,300	\$13,140	
14" FLEX CONNECTION	150	LF	\$2.08	\$312	\$0.75	\$113	\$425	
10" X 9" S.A. 2ND FLR.	1000	LF	\$2.09	\$2.090	\$10.22	\$10,220	\$12,310	
10" FLEX CONNECTION	150	LF	\$2.09	\$314	\$0.75	\$113	\$426	
18 VAV BOXES 2ND FLR.	18	EA	\$380.00	\$6,840	\$350.00	\$6,300	\$13,140	
800 CFM DIFFUSERS THIRD FLOOR	18	EA	\$20.00	\$360	\$64.00	\$1,152	\$1,512	
400 CFM DIFFUSERS SECOND FLOOR	18	EA	\$20.00	\$360	\$33.00	\$594	\$954	
VARIABLE SPEED CONTROLLER UNITS	2	EA	\$1,500.00	\$3.000	\$6,000.00	\$12,000	\$15,000	
SYSTEM TEST AND BALANCE	1	LS	\$520.00	\$520	\$100.00	\$100	\$620	
MOBILIZATION	1	LS	\$1,030.00	\$1,030	\$500.00	\$500	\$1.530	
ELEC. CONNECT SERVICE	1	LS	\$700.00	\$700	\$100.00	\$100	\$800	
ELEC. DISCONNECT SERVICE	1	LS	\$400.00	\$400	\$0.00	\$0	\$400	
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NG. FORM 150								

ENG. FORM 150 1AVC-59

PREVIOUS EDITION MAY BE USED

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CONSTRUCTION COST ESTIMA	TE		DATE PRE		-	SHEET	OF	
PROJECT			1	16-Feb-87 BASIS FOR		3	5	
BELL HALL ENERGY STUDY				x		NO DESIGN	COMPLETED	
FORT LEAVENWORTH, KANSA ARCHITECT/ENGINEER	S				CODEB (	PRELIMINAF	RY DESIGN)	
CLARK, RICHARDSON & BISKU	P	1			OTHER (S			
DESCRIPTION ECO-M1 (BMT OFFICES)	ECO-M1 (BMT OFFICES)						BY G.S.	
(SUMMARY)	QUAI NO.		PER	OR TOTAL	PER MATE	RIAL TOTAL	TOTAL COST	
DEMOLITION:	UNITS	MEAS.			UNIT			
480 CFM DIFFUSERS	8	EA	\$0.85	\$7	\$0.15	\$1	\$8	
CONSTRUCTION: VAV BOXES	9	EA	\$380.00	\$3,420	\$350.00	\$3,150	\$6,570	
480 CFM DIFFUSERS	9	EA	\$25.00	\$225	\$33.00	\$297	\$522	
14" FLEX CONNECTION	40	LF	\$2.08	\$83	\$0.75	\$30	\$113	
4.0 MBH FIN/TUBE RADIATORS W/COVERS	100	LF	\$6.00	\$600	\$11.75	\$1,175	\$1,775	
VARIABLE SPEED CONTROLLER	1	EA	\$1,500.00	\$1,500	\$6,000.00	\$6,000	\$7,500	
3" HOT WATER PIPE FOR RADIATOR	250	LF	\$10.09	\$2.523	\$8.22	\$2,055	\$4,578	
3/4" PIPE FOR RADIATOR	880	LF	\$5.05	\$4,444	\$3.28	\$2.886	\$7,330	
3/4" ISOLATION VALVES	24	EA	\$13.73	\$330	\$12.33	\$296	\$625	
STATS FOR RADIATORS	12	EA	\$35.00	\$420	\$50.00	\$600	\$1,020	
FIN TUBE HEATER CONTROLS	1	LS	\$25.00	\$25	\$25.00	\$25	\$50	
CEILING REMOVAL/REPLACEMENT	12000	SF	\$2.75	\$33,000	\$0.45	\$5,400	\$38,400	
SYSTEM TEST AND BALANCE	1	LS	\$3,500.00	\$3,500	\$400.00	\$400	\$3,900	
MOBILIZATION	1	LS	\$3,500.00	\$3,500	\$400.00	\$400	\$3,900	
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CONSTRUCTION COST ESTIMA	TE		DATE PRE				OF	
				16-Feb-87 BASIS FOR		4	5	
PROJECT BELL HALL ENERGY STUDY					ESTIMATE			
LOCATION	_			<u> </u>		NO DESIGN (		
FORT LEAVENWORTH, KANSA	S					PRELIMINAR' FINAL DESIGI		
CLARK, RICHARDSON & BISKU				OTHER (S		•		
DECRIPTION		ESTIM	ATOR	1.7		CHECKED E	3Y G.S.	
ECO-M1 (AUDITORIUM)			LAE	<u>J.B.</u> XOR	MATE	1	TOTAL	
(SUMMARY)	NO.	UNIT	PER	TOTAL	PER	TOTAL	COST	
DEMOLITION:	UNITS	MEAS.				<u>├</u> ├		
2000 CFM DIFUSSERS	15	EA	\$1.85	\$28	\$0.25	\$4	\$3	
900 CFM DIFFUSERS	10	EA	\$1.85	\$19	\$0.25	\$3	\$2	
		SF	\$10.00	\$500	\$2.00	\$100	\$600	
CONSTRUCTION:						0100		
AV BOXES ON MAIN LEVEL	9	EA	\$380.00	\$3,420	\$350.00	\$3,150	\$6.570	
VAV BOXES ON LOWER LEVEL	6	EA	\$380.00	\$2,280	\$350.00	\$2,100	\$4,380	
AV BOXES ON UPPER LEVEL	10	EA	\$380.00	\$3,800	\$350.00	\$3,500	\$7,300	
2000 CFM DIFFUSERS	15	EA	\$25.00	\$375	\$135.00	\$2.025	\$2,400	
1000 CFM DIFFUSERS	10	EA	\$25.00	\$250	\$75.00	\$750	\$1.000	
20" DIA. FLEX DUCT	150	LF	\$2.09	\$314	\$1.50	\$225	\$539	
24" X 17' S.A. DUCTWORK	250	LF	\$4.96	\$1,240	\$24.21	\$6,053	\$7.293	
ARIABLE SPEED CONTROLLER UNIT	1	EA	\$1,500.00	\$1,500	\$6,000.00	\$6,000	\$7.500	
CONTROL MODIFICATIONS	1	LS	\$1,000.00	\$1.000	\$250.00	\$250	\$1.250	
SYSTEM TEST AND BALANCE	1	LS	\$2,500.00	\$2,500	\$300.00	\$300	\$2.800	
MOBILIZATION	1	LS	\$2,500.00	\$2,500	\$500.00	\$500	\$3,000	
ELEC. DISCONNNECT SERVICE	1	LS	\$400.00	\$400	\$0.00	\$0	\$400	
ELEC. CONNECT SERVICE	1	LS	\$700.00	\$700	\$100.00	\$100	\$800	

ENG. FORM 1AVC-59 150

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CONSTRUCTION COST ESTIMA	TE		DATE PRE	PARED 16-Feb-87		SHEET	OF 5	
PROJECT			.1	BASIS FOR		<u> </u>		
BELL HALL ENERGY STUDY OCATION FORT LEAVENWORTH, KANSAS ARCHITECT/ENGINEER	S			×		NO DESIGN COMPLETED PRELIMINARY DESIGN)		
CLARK, RICHARDSON & BISKU	P	ESTIM	ATOP		OTHER (S	FINAL DESIGN) IPECIFY) CHECKED BY		
ECO-M1 (STORE/BARBER)				J.B.			G.S.	
(SUMMARY)	NO.	UNIT MEAS	PER	BOR TOTAL	PER UNIT	TOTAL	TOTAL COST	
DEMOLITION: 24" X 18" S.A. DUCTWORK	1	LS	\$50.00	\$50	\$25.00	\$25	\$7	
CONSTRUCTION: /AV BOX - 2800 CFM	1	EA	\$380.00	\$380	\$350.00	\$350	\$730	
/AV BOX - 400 CFM	. 1	EA	\$380.00	\$380	\$350.00	\$350	\$730	
UCTWORK MODIFICATIONS	1	LS	\$500.00	\$500	\$80.00	\$80	\$580	
HUMODIFICATIONS	1	LS	\$250.00	\$250	\$120.00	\$120	\$37	
ARIABLE SPEED CONTORLLER	1	EA	\$1,500.00	\$1.500	\$6.000.00	\$6,000	\$7,500	
LEC. DISCONNECT	1	LS	\$400.00	\$400	\$0.00	\$0	\$400	
LEC. CONNECT	1	LS	\$700.00	\$700	\$100.00	\$100	\$800	
ONTROLS	1	LS	\$1,000.00	\$1.000	\$250.00	\$250	\$1,250	
YSTEM TEST AND BALANCE	1	LS	\$800.00	\$800	\$100.00	\$100	\$900	
IOBILIZATION	1	LS	\$1,000.00	\$1,000	\$100.00	\$100	\$1,100	
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LIFE CYCLE COST ANALYSIS SUMMARY - STUDY: FTLVBDLM ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.001 INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS REGION NO. 7 PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOM1 ANALYSIS DATE: 07-21-87 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

1.	INVESTMENT		
	A. CONSTRUCTION COST	\$	320775.
	B. SIOH	\$	32078.
	C. DESIGN COST	\$	16039.
	D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	332003.
	E. SALVAGE VALUE COST	-\$	Ο.
	F. TOTAL INVESTMENT (1D-1E)	Ş	332003.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	s 15.50	1287.	\$ 19949.	8.59	171358.
B. DIST	s .00	Ο.	ş 0.	11.28	0.
C. RESID	s .00	Ο.	ş 0.	12.01	0.
D. NAT G	\$ 3.15	4728.	ş 14893.	12.76	190037.
E. COAL	\$ .00	0.	\$ O.	10.17	0.
F. TOTAL		6015.	\$ 34842.	•	\$ 361395.

3. NON ENERGY SAVINGS(+) / COST(-)

А.	ANNUAL RECURRING (+/-)		\$ Ο.
	<ul><li>(1) DISCOUNT FACTOR (TABLE A)</li><li>(2) DISCOUNTED SAVING/COST (3A X 3A1)</li></ul>	9.11	\$ 0.

- C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4) \$ 0.
- D. PROJECT NON ENERGY QUALIFICATION TEST
  (1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 119260.
  A IF 3D1 IS = OR > 3C GO TO ITEM 4
  B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=
  C IF 3D1B IS = > 1 GO TO ITEM 4
  D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY</pre>

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 34842.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 361395.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.09

(IF < 1 PROJECT DOES NOT QUALIFY)

# FORT LEAVENWORTH - BELL HALL BUILDING 111

# ENERGY CONSERVATION OPPORTUNITY: ECO-M9

#### PURPOSE:

The purpose of this Energy Conservation Opportunity run (ECO-M9) is to analyze the energy savings that may be realized by converting the existing primary pumping system into a primary-secondary type pumping system. The conversion will retain the existing two- pipe heating and cooling distribution network in the facility.

#### SCOPE:

This E.C.O. simulation (ECO-M9) converts the existing two-pipe heating and cooling pumping system into a primary-secondary pumping system. The conversion from the existing system to a primary-secondary pumping system will require the following:

- 1. New primary circulation pumps
- 2. Modifications to the existing boiler room chilled water piping and boiler piping loops
- 3. Pipe modifications to connect the existing radiation pumps into the secondary loop
- 4. New variable speed controller units for each circulation pump
- 5. New electrical services for the pumps and variable speed controllers

The construction work involved in this simulation may disrupt the heating and cooling capabilities of the boiler room facility during the construction phases.

PAGE 1

The installation of the primary and secondary pumping system will require testing and balancing of the hydronic system in the boiler room as well as the distribution network. Reference Figures No. 1 and 2 for the layout of the boiler room equipment and piping.

# MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

- Since PC-DOE is not capable of calculating pumping energy for primary/secondary pumping (Re: Section I, Modeling Techniques), we calculated the average flow required for cooling and heating during one full year. We then calculated what the average head pressure would be for the existing pumps. This information was then used to redefine the pump criteria entered in the input file (Re: Volume II, Section I) on line No.'s 2,349 through 2,354. The following pump criteria was changed:
  - A. CIRC-DESIGN-T-DROP=9.8
  - B. CCIRC-HEAD=29'
  - C. HEAT-DESIGN-T-DROP=12.5
  - D. HEAT-HEAD=32'

#### SUMMARY:

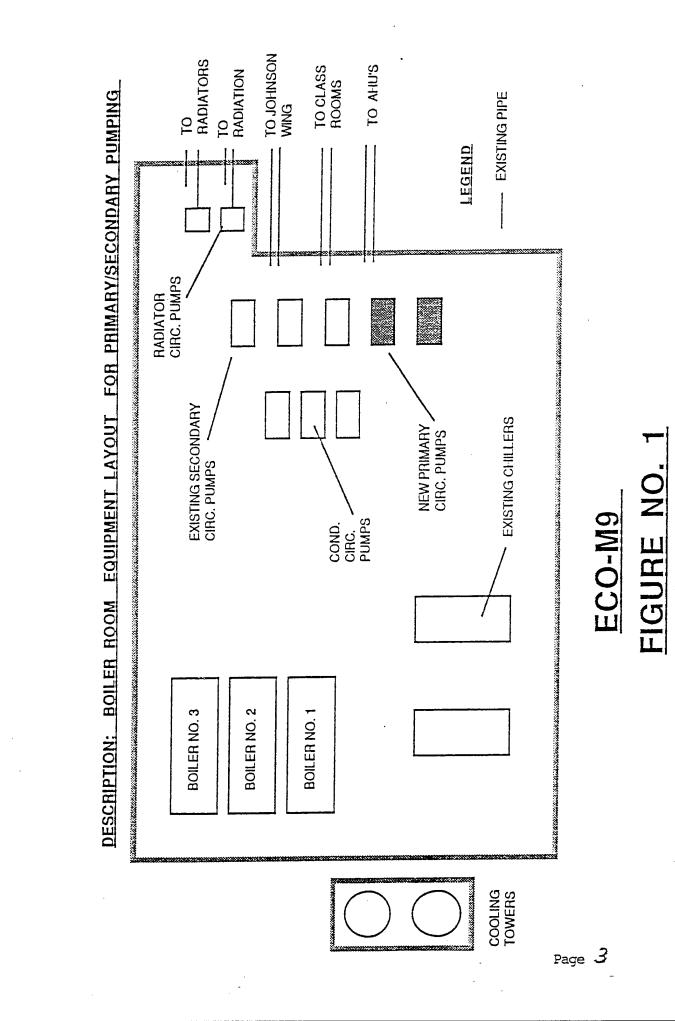
The probable project cost is \$345,792. This project cost is the construction cost plus 10% SIOH

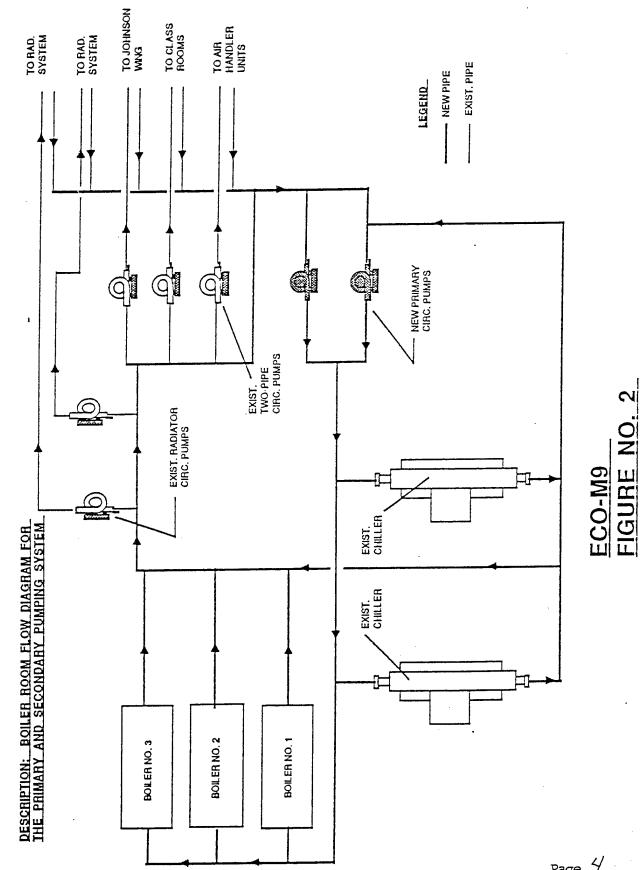
The energy savings realized by this E.C.O. run (ECO-M9) are approximately 2,280 MBTU per year and \$38,700 per year.

The simple payback for this simulation is 8.1 years.

The savings to investment ratio (S.I.R.) for this simulation is 1.01.







Page 4

CONSTRUCTION COST ESTIMATI			DATE PREF	16-Feb-87		SHEET 1	OF 3
PROJECT			L.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		ESTIMATE		
BELL HALL ENERGY STUDY				×		(NO DESIGN	
FORT LEAVENWORTH, KANSAS					CODEB	(NO DESIGN	RY DESIGN
ARCHITECT/ENGINEER CLARK, RICHARDSON & BISKUP						(FINAL DESIC SPECIFY)	GN)
DECRIPTION		ESTIMA	ATOR	·		CHECKED E	
		I NTITY	1.4	J.B. ABOR	MA	I TERIAL	G.S. TOTAL
SUMMARY: ECO-M9	NO.	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	COST
DEMOLITION WORK TOTAL:	_			\$6,950	·	\$2,276	\$9,2
NEW WORK TOTAL:				\$87,882		\$114,622	\$202,5
SUBTOTAL:				\$94,832		\$116,898	\$211,7
CONTINGENCY			10.00%	\$9,483	10.00%	\$11,690	\$21,1
SUBTOTAL				\$104,315		\$128,587	\$232.9
COMP., TAX. SOC. SEC., INS.		 	13.50%	\$14,082	3.50%	\$4,501	\$18,5
SUBTOTAL				\$118,397		\$133,088	\$251,4
OVERHEAD AND PROFIT			25.00%	\$29,599	25.00%	\$33,272	\$62.8
CONSTRUCTION COSTS:							\$314,3
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				ARED 16-Feb-87	SHEET 2	OF 3	
PROJECT	1		RESTIMATE		<u></u>		
BELL HALL ENERGY STUDY LOCATION FORT LEAVENWORTH, KANSAS	<u>.</u>			X		(NO DESIGN (PRELIMINA)	
ARCHITECT/ENGINEER CLARK, RICHARDSON & BISKUP				(FINAL DESI	,		
DESCRIPTION ECO-M9 (PRIMARY/SECONDARY)		ESTIM		J.B.		CHECKED	G.S.
(SUMMARY)		ANTITY		BOR	PER MA	TERIAL TOTAL	TOTAL COST
		MEAS.	UNIT		UNIT		
DEMOLITION: REMOVE EXIST. CIRCULATION PUMPS		2 EA	\$325.00	\$650	\$25.00	\$50	\$70
REMOVE EXIST. ELEC. SERVICE TO PUMPS	2	2 EA	\$140.00	\$280	\$50.00	\$100	\$38
REMOVE 12" PIPE	180		\$4.65	\$837	\$1.50	\$270	\$1,10
REMOVE 8" PIPE	700		\$4.65	\$3,255	\$1.50	\$1,050	\$4,30
REMOVE 4" PIPE	200		\$3.75	\$750	\$1.15	\$230	\$98
	250		\$3.75	\$938	\$1.15	\$288	\$1,22
REMOVE EXIST. CONTROL VALVES	4	EA	\$10.00	\$40	\$12.00	\$48	\$8
REMOVE EXISTING ISOLATION VALVES	20	EA	\$10.00	\$200	\$12.00	\$240	\$44
CONSTRUCTION: INSTALL 1000 GPM PRIMARY PUMPS	2	EA	\$305.00	\$610	\$2,000.00	\$4.000	\$4,61
MODIFY EXIST. 350 GPM PUMPS	3	EA	\$205.00	\$615	\$250.00	\$750	\$1,36
PRIMARY PUMP SPEED CONTROLLER	2	EA	\$1,500.00	\$3.000	\$6,000.00	\$12.000	\$15.00
SECONDARY PUMP SPEED CONTROLLER	3	EA	\$1,500.00	\$4,500	\$6,000.00	\$18,000	\$22,50
RADIATOR PUMP SPEED CONTROLLER	2	EA	\$1,500.00	\$3,000	\$6,000.00	\$12,000	\$15,00
10" CHECK VALVES TO PRIMARY PUMPS	2	EA	\$250.00	\$500	\$3,475.00	\$6,950	\$7,45
10" PRIMARY ISOLATION VALVES	4	EA	\$120.00	\$480	\$33.00	\$132	\$61:
6" SECONDARY ISOLATION VALVES	6	EA	\$90.00	\$540	\$23.00	\$138	\$678
"ISOLATION VALVES-CHILLER/BOILER	8	EA	\$110.00	\$880	\$27.00	\$216	\$1,096
4" ISOLATION VALVES-CHILLER/BOILER	4	EA	\$77.00	\$308	\$22.00	\$88	\$39
PRIMARY/SECONDARY PUMP CONTROLS	1	LS	\$1,200.00	\$1.200	\$3,000.00	\$3,000	\$4,200
12" PIPE	200	LF	\$35.00	\$7,000	\$55.00	\$11,000	\$18,000
3" PIPE	200	LF	\$22.00	\$4,400	\$32.00	\$6,400	\$10,800
	150	LF	\$8.50	\$1,275	\$8.00	\$1,200	\$2,475
** PIPE	150	LF	\$12.00	\$1,800	\$12.00	\$1,800	\$3,600
PUMP FLEX. CONNECTION	14	EA	\$35.00	\$490	\$345.00	\$4,830	\$5,320
NEW TO EXIST. UTILITY CONNECTIONS	10	EA	\$223.00	\$2,230	\$172.00	\$1,720	\$3,950
- CONTROL VALVES ENG. FORM 150	4	EA	\$800.00	\$3,200	\$200.00	\$800	\$4,000

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CONSTRUCTION COST ESTIMATE	=		DATE PREF	PARED 16-Feb-87		SHEET 3	OF 3
PROJECT			1		ESTIMATE		······································
BELL HALL ENERGY STUDY			<u> </u>	×		(NO DESIGN	
FORT LEAVENWORTH, KANSAS	· · · · · · · · · · · · · · · · · · ·	<u> </u>				PRELIMINAR	
CLARK, RICHARDSON & BISKUP	· · · · · ·	1				SPECIFY)	
DESCRIPTION ECO-M9 (PRIMARY/SECONDARY)		ESTIM	ATOR	J.B.		CHECKED E	F.S.
(SUMMARY)	QUA NO.	UNIT	PER	BOR TOTAL	MA PER	TERIAL TOTAL	TOTAL COST
		MEAS.			UNIT		
STRAINERS	7	EA	\$210.00	\$1,470	\$500.00	\$3,500	\$4,97
TEMP. GAUGES	24	EA	\$7.00	\$168	\$50.00	\$1,200	\$1,36
PRESS. GAUGES	24	EA	\$6.00	\$144	\$20.00	\$480	\$62
SECONDARY PUMP CHECK VALVES	5	EA	\$220.00	\$1,100	\$2,200.00	\$11,000	\$12,10
4" TO 6" PIPE FITTINGS	40	EA	\$145.00	\$5,800	\$127.00	\$5,080	\$10,88
8" TO 12" PIPE FITTINGS	20	EA	\$225.00	\$4,500	\$304.00	\$6,080	\$10,58
EQUIPMENT MOBILIZATION	1	LS	\$1,300.00	\$1,300	\$430.00	\$430	\$1,73
	1	LS	\$2,500.00	\$2,500	\$1,000.00	\$1,000	\$3,50
SYSTEM TEST AND BALANCE	1	LS	\$3,000.00	\$3,000	\$500.00	\$500	\$3,50
CONNECT PRIMARY PUMP	2	EA	\$305.00	\$610	\$80.00	\$160	\$77
CONNECT SECONDARY PUMP	3	EA	\$300.00	\$900	\$55.00	\$165	\$1.06
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LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOM9 ANALYSIS DATE: 07-22-87 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

- 1. INVESTMENT A. CONSTRUCTION COST \$ 314356. 31436. B. SIOH \$ C. DESIGN COST \$ 15718. D. ENERGY CREDIT CALC (1A+1B+1C)X.9 \$ 325359. E. SALVAGE VALUE COST -\$ 0. F. TOTAL INVESTMENT (1D-1E) \$ 325359.
- 2. ENERGY SAVINGS (+) / COST (-)
  ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUE	EL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	NUAL \$ VINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
Α.	ELECT	\$ 15.50	2552.	\$ 39556.	8.59	339786.
в.	DIST	\$.00	0.	\$ Ο.	11.28	Ο.
с.	RESID	\$.00	0.	\$ Ο.	12.01	Ο.
D.	NAT G	\$ 3.15	-278.	\$ -876.	12.76	-11174.
Ε.	COAL	\$.00	0.	\$ 0.	10.17	0.
F.	TOTAL		2274.	\$ 38680.		\$ 328612.

3. NON ENERGY SAVINGS (+) / COST (-)

Α.	ANNUAL RECURRING (+/-)	\$ Ο.
	(1) DISCOUNT FACTOR (TABLE A) 9.11	
	(2) DISCOUNTED SAVING/COST (3A X 3A1)	\$ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4) \$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 108442.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY</pre>

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 38680.
5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 328612.
6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.01

(IF < 1 PROJECT DOES NOT QUALIFY)

Page 8

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BHGROUP ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.001 INSTALLATION & LOCATION: FT LEAVENWORTH REGION NO. 7 PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987DISCRETE PORTION NAME: GROUP3ANALYSIS DATE:05-31-89ECONOMIC LIFE 15 YEARSPREPARED BY: CRB

1.	INVESTMENT		
	A. CONSTRUCTION COST	\$	635131.
	B. SIOH	\$	63513.
	C. DESIGN COST	\$	31757.
	D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	657361.
	E. SALVAGE VALUE COST	-\$	0.
	F. TOTAL INVESTMENT (1D-1E)	\$	657361.

2. ENERGY SAVINGS (+) / COST (-) ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

	FUEL	UNIT COST \$/MBTU(1)			NNUAL \$ AVINGS(3)	DISCOUNT FACTOR(4)	SCOUNTED AVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ 15.50 \$ .00 \$ .00 \$ 3.15 \$ .00	3840. 0. 0. 4450. 0.	\$\$	59520. 0. 0. 14018. 0.	8.59 11.28 12.01 12.76 10.17	511277. 0. 0. 178863. 0.
	F. TOTAL		8290.	\$	73538.		\$ 690140.
3.	NON ENERGY	Y SAVINGS(+) /	COST(-)				
		ECURRING (+/- UNT FACTOR (			9.11		\$ 0.
			G/COST (3A X 3A	(1)	9.11		\$ 0.
	C. TOTAL NO	N ENERGY DIS	COUNTED SAVIN	IGS(+)	)/COST(-) (3	3A2+3BD4)	\$ 0.
	(1) 25% M/ A IF 30 B IF 30 C IF 30	AX NON ENER( D1 IS = OR > 30 D1 IS < 30 CAL( D1B IS = > 1 G0	SIR = (2F5+3D	.33) 01)/1F)	=	\$    227746. 	
4.	FIRST YEAR D	OOLLAR SAVIN	GS 2F3+3A+(3B1[	)/(YEA		MIC LIFE))	\$ 73538.
5.	TOTAL NET D	ISCOUNTED SA	VINGS (2F5+3C)				\$ 690140.
6.	DISCOUNTED (IF < 1 PROJE	SAVINGS RAT CT DOES NOT	-	(S	IR)=(5 / 1F)=	1.05	

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# PROJECT DEVELOPMENT BROCHURE

# facility

BELL HALL FORT LEAVENWORTH, KANSAS

# project coordinator for using service

functional requirements summary, PDB-1

DA FORM 5020-1-R, Feb 82

TM 5-800-3

A-7

installation:	FORT LEAVENWORTH		
	HVAC MODIFICATIONS (BEL	L HALL)	<u>.</u>
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# project development brochure, PDB-1

DA FORM 5020-R, Feb 82

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### **OBJECTIVE**

This project will provide energy savings by increasing the efficiency of the Bell Hall HVAC systems.

## **CURRENT CONDITIONS**

Currently the existing multi-zone air handling units function as constant volume units that supply the same amount of air at varying temperatures. This requires the fans to operate at full capacity all of the time. The existing constant volume chilled water pumping system supplies the same amount of chilled water throughout the building, regardless of the cooling requirement. The temperatures are maintained by mixing return chilled water with the supply chilled water. This requires that the pumps operate at design capacity all of the time.

## **PROOSED MODIFICATIONS**

This project would convert 5 existing multizone air handling units to allow operation as variable air volume units and convert the existing constant volume chilled water pumping system to a variable flow primary/secondary pumping system.

The multizone units converted to VAV would serve the basement office area, library area, archive area, Eisenhower Auditorium area and the bookstore and barbershop area. The conversion would consist of a variable speed controller on the fan motors, control modifications, and installation of variable volume supply boxes in the individual areas.

The conversion of the constant volume pumping system would include, new primary circulation pumps, modifications to the chilled water and heating water piping loops, new variable speed controllers for the secondary circulation pumps and DDC control modifications.

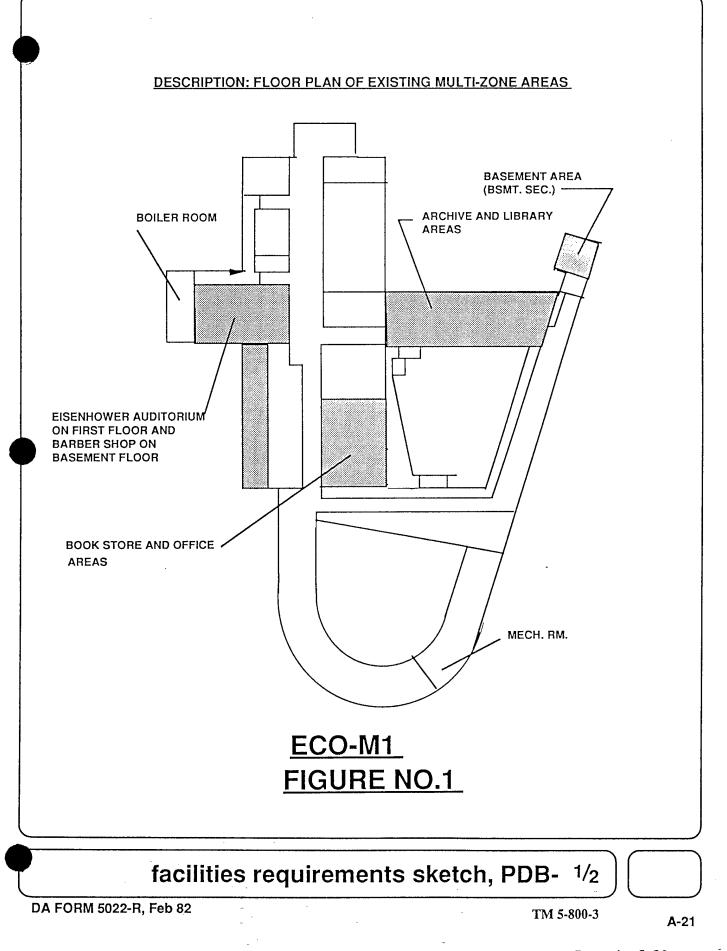
The electrical savings is 8289 MBTU's per year and the the savings to investment ratio is 1.05.

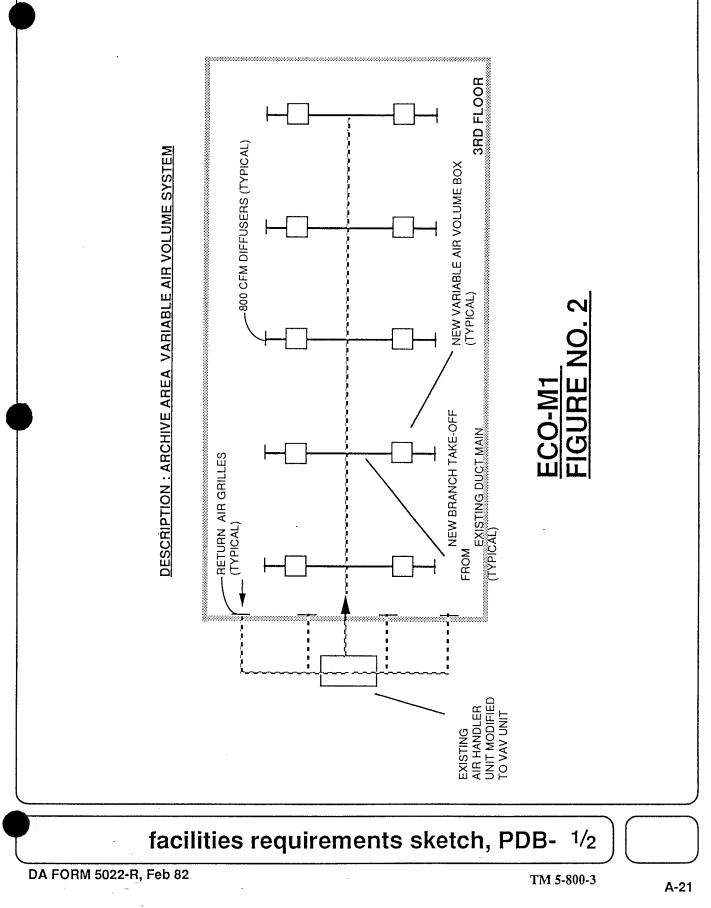
## functional requirements summary, PDB-1

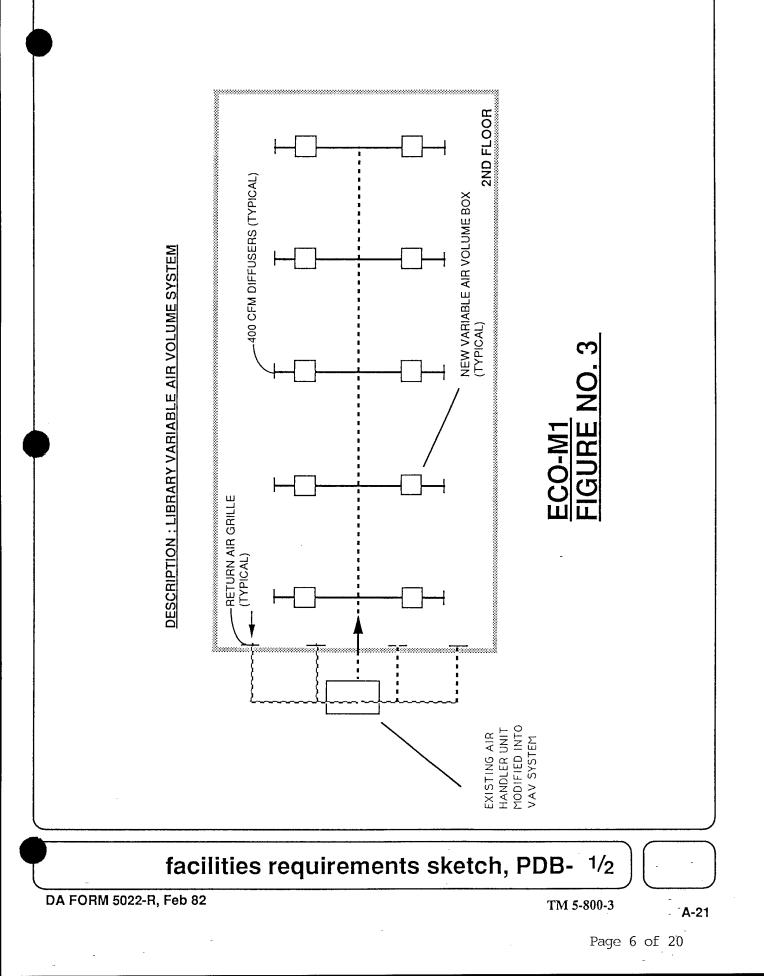
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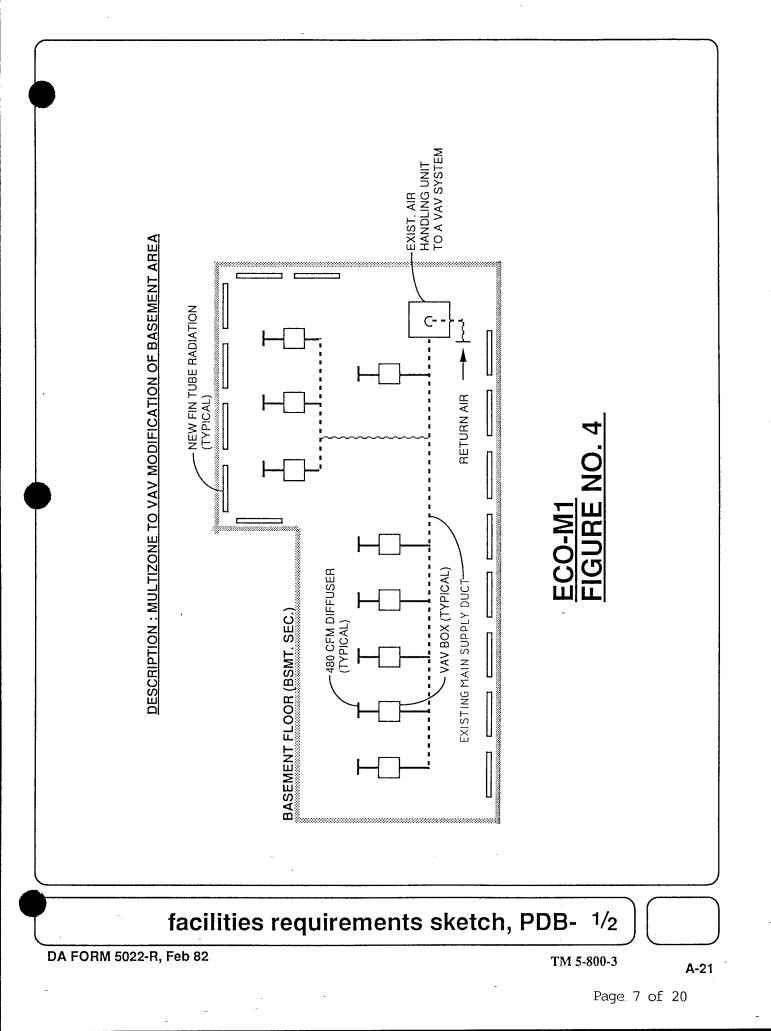
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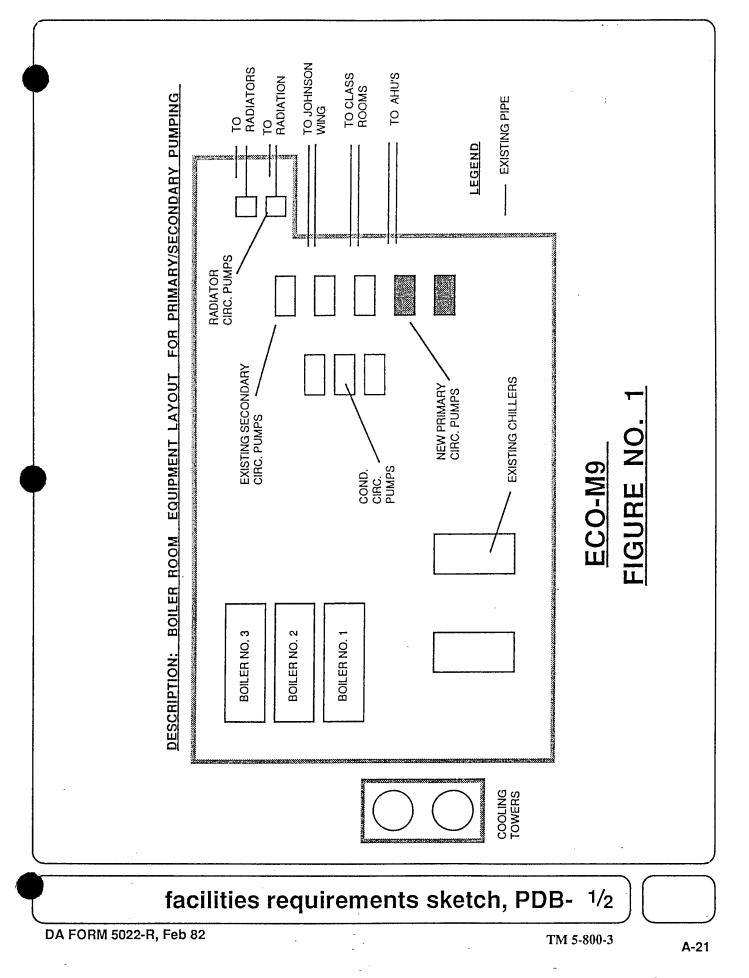
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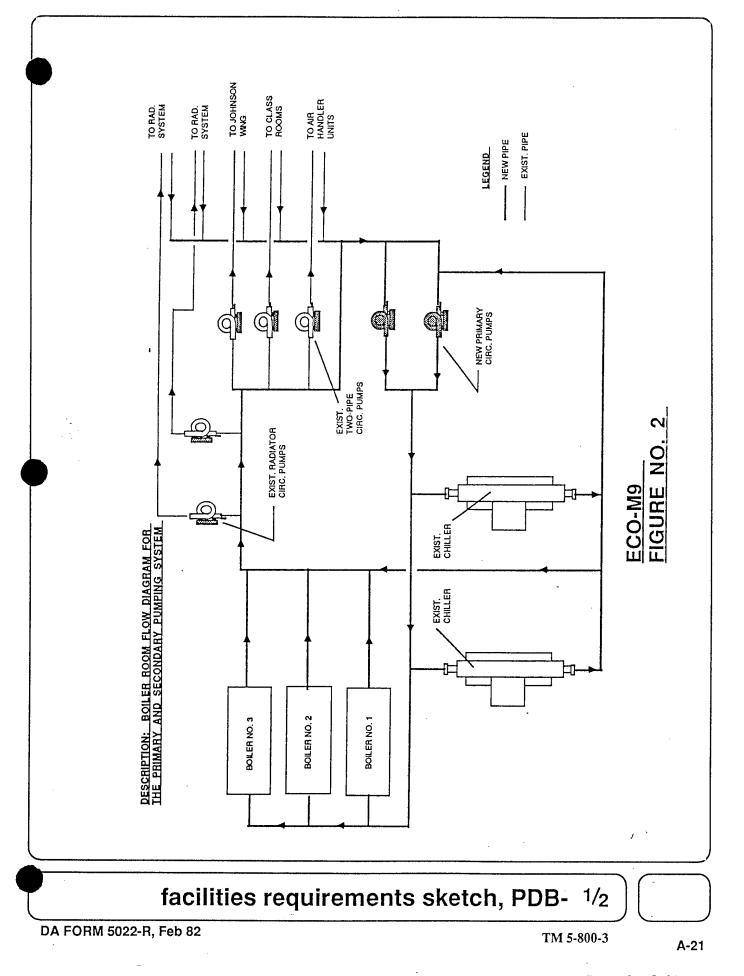












	A. SPECIAL CONSIDERATIONS		ea or quired	* nined	ent ed	ent ed
	ITEM		Not Required or	To Be * Determined	Comment Attached	Document Attached
A-1	Cost estimates for each primary and supporting facility		R	D		V
A-2	Telecommunications system coordination with USACC & authorization for exemptions		NR			••••
A-3	Coordination with state and local governmental requirements (blind vendors, medical facilities, construction and operating permints, clearinghouse coordination, etc.)		NR			•••••
A-4	Assignment of airspace		NR			•••••
A-5	Economic analysis of alternatives	1	R	•••••	••••••	√
A-6	Approval for new starts	·   ····	NR			
A-7	International balance of payments (IBOP) coordination with U.S. European command and NATO-overseas cost estimates and comparables (include rate of exchange used)		NR			
A-8	Impact on historic places-on site survey by authorized acheologist and coordination with state historic preservation officer and advisory council on historic preservation		NR			
A-9	Exceptions to established criteria		NR			
A-10	Coordination with various staff agencies (Provost Marshall-physical security, etc.)	1	NR			
A-11	Identification of related support projects (so projects can be coordinated)		R	В	•••••	
A-12	Required completion date		NR			
E in TO BI fo COMI at DOCL	JIRED OR NOT REQUIRED - Not relevant or no information to communicate. nter "R" if item is relevant and is required for this project. Enter "NR" if item is relevant and is not required for this project. E DETERMINED - Information needed by not currently available. Enter code r information souce. MENT ATTACHED - Significant information summarized or explained and tached. JMENT ATTACHED - Significant information is in an existing document which attached.	ар) А - В - С - D -	DFAE Using Cons Desig Other	Service truction	) Service Comm	ents

# documentation checklist

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Consultation with the District Office to determine and evaluate flood plain hazards Preparation, submission, and/or approval of new General Site Plan Annotated General Site Plan Sketch Site Plan Facilities Requirements Sketch Preparation of Site Survey Subsoil information Approval by Department of Defense Explosive Safety Board (DDESB) for Safety Site Plan Other Site Development Considerations (List and number items)	NR NR NR NR NR NR		Comment
General Site Plan Annotated General Site Plan Sketch Site Plan Facilities Requirements Sketch Preparation of Site Survey Subsoil information Approval by Department of Defense Explosive Safety Board (DDESB) for Safety Site Plan			
Annotated General Site Plan Sketch Site Plan Facilities Requirements Sketch Preparation of Site Survey Subsoil information Approval by Department of Defense Explosive Safety Board (DDESB) for Safety Site Plan			
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other Site Development Considerations (List and number items)			
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ITEM Reconciliation with troop housing programs and requirements Evaluation of existing facilities (including degree of utilization) Approval for removal and relocation of existing useable facilities	Required or Not Required	To Be * Determined	Comment Attached	
Evaluation of existing facilities (including degree of utilization) Approval for removal and relocation of existing useable facilities				
Evaluation of existing facilities (including degree of utilization) Approval for removal and relocation of existing useable facilities	NR			
	NR			L
Evaluation of off-post community facilities	NR			-
Storage and maintenance facilities (including nuclear weapons)	NR			_
Coordination hospitals, medical and dental facilities with Surgeon General	NR			ŀ
Coordination of aviation facilities with FAA	NR			ļ
Coordination air traffic control and navigational aids with USACC	NR_	ļ		ŀ
Tabulation of types and numbers of aircraft	NR	.}		-
Evaluation of laboratory, research and development, and technical maintenance facilities	NR	.		-
Coordination chapels with Chief of Chaplains				-
Review food service facilities by USATSA	NR			-
communication centers not co-located with related facilities	NR			_
	NR			-
				-
	R	<u>A</u>		-
Facilities for or exposed to explosions, toxic chemicals, or ammunition-review by DDESB (See also Item B-4)	NR			_
Analysis of deficiencies	<u> </u>			-
Consideration of alternatives				-
	NK		ļ	-
	K	<u> </u>		-
	NIC			-
<ul> <li>Direct OR NOT integrating both the project.</li> <li>A - DFAE</li> <li>B - Using Service</li> <li>C - Construction</li> <li>Deter code for information source.</li> <li>MENT ATTACHED - Significant information summarized or explained</li> <li>JMENT ATTACHED - Significant information is in an existing docuent which is attached.</li> </ul>	ce n Service ck Comm	ents Att		
	Coordination chapels with Chief of Chaplains Review food service facilities by USATSA Automated data processing system or equipment approvals-cost analysis when ADP and/or communication centers not co-located with related facilities Coordination postal facilities coordination with ASD(I&L) Tenant facilities coordination with installation where sited Facilities for or exposed to explosions, toxic chemicals, or ammunition-review by DDESB (See also Item B-4) Analysis of deficiencies Consideration of alternatives Determination whether occupants will Include physically handicapped or disabled persons As-build drawings for alterations or additions Availability of Standard Design or site adaptable designs Other Architectural & Structural (List and number items)  *By WHOM (Check A - DFAE B - Using Service C - Construction ther "NR" if item is relevant and is required for this project. E DETERMINED - Information needed but not currently available. ter code for information source.  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Coordination chapels with Chief of Chaplains       NL         Review food service facilities by USATSA       NL         Automated data processing system or equipment approvals—cost analysis when ADP and/or communication centers not co-located with related facilities       NL         Coordination postal facilities coordination with ASD(I&L)       NL         Tenant facilities coordination with installation where sited       Review by DDESB (See also item B-4)         Facilities for or exposed to explosions, toxic chemicals, or ammunition—review by DDESB (See also item B-4)       NL         Analysis of deficiencies       R         Consideration of alternatives       R         Determination of sterations or additions       NL         Availability of Standard Design or site adaptable designs       NL         Other Architectural & Structural (List and number items)       NL         Vine Code Construction Survice       A - DFAE         B - Using Service       C - Construction Survice         C - Construction Survice       C - Onther (Check Comm explained d attached.         MENT ATTACHED – Significant information summarized or explained d attached.       D - Designer         E - Other (Check Comm explain)       E - Other (Check Comm explain)	Coordination chapels with Chief of Chaplains       NL         Review food service facilities by USATSA       NL         Automated data processing system or equipment approvals-cost analysis when ADP and/or communication centers not co-located with related facilities       NL         Coordination posal facilities with U.S. Postal Service Regional Director       NL         Laundry and dry cleaning facilities coordination with ASD(I8L)       NL         Tenant facilities coordination with related facilities       R         Facilities coordination with installation where sited       R         Facilities coordination with related facilities       R         Consideration of alternatives       R         Determination whether occupants will include physically handicapped or disabled persons       NK         Ax-build drawings for alterations or additions       R         Availability of Standard Design or site adaptable designs       NR         Other Architectural & Structural (List and number items)       *8Y WHOM (Check and insert approunce, the related for this project.         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Enter "R" if term is relevant and is required for this project.       NR         E DETERMINED – Information needed but not currently evaliable.       B - Using Struke         Liter Code for information second but not currently evaliable.       C - Construction Service         D Designer       E - Other (Check Comment Attached ar explain)         MIRED ATACHED – Significant information is in an exi

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	D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS		red o equii	minee	hed
	ITEM		Required or Not Required	To Be * Determined	Comment Attached
D-1	Fuel considerations and cost comparison analysis		NR		
D-2	Energy requirements appraisal (ERA)		NR		
D-3	Conformance with DOD Energy Reduction requirements		RNR	D	
D-4	Evaluation of existing and/or proposed utility systems		NR		
	Other Mechanical and Utility Systems (List and number items)				
		-			
	UIRED OR NOT REQUIRED – Not relevant or no information to com- nunicate. Enter "R" if item is relevant and is required for this project. nter "NR" if item is irrelevant and is not required for this project. BE DETERMINED – Information needed but not currently available. nter code for information source. IMENT ATTACHED – Significant information summarized or explained nd attached. UMENT ATTACHED – Significant information is in an existing docu- nent which is attached.	*BY WHOM (Check A - DFAE B - Using Servic C - Construction D - Designer E - Other (Chec explain)	e n Service		

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· · ·		E. ENVIRONMENTAL CONSIDERATIONS	Required or Not Required	To Be * Determined	Comment Attached	Document Attached
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	E-1 E-2	Environmental impact assessment EIA conclusions require Environmental Impact Statement	NR			
	E-2 E-3	Determination of health, environmental or related hazards. Assistance to determine existence of any health, environmental or related hazard may be requested from Aberdeen Proving Ground, MD 21010, the Office of the Surgeon General, Attn: DASG-HCH (Army Environmental Hygiene Agency)	NR.			
	E-4	Air/water pollution permit, coordination with agencies and compliance with standards at Federal, state and local level	NR			
	E-5	Corrective measures associated with Environmental Impact Statements or assessment—list separately and evaluate.	NR			
	m Er	URED OR NOT REQUIRED – Not relevant or no information to com- unicate. Enter "R" if item is relevant and is required for this project. E DETERMINED – Information needed but not currently available.		t approf	priate let	ter)
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4	A. SPECIAL CONSIDERATIONS	Required or Not Required	To Be * Determined	nent hed	ment
	ITEM	Requi Not B	To Be Deter	Comment Attached	Document
A-1	Factors of risk, restriction or unusual circumstance expected to increase costs beyond applicable area averages	RRRR	D		
A-2	Construction phasing requirements	R	D		
A-3	Functional support equipment (mechanical, electrical, structural, and security) to be built in	R	D		
A-4	Equipment in place and justification	NR			
A-5	Other equipment and furniture (O&MA, OPA) and costs	NR			
A-6	Special studies and tests (hazards analyses, compatibility testing, new technology testing, etc.)	NR			
A-7	Type of construction (permanent, temporary, semi-permanent)	R	D		
A-8	Government furnished equipment (quantities, procurement time, availability and special handling and storage requirements). Funds used for procurement.	NR-			
TO B	VIRED OR NOT REQUIRED – Not relevant or no information to com- unicate. Enter "R" if item is relevant and is required for this project. ther "NR" if item is irrelevant and is not required for this project. E DETERMINED – Information needed but not currently available. E DETERMINED – Information needed but not currently available. C – Construction	ce		priate let	tter)
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	technical data chec	kli	st		-

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	B. SITE DEVELOPMENT	Required or Not Required	* mined	lent Jed	nent hed
$\bigcap$	ITEM	Requi	To Be * Determined	Comment Attached	Document Attached
B-1 (A)	Construction restrictions or guidelines pertaining to site access and preferred construction routes	NR			
(B) (C)	Airfield clearance, explosive storage, working hours, safety, etc. Facilities and/or functions or adjoining areas (structures,	NR.			
	materials, impact)	NR			
8-2	Real estate actions (acquisition, disposal, lease, right-of-way)	HR			
B-3	Demolition/relocation required (data)				
(A) 	Special considerations due to explosives/radioactivity/ chemical contamination/asbestos emissions/toxic gases	NR			
(B)	Restrictions on disposal of demolished/relocated material including hazardous waste	NR			
B - 4	Pavement types and requirements (including traffic surveys and MTMC coordination)	HR			
B-5 (A)	Landscape considerations Protection of existing vegetation	NE			
(8)	Stockpile topsoil	NR_	+		
	Other Site Development (List and number items)				
mur Ent TO BE Ent COMM and DOCUM	<ul> <li>IRED OR NOT REQUIRED – Not relevant or no information to com- nicate. Enter "R" if item is relevant and is required for this project.</li> <li>DETERMINED – Information needed but not currently available.</li> <li>er code for information source.</li> <li>ENT ATTACHED – Significant information summarized or explained attached.</li> <li>MENT ATTACHED – Significant information is in an existing docu- nt which is attached.</li> </ul>	ce In Service			
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	C. ARCHITECTURAL & STRUCTURAL	Required or Not Required	To Be * Determined	Comment Attached	
	ITEM	Regu	To B Dete	Com Atta	
C-1	Vibration-producing equipment requiring isolation	R	D		
C-2	Seismic zone and other design load criteria (typhoon, hurricane, earthquake loads, high or low loss potential)	R	D		
C-3	Protective shelter evaluation and resistant design criteria (conventional/nuclear blast and radia- tion, chemical/biological)	NR			
C-4	Unusual foundation requirements (pier, pile, caisson, deep foundations, mat, special treatment, permafrost areas, soil bearing)	NR			
C-5	Designation and strength of units to be accommodated	NR			
C-6	Requirements and data for special design projects	NR			
C-7	Unusual floor and roof loads (safes, equipment)	NR			_
<u>C-8</u>	Security features (arms rooms, vaults, interior secure areas)	NR		l	. .
mu En TO Bl En COMM and DOCU	<ul> <li>IRED OR NOT REQUIRED – Not relevant or no information to com- inicate. Enter "R" if item is relevant and is required for this project.</li> <li>ter "NR" if item is irrelevant and is not required for this project.</li> <li>E DETERMINED – Information needed but not currently available.</li> <li>ter code for information source.</li> <li>MENT ATTACHED – Significant information is in an existing docunt the attached.</li> </ul>	e n Servic <del>e</del>			
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	D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS	Required or Not Required	To Be <sup>+</sup> * Determined	Comment Attached	Document
	ITEM	Regu Not I	To B Dete	Com Atta	Doct
D-1	Special mechanical requirements or considerations (elevator, crane, hoist, etc.)	NR			
D-2	Special peak usage periods and peak leveling techniques	NR			
D-3	Maintenance considerations (accessibility of equipment, compatibility with existing equipment)	R	D		
D-4	Plumbing-availability, general system type and characteristics (proposed and/or existing, incl. compressed air and gas)	NR			
D-5	Heating-availability, general system type and characteristics (proposed and/or existing)	R	D		
D-6	Ventilating, air condition/refrigeration—availability, general system type and characteristics (pro- posed and/or existing)	R	0		
D-7	Electrical-availability, general system type and characteristics incl. airfield lighting, communica- tion, etc. (proposed and/or existing)	R	P		
D-8	Water supply/waste treatment-availability, general system type and characteristics (proposed and/or existing)	NR			
D-9	Energy requirements/fuel conversion (sources, availability, loads, types of fuel, etc.)	MR			
D-10	Solar energy evaluation	<u> </u>			
mul Ent TO BE Ent COMM and DOCUI	RED OR NOT REQUIRED – Not relevant or no information to com- hicate. Enter "R" if item is relevant and is required for this project. DETERMINED – Information needed but not currently available. er code for information source. ENT ATTACHED – Significant information is in an existing docu- MENT ATTACHED – Significant information is in an existing docu-	Service			
mer	technical data check				

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D-11

ITEM E-1 Waste water treatment, air quality, and solid waste disposal criteria		- <del>5</del> CC	i ng	Comment Attached	Document
E-1 Waste water treatment, air quality, and solid waste disposal criteria		Required or Not Required	To Be * Determined	Con Atta	Doc
		HR			_
Other Environmental Considerations (List and number items)					
	-				
<ul> <li>REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.</li> <li>TO BE DETERMINED – Information needed but not currently available. Enter code for information source.</li> <li>COMMENT ATTACHED – Significant information summarized or explained and attached.</li> <li>DOCUMENT ATTACHED – Significant information is in an existing document which is attached.</li> </ul>	*BY WHOM (Check A – DFAE B – Using Servic C – Constructio D – Designer E – Other (Chec explain)	e n Service			

DA FORM 5024-E-R, Feb 82

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## TM 5-800-3 D-13

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ITEM       Item	F-1 Special fire protection systems or features (detection and suppression equipment, hazards, etc.)	F-1 Special fire protection systems or features (detection and suppression equipment, hazards, etc.)		F. FIRE PROTECTION	)	Required or Not Required	To Be * Determined	Comment Attached
		Other Fire Protection Considerations (List and number items)		ITEM		Req Not	To Be Detern	Com Atta
		REQUIRED OR NOT REQUIRED Not relevant or no information to com- municate. Enter "A" if item is relevant and is required for this project.	F-1		quipment, hazards, etc.)	NR		
		municate. Enter "R" if item is relevant and is required for this project.						

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D-15

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# FORM 1391

1. COMPONENT ARMY	FY 1990 MILITARY CONS	STRUCTION PROJECT	DATA		2. DATE 5-Jun-90	
3. INSTALLATION AND LC FORT LEAVENWORTI		4. PROJECT TITLE HVAC Modifications	(Bell Hal	l)		<del>7 999</del> 9
5. PROGRAM ELEMENT	6. CATEGORY CODE 80000	7. PROJECT NUMBEI	R	8. PROJEC	T COST \$700,000	
		9. COST ESTIMATES				
	ITEM	***	U/M	QUANTITY	UNIT COST	COST (\$000)
Steam and/or Chilled W	ater Distribution.	_				
Convert CHW system to	o Primary/Secondary Pumpi	ing	LS	1	\$345,792	\$34
Air Conditioning		_				
Convert Milti-Zone AHL	J to VAV		LS	1	\$353,853	\$354
		Facility Subtotal			\$699,645	\$70
This project would conv and convert the existing pumping system. The multi-zone units co Auditorium area and the fan motors, control mod The conversion of the c	DPOSED CONSTRUCTION rent 5 existing multi-zone air g constant volume chilled wa nverted to VAV would serve b bookstore and barbershop lifications, and installation of onstant volume pumping sy- heating water piping loops, cations.	handling units to allow of ater pumping system to a the basement office are: area. The conversion w variable volume supply stem would include, new	variable a, library ould con boxes in	flow primary/ area, archive sist of a varia the individual circulation ou	secondary area, Eisenl ble speed co l areas. mps. modific	nower ntroller on t
The electrical savings is	s 8289 MBTU's per year and	d the the savings to inves	tment rat	io is 1.05.		
DD FORM 1391 1 DEC 76	INTE	IOUS EDITIONS MAY B ERNALLY UNTIL EXHAL FOR OFFICIAL USE ON WHEN DATA IS ENTERI	JSTED <b>LY</b>			

.

1. COMPONENT ARMY

5. PROJECT NUMBER

#### 3. INSTALLATION AND LOCATION FORT LEAVENWORTH, KANSAS

#### 4. PROJECT TITLE

#### HVAC Modifications (Bell Hall)

#### 11.J REMARKS:

This project will provide energy savings by increasing the efficiency of the Bell Hall HVAC systems.

#### 11.K RELATED PROJECTS:

No other project are dependent upon this project.

#### 11.L PROJECT:

Conversion of the existing multi-zone air handling units to allow operation as variable air volume units and conversion of the existing constant volume chilled water pumping system to a variable flow primary/secondary pumping system.

#### 11.M REQUIREMENT

- a. This project will aid in reducing the consumption of electricity to help meet national energy reduction goals which is the reason for the ESOS and ECIP programs.
- b. All buildings will be in active use during the amortization period.

#### 11.N CURRENT SITUATION:

Results from the field survey indicate that the existing systems are currently meeting the requirements cond of the facility. However, this project improves the efficiency of the HVAC systems by allowing them to modulate and follow the changes in the air conditioning loads. The current systems are constant volume and run at full air flow and water flow capacity all of the time, which uses more fan and pump horsepower than the variable flow systems.

#### 11.0 IMPACT IF NOT PROVIDED:

If this project is not approved, the electrical energy consumption will remain the same and will not contribute to the energy saving goals of the DOD.

PREVIOUS EDITIONS MAY BE USED INTERNALLY UNTIL EXHAUSTED FOR OFFICIAL USE ONLY (WHEN DATA IS ENTERED) 1. COMPONENT ARMY

#### 3. INSTALLATION AND LOCATION FORT LEAVENWORTH, KANSAS

4. PROJECT TITLE	5. PROJECT NUMBER
HVAC Modifications (Bell Hall)	

#### D1. GENERAL:

This project is required as part of the DOD plan to reduce the energy consumption per gross square foot of building area. This project improves the efficiency of the air conditioning systems at Bell Hall, located at Fort Leavenworth. The primary mission of Ft. Leavenworth is the Military War College. This building is the primary center for this function. This project does not involve the arrival of a new weapons system.

D2. ACCOMMODATIONS NOW IN USE:

Building 111, Bell Hall.

D3. ANALYSIS OF DEFICIENCY:

Currently the existing multi-zone air handling units function as constant volume units that supply the same amount of air at varying temperatures. This requires the fans to operate at full capacity all of the time. The existing constant volume chilled water pumping system supplies the same amount of chilled water throughout the building, regardless of the cooling requirement. The temperatures are maintained by mixing return chilled water with the supply chilled water. This requires that the pumps operate at design capacity all of the time.

D4. CONSIDERATION OF ALTERNATIVES:

The alternatives to reduce fan and pump horsepower involve reducing air and water flows or modifying existing duct and piping supply & return systems to reduce pressure drops. Reducing the air and water flows was unacceptable because the system would not meet peak load requirements. Modifying the existing duct and piping alternatives were rejected because of high capitol costs and excessive downtime required for construction, and the minimal benefit.

D5. CRITERIA FOR PROPOSED CONSTRUCTION:

The proposed project will conform with all applicable Federal and US Army regulations.

D6. PROGRAM FOR RELATED FURNISHINGS AND EQUIPMENT:

Not applicable.

D7. DISPOSAL OF PRESENT ASSETS:

Not applicable.

D8. SURVIVAL MEASURES:

Not applicable.

D9. SUMMARY OF ENVIRONMENTAL CONSEQUENCES:

This project has no environmental consequences, other than a reduction in energy use, which translates to a positive impact.

DD FORM 1391C 1 DEC 76 PREVIOUS EDITIONS MAY BE USED INTERNALLY UNTIL EXHAUSTED FOR OFFICIAL USE ONLY (WHEN DATA IS ENTERED)

1. COMPONENT ARMY	FY 1990 MILITARY CONSTRUCTION PROJECT DATA		2. DATE 5-Jun-90
3. INSTALLATION A FORT LEAVENV	ND LOCATION VORTH, KANSAS	<u></u>	<b>.</b>
4. PROJECT TITLE		5. PROJEC	TNUMBER
HVAC Modificat	ions (Bell Hall)		iervestr i i
	ION OF FLOOD HAZARDS:		
Not applicable.			
	C JUSTIFICATION:		
See attached LC			
	ND COMMUNICATIONS SUPPORT:		
	are required for support of this project.		
D13.PROTECTIO	ON OF HISTORIC PLACES AND ARCHAEOLOGICAL SITES:		
The proposed pr	oject will not alter building construction or appearance.		
D14. PROJECT	DEVELOPMENT BROCHURE:		
A Project Develo	pment Brochure has been prepared.		
D15. ENERGY	REQUIREMENTS:		
A summary of the	e results of the full energy study follows.:		
Annu: :	3840 MBTU's per year electricity 4450 MBTU's per year natural gas		
Total :	\$690,140		
Initial :	\$657,361		
Savin :	1.05	-	
D16. PROVISIC	ONS FOR THE HANDICAPPED:		
Not applicable.			
D17. REAL PRO	OPERTY MAINTENANCE ACTIVITY (RPMA):		
The completion of	of this project will not have an impact on property maintenance.		
D18. COMMER	CIAL ACTIVITIES (CA) ANALYSIS:		
Not applicable.	This project does not constitute a new start or expansion.		

DD

#### PREVIOUS EDITIONS MAY BE USED INTERNALLY UNTIL EXHAUSTED FOR OFFICIAL USE ONLY (WHEN DATA IS ENTERED)