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EUROPE DIVISION, CORPS OF ENGINEERS

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ENERGY ENGINEERING ANALYSIS PROGRAM

U.S.M.C.A. AFCENT SUPPORT ACTIVITY (US)

SCHINNEN EMMA MINE, NE 035

EXECUTIVE SUMMARY

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ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)
GLOSSARY OF TERMS AND ABBREVIATIONS
ENERGY REPORT

AAFES	-	ARMY AIR FORCE EXCHANGE SERVICE
ADMIN	-	ADMINISTRATION
AFCENT	-	ALLIED FORCES CENTRAL
AHU	-	AIR HANDLING UNIT
ASG	-	AREA SUPPORT GROUP
ASHRAE	-	AMERICAN SOCIETY OF HEATING, REFRIGERATION, AND AIR CONDITIONING ENGINEERS, INC.
AVG	-	AVERAGE
BAR	-	BAR: 14.5 PSI
BE	-	BELGIUM
BEQ	-	BACHELOR ENLISTED QUARTERS
BF	-	BELGIUM FRANC
BKS	-	BARRACKS
BLDG	-	BUILDING
BOQ	-	BACHELOR OFFICER'S QUARTERS
BTU	-	BRITISH THERMAL UNIT: A HEAT UNIT EQUAL TO THE AMOUNT OF HEAT REQUIRED TO RAISE ONE POUND OF WATER ONE DEGREE FAHRENHEIT.
BTU/HR OR BTUH	-	BRITISH THERMAL UNITS PER HOUR
C	-	CELSIUS
C & D	-	CHIEVRES & DAUMERIE
CFH	-	CUBIC FEET PER HOUR
CFM	-	CUBIC FEET PER MINUTE
CMU	-	CONCRETE MASONRY UNIT (BLOCK)
COMM	-	COMMISSARY

Glossary of Terms and Abbreviations (continued)

COMTY	-	COMMUNITY
CUFT	-	CUBIC FOOT
DA	-	DEPARTMENT OF THE ARMY
DD	-	DEGREE DAY: THE DIFFERENCE BETWEEN THE AVERAGE TEMPERATURE FOR A DAY AND 65° F.
DEH	-	DIRECTOR OF ENGINEERING AND HOUSING
DG	-	DUTCH GUILDER
DHW	-	DOMESTIC HOT WATER
DM	-	DEUTSCHE MARK
DOE	-	DEPARTMENT OF ENERGY
ECIP	-	ENERGY CONSERVATION INVESTMENT PROGRAM
ECO	-	ENERGY CONSERVATION OPPORTUNITY
ECOS	-	ENERGY CONSERVATION OPPORTUNITIES
EEAP	-	ENERGY ENGINEERING ANALYSIS PROGRAM
EFF	-	EFFICIENCY
EMCS	-	ENERGY MONITORING AND CONTROL SYSTEM
ESIR	-	ENERGY SAVINGS-TO-INVESTMENT RATIO
ESP	-	ENERGY SIMULATION PROGRAM
EUD	-	EUROPE DIVISION, CORPS OF ENGINEERS
F	-	FAHRENHEIT
FG	-	FIBERGLASS
FH	-	FAMILY HOUSING
FLUO	-	FLUORESCENT
FO	-	FUEL OIL
FRG	-	FEDERAL REPUBLIC OF GERMANY (WEST GERMANY)
FT	-	FEET
FUNC	-	FUNCTION
FY	-	FISCAL YEAR

Glossary of Terms and Abbreviations (continued)

GAL	-	GALLON
GPM	-	GALLONS PER MINUTE
GWB	-	GYPSUM WALL BOARD
GY AREA	-	GERMANY (GY) AREA
HGT	-	HEIGHT
HVAC	-	HEATING, VENTILATING, AIR CONDITIONING
KASER	-	KASERNE
KW	-	KILOWATT, 1000 WATTS
KWHR	-	KILOWATT HOUR
LAB	-	LABORATORY
LF	-	LINEAL FOOT
M	-	METER
M3	-	CUBIC METERS
MAN	-	MANUAL
MBTU	-	ONE MILLION BRITISH THERMAL UNITS
MEGA	-	MILLION
MH/MH	-	MAN-HOUR
MM	-	MILLIMETER
MO	-	MONTH
M & R	-	MAINTENANCE AND REPAIR
MUX	-	MULTIPLEX
MW	-	MEGAWATT, ONE MILLION WATTS
MWH	-	MEGAWATT-HOUR, ONE MILLION WATT-HOUR
MWHR	-	MEGAWATT-HOUR, ONE MILLION WATT-HOUR
MWHRS	-	MEGAWATT-HOUR, ONE MILLION WATT-HOURS
NATO	-	NORTH ATLANTIC TREATY ORGANIZATION
N/A	-	NOT APPLICABLE; NOT AVAILABLE

Glossary of Terms and Abbreviations (continued)

NBS	-	NATIONAL BUREAU OF STANDARDS
NE	-	NETHERLANDS
NL	-	NETHERLANDS
NOAA	-	NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NO.	-	NUMBER
NSSG	-	NATO SHAPE SUPPORT GROUP
OA	-	OUTSIDE AIR
OCCUP	-	OCCUPANCY
OH	-	OVERHEAD
OPER	-	OPERATIONS
O & M	-	OPERATION AND MAINTENANCE
PF	-	POWER FACTOR; RELATIONSHIP BETWEEN KW AND KVA. WHEN THE POWER FACTOR IS UNITY, KVA EQUALS KW.
PF	-	PFENNING
POMCUS	-	PREPOSITIONED MATERIAL CONFIGURED TO UNIT SETS
PSI(A)(G)	-	POUNDS PER SQUARE INCH (ABSOLUTE)(GAUGE)
PX	-	POST EXCHANGE
R-VALUE	-	THE RESISTANCE TO HEAT FLOW EXPRESSED IN UNITS OF (SQUARE FEET)(HOUR)(DEGREE F.)/BTU; R VALUE - 1/U VALUE.
SA	-	SUPPORT ACTIVITY
SF	-	SQUARE FOOT
SHAPE	-	SUPREME HEADQUARTERS ALLIED POWERS EUROPE
SIR	-	SAVINGS-TO-INVESTMENT RATIO: TOTAL LIFE CYCLE BENEFITS DIVIDED BY 90 PERCENT OF THE DIFFERENTIAL INVESTMENT COST.
SIOH	-	SUPERVISION, INSPECTION AND OVERHEAD
SOS	-	STATEMENT OF SERVICES
SP	-	SINGLE PANE
STY	-	STORY
TRY	-	TEST REFERENCE YEAR

'U' VALUE	-	A COEFFICIENT EXPRESSING THE THERMAL CONDUCTANCE OF A COMPOSITE STRUCTURE IN BTU PER (SQUARE FOOT) (HOUR) (DEGREE F. TEMPERATURE DIFFERENCE)
UA	-	OVERALL HEAT TRANSFER COEFFICIENT (BTU/HR DEGREE F.)
UPW	-	UNIFORM PRESENT WORTH FACTOR: A FACTOR, WHICH WHEN APPLIED TO ANNUAL SAVINGS, WILL ACCOUNT FOR THE TIME VALUE OF MONEY AND INFLATION OVER THE LIFE OF THE PROJECT.
US	-	UNITED STATES
USAREUR	-	UNITED STATES ARMY; EUROPE
V	-	VOLT
VET	-	VETERINARY
W	-	WATT
WDW	-	WINDOW
WHSE	-	WAREHOUSE
WK	-	WEEK
YR/yr	-	YEAR

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1. INTRODUCTION

1.1. Scope.

This Summary outlines the information compiled during Phase II of Contract DACA 90-83-C-0013, "Energy Engineering Analysis Program." The purpose of the contract is to reduce energy consumption in the community by identifying actions and/or projects that will accomplish this end. The contract is divided into three phases:

1.1.1. Phase I - Data Gathering.

During this phase, data was compiled describing the pertinent features of energy consuming facilities and past history of energy consumption. This data is contained in the "Data Report" dated 15 April 1983.

1.1.2 Phase II - Data Analysis.

During this phase, the data collected in Phase I was analyzed. Energy conservation opportunities (ECOS) were identified and economically analyzed. The "Energy Report" presents recommendations, justifications, and preliminary DD Form 1391s.

1.1.3. Phase III - Project Documents.

During this phase, applicable DA Form 4283s, DD Form 1391s, and Project Development Brochures were prepared.

1.2. General Description.

AFCENT Support Activity (US) NE 035 is located at Schinnen Mine, next to the town of Schinnen, Netherlands. The organization provides support to U.S. Troops assigned to various allied force organizations in the area.

Since FY 1979, AFCENT SA (US) has acquired new facilities built under NATO programs at Moenchengladbach and Herongen FRG. These were then transferred to the 54th ASG in Rheinberg on 1 October 1982. Since being separated from NSSG (US) on 1 October 1981 and becoming a separate community, the mission and boundaries of responsibility have continually changed. A Phase I Master Plan was in process of preparation during FY 83 but development of the Phase II Master Plan and Future Development Plan have been delayed due to mission uncertainties.

1.2.1. Facilities.

AFCENT Support Activity's principal facilities are located at Schinnen Mine. The "Schinnen Mine" buildings were formerly occupied by a coal mining company and Schinnen was an operational mine. All facilities are leased. Most of the buildings are exposed concrete with flat roofs and wall construction of generally uninsulated precast concrete. Roofs are usually bituminous built-up roofing. The buildings are in good condition and have been well maintained. Since there is no air conditioning, windows are operable and generous in size. Generally, the windows are well fitted and in very good condition. Where windows are unused (storage spaces) they have been insulated by the community. The principal activities/uses are administration, commissary, PX, warehousing, vehicle maintenance, facility engineering and maintenance. Generally office spaces are heated with low temperature hot water radiators. The commissary has a combination of radiators and hot water unit heaters supplied from a low temperature hot water gas-fired boiler located in the commissary building. The motor repair shop is heated with indirect gas-fired unit heaters. All other buildings at Schinnen are supplied with low temperature hot water from a central heating plant, Building T16. The heating plant has four (4) separate supply zones and hot water temperatures for each zone are reset as a function of outdoor temperature. Temperatures are further depressed at night to conserve energy. Complaints from the Military Police Office, which is the only building at Schinnen occupied 24 hours are evidence that the night setback system is functioning.

Schinnen Mine operates from 8 a.m. to 5 p.m. with the exception of the commissary and PX which stay open until 6 p.m. and Provost Marshal office which operates 24 hours. The support activity also occupies facilities at the following locations:

* Tapijn Kaserne at Maastricht - 2 small office buildings, D and X. The buildings are owned by the Government of the Netherlands.
* Education Center at Heerlen (L80).
* AAFES Garage in Brunsum (L86).
* BEQ in Brunsum (L90).
* Laundry/warehouse T-44 (14) and BEQ T-52 (19) at Camp Hendrick at Brunsum.

MCA projects have been submitted to replace the BEQS in Brunsum with new facilities at Schinnen Mine.

1.2.2. Location.

Schinnen, NE 035, is approximately 20 miles NNW of Aachen, FRG and 12 miles NNE of Maastricht, NL, near the town of Geleen, NL.

1.2.3. Climate.

Schinnen is in the south eastern corner of the lowlands just east of the Maas River. Summers are cool and winters mild. There is a great deal of overcast all year. Precipitation is frequent, generally occurring as light rain. Schinnen Mine is included in TM 5-785 "Engineering Weather Data".

2. EXISTING ENERGY SITUATION

2.1. Baseline FY 75 Energy Consumption.

Facilities not located on Schinnen Mine have either been converted or acquired during the past 2 years so that there is no consumption history available for FY 75. The commissary was not relocated to Schinnen Mine until August of 1976 so the commissary use is not included in the Schinnen Mine total in FY 75.

Electricity	MWHRS	MBTU (Raw Source)*
Schinnen Mine	654	7,586
Natural Gas	1000 CUFT	MBTU
Schinnen Mine	20,355	18,930
Total Energy:		26,516

* 11,600 BTU/KWHR represents fuel input at generating plant.

2.2. Source Energy Consumption.

2.2.1.

Electricity in MWHRS	FY 75	FY 77	FY 80	FY 81	FY 82
Commissary		656	622	655	717
SM w/o Commissary	654	879	886	916	935
TOTAL Schinnen	654	1,535	1,508	1,571	1,652

2.2.2.

Natural Gas in MWHRS	FY 75	FY 77	FY 80	FY 81	FY 82
Commissary		2,626	2,206	1,987	2,470
SM w/o Commissary	18,930	19,920	20,264	19,706	19,096
TOTAL Schinnen	18,930	22,546	22,470	21,693	21,566

2.2.3.

Cost Data	FY 75	FY 77	FY 80	FY 81	FY 82
Electricity $/KWHR	N/A	.037	.048	.058	.06
Natural Gas $/MBTU	N/A	2.23	3.18	4.05	5.19

Early in FY 83, the cost of natural gas dropped to $4.61/MBTU. Since this may be only a temporary decrease, FY 83 costs are projected to be an average of FY 82 and the first 3 months of FY 83 or $4.90/MBTU.

No increase has yet occurred in the piece of electricity. FY 83 costs are projected to be $.06/KWHR or $5.17/MBTU.

2.3. Present Annual Energy Consumption (FY 82).

Schinnen Mine is supplied with electricity and gas from the public utility through single meters. The commissary is the only building at the mine which is individually submetered. No utility data exists for Buildings T44 (14) and T52 (19) at Camp Hendricks in Brunsum. Only partial utility data are available for the other off-site locations occupied by AFCENT SA and included in this study.

2.3.1. Present Annual Energy Consumption (FY 82), Schinnen Mine.

Electricity	MWHRS	MBTU (Raw Source)
Schinnen Mine	1,652	19,163
Commissary	(717)	(8,317)
TOTAL	1,652	19,163
Natural Gas	**1000 CUFT**	**MBTU**
Schinnen Mine	23,190	21,566
Commissary	(2,658)	(2,470)
TOTAL	23,190	21,566
Total Energy:		40,729

2.3.2. Present Annual Energy Consumption (FY 82), AFCENT (Off-Site) Facilities.

Electricity	MWHRS	MBTU (Raw Source)*
BEQ (Building L90 Brunsum)	122.6	1,422
Education Center (L80)	59.1	686
AAFES Garage (L86)	37.0	429
TAPIJN (Buildings D and X)	71.2	884
TOTAL	289.9	3,421

Heating Fuel

Natural Gas	1000 CUFT	MBTU
BEQ	4,350	4,045
Education Center	2,800	2,604
AAFES Garage	679	631
TAPIJN	N/A	N/A
TOTAL	7,829	7,280
Fuel Oil	**LITERS**	**MBTU**
Education Center	11,509	427
AAFES Garage	6,431	238
TOTAL	17,940	665
TOTAL HEATING FUEL		7,945

2.4. Existing Building Source Energy Consumption.

2.4.1. Heating Demand.

Heating demand and consumption has been estimated for each of the buildings using the modified degree-day method. The losses for each building are shown in Table 2-1.

Table 2-1. Building Heat Loss, Schinnen

BLDG	HLWALL	HLROOF	HLGLAS	HLDOOR	TOTHLOS	ANUALHT	HTPSFYR
T02	41,190	67,378	40,733	2,260	151,562	352	170,219
T04	18,083	81,247	35,571	2,260	137,163	318	134,077
T06	18,083	81,247	35,571	946	135,849	315	122,003
T08	234,600	134,858	102,611		472,069	1,096	70,964
T09	28,014	31,027	27,186	2,849	89,077	206	58,274
T10	462,106	480,585	21,758	1,139	965,589	2,490	89,404
T11	113,417	32,775	9,765	2,849	158,808	363	191,347
T12	522,016	311,880	19,349	18,083	871,329	2,625	116,183
T15	343,507	262,200	118,080	24,068	747,855	2,253	245,416
T17	3,882	3,930	34,017	473	42,303	90	53,175

Table 2-1. Building Heat Loss, Schinnen (continued)

BLDG	HLWALL	HLROOF	HLGLAS	HLDOOR	TOTHLOS	ANUALHT	HTPSFYR
T18	44,997	82,054	166,980	17,276	311,308	723	121,598
T22	100,195	82,054	66,387	15,015	263,653	612	102,985
T25	220,101	131,221	9,411	18,298	379,033	977	47,980
T26	23,598	10,524	5,363	946	40,433	86	83,519
T28	87,360	36,349	31,169	22,259	177,139	540	82,240

TOTAL KASERNE ANUALHT IN MILLION BTUS	13,053
TOTAL KASERNE SQUARE FEET	129,157
AVERAGE ANNUAL BTU/SF	112,626
PEAK HEAT LOSS IN BTU	4,943,177

HLWALL, HLROOF, HLGLAS, HLDOOR, TOTHLOS are the wall, roof, window, door, and total peak heat losses in BTUH based on an outdoor design condition of 21^{o} F. and an indoor condition of 68^{o} F. ANUALHT is the estimated annual heating requirement in millions of BTUS. HTPSFYR is the annual heating requirement per square foot of building area. These are heating requirements and not fuel consumption. To make a meaningful comparison of the estimates and actual requirements, it is first necessary to delete the commissary from the total. There is no way to estimate the reheating that is required due to refrigeration of the food cases in the sales area. The heating requirement of the commissary is estimated to be 977 MBTU per year but the actual gas consumption is 2,470 MBTU/YR. Adjusting for efficiency, the heating due to external conditions represents only 56 percent of total consumption. This is normal for a food store. The amount of reheat can be reduced by covering open cases with insulating blankets and night setback of temperatures.

Deducting the commissary from the total yields a heating requirement for the remaining buildings of 13,053 - 977 = 12,076 MBTU. To this must be added the heat loss from the distribution piping which was estimated to be 730 MBTU/YR. This gives a new total of 12,806 MBTU. To convert to fuel consumption, we must include boiler plant combustion efficiency and losses. Total plant annual efficiency has been estimated as follows:

• Combustion Efficiency:	80 Percent
• Jacket Losses:	1 Percent
• Scale Build Up:	3 Percent
• Standby Losses:	5 Percent
• Header/Valve Losses:	1 Percent
TOTAL PLANT EFFICIENCY	70 Percent

Fuel Consumption = 12,806/0.7 = 18,294 MBTU

This compares quite favorably with the actual consumption of Schinnen exclusive of the commissary of 19,096 MBTU (96 percent).

2.4.2. Electrical Systems.

Electricity is supplied by the local utility through a single electric meter at 380/220 volts. Only the commissary is submetered. Schinnen, exclusive of the commissary, consumes 1652 - 717 = 935 MWHRS per year. Building lighting has been estimated to consume 590 MWHRS/YR or 63 percent. Street lighting (recently replaced) is estimated to consume 64 MWHRS per year and domestic hot water heating 36 MWHRS per year. The remaining 245 MWHRS per year is composed of highly variable and non-controlable loads such as:

- Power tools in motor repair and facilities engineering shops.
- Air compressor and x-ray in dental clinic.
- Display lighting in PX.
- Food preparation equipment in exchange cafe.

The largest single consumers at Schinnen Mine are the refrigerated food cases and freezers in the commissary. There are 216 lineal feet of open cases and 20 refrigeration compressors.

Discussions were held with commissary personnel regarding covering cases with insulating blankets at night and rotating compressors to improve air flow and efficiency.

3. ENERGY CONSERVATION OPPORTUNITIES DEVELOPED

3.1. ECOs Investigated.

3.1.1. Weatherization Projects.

Evaluation of ECOs relating to building envelope, HVAC and lighting resulted in the following project qualifying under ECIP criteria:

PROJECT DESCRIPTION	COST	ANNUAL SAVINGS (MBTU)	ANNUAL SAVINGS US$	SIR
Weatherization Walls and Roofs	$442,385	10,909	53,456	1.5

During a field survey of the community, ten (10) different types of walls and thirteen (13) different types of roofs were identified. Each wall and roof type was analyzed and a modification for each was proposed to (wherever practical) achieve "U" factors required by current criteria. Cost estimates were developed for each modification. Unit prices and revised "U" factors were used to compute costs and savings. All modifications having a SIR less than 1.0 were eliminated.

The wall and roof modifications having SIRs equal to or greater than one (1) are shown in Tables 3-1 and 3-2 for Schinnen Mine and Tables 3-3 and 3-4 for AFCENT (Off-Site) facilities. While wall and roof insulation has been combined into a single insulation project, walls and roofs in the same building do not necessarily always qualify economically and therefore are listed separately.

3.1.1.1. Schinnen Mine.

ANNUAL SAVINGS	HEAT MBTU	FUEL MBTU	COST
Walls	2,063	2,947	14,440
Roofs	3,230	4,614	22,608
TOTAL	5,293	7,561	37,048

Discounted Savings (15-year) = 474,214

Cost:

Walls	147,374
Roofs	178,319
TOTAL	325,693

SIR = 1.45

3.1.1.2. AFCENT (Off Site).

ANNUAL SAVINGS	HEAT MBTU	FUEL MBTU	COST
Walls	470	671	3,290
Roofs	1,874	2,677	13,118
TOTAL	2,344	3,348	16,408

Discounted Savings (15-year) = 210,022

Cost:

Walls	40,773
Roofs	75,919
TOTAL	116,692

SIR = 1.79

3.1.1.3. TOTAL Schinnen and AFCENT (Off Site).

ANNUAL SAVINGS	HEAT MBTU	FUEL MBTU	COST
Schinnen	5,293	7,561	37,048
AFCENT (Off Site)	2,344	3,348	16,408
TOTAL	7,637	10,909	53,456

Discounted Savings (15-year) = 684,236

Cost:

Schinnen	325,693
AFCENT (Off Site)	116,692
TOTAL	442,385

SIR = 1.54

Table 3-1. Savings Weatherization Walls

BLDG	KASERNE	FUNCTION	WALL TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT WALL
T12	NE 035	GEN. STOREH	CONC1	22,600	1,244	111,503	88,884	1.25	NAT GA	21,172
T15	NE 035	GEN. STOREH	CONC1	9,183	818	73,377	58,489	1.25	NAT GA	13,932

TOTAL ANNUAL HEAT SAVINGS MBTU	2,063
TOTAL DOLLAR SAVINGS	184,880
TOTAL COST	147,374
TOTAL SQFT	31,783
TOTAL SQFT WALLS	35,104
PEAK LOAD REDUCTION	855,835

Table 3-2. Savings Weatherization Roofs

BLDG	KASERNE	FUNCTION	ROOF TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT ROOF
T02	NE 035	M.P. ADMIN.	CON1	2,068	118	10,604	7,749	1.36	NAT GA	1,953
T04	NE 035	GEN. WAREHO	CON1	2,376	142	12,779	9,345	1.36	NAT GA	2,355
T06	NE 035	DENTAL CLIN	CON1	2,586	142	12,779	9,345	1.36	NAT GA	2,355
T08	NE 035	POST HDQTRS	CON2	15,450	220	19,742	7,542	2.61	NAT GA	7,715
T09	NE 035	HDQTRS. LIN	CON2	3,550	50	4,535	1,735	2.61	NAT GA	1,775

Table 3-2. Savings Weatherization Roofs (continued)

BLDG	KASERNE	FUNCTION	ROOF TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT ROOF
T10	NE 035	EXCH. WAREH	CON1	27,857	871	78,043	55,276	1.41	NAT GA	13,930
T11	NE 035	EXCH. CAFE.	CON1	1,900	56	5,561	3,769	1.47	NAT GA	950
T12	NE 035	GEN. STOREH	CON1	22,600	877	98,229	44,840	2.19	NAT GA	11,300
T15	NE 035	GEN. STOREH	CON1	9,183	737	82,595	37,697	2.19	NAT GA	9,500
T26	NE 035	DISPATCH OF	WD1	1,040	14	1,263	1,016	1.24	NAT GA	1,040

TOTAL ANNUAL HEAT SAVINGS MBTU	3,230
TOTAL DOLLAR SAVINGS	326,134
TOTAL COST	178,319
TOTAL SQFT	88,610
TOTAL SQFT ROOFS	52,873
PEAK LOAD REDUCTION	1,515,635

Table 3-3. Savings Weatherization Walls

BLDG	KASERNE	FUNCTION	WALL TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT WALL
T44	NE 035	MULTI USE	MAS1	8,877	220	19,793	17,930	1.10	NAT GA	4,271
T52	NE 035	HOUSING	MET1	18,809	249	24,503	22,842	1.07	NAT GA	5,441

TOTAL ANNUAL HEAT SAVINGS MBTU	470
TOTAL DOLLAR SAVINGS	44,296
TOTAL COST	40,773
TOTAL SQFT	27,686
TOTAL SQFT WALLS	9,712
PEAK LOAD REDUCTION	191,026

Table 3-4. Savings Weatherization Roofs

BLDG	KASERNE	FUNCTION	ROOF TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT ROOF
D	NE 035	ADMINISTRAT	ATT1	11,070	54	3,658	2,096	1.74	NAT GA	2,144
L80	NE 035	EDUC. CTR.	WD1	21,500	292	28,730	21,019	1.36	NAT GA	21,500
L86	NE 035	GARAGE	WD4	8,800	200	24,946	7,464	3.34	NAT GA	7,635
L90	NE 035	HOUSING	CON3	32,280	687	67,491	28,597	2.36	NAT GA	29,251
T52	NE 035	HOUSING	CON2	18,809	336	33,077	8,920	3.70	NAT GA	9,124
X	NE 035	ADMIN.	CON2	14,405	303	20,466	7,821	2.61	NAT GA	8,000

TOTAL ANNUAL HEAT SAVINGS MBTU	1,874
TOTAL DOLLAR SAVINGS	178,371
TOTAL COST	75,919
TOTAL SQFT	106,864
TOTAL SQFT ROOFS	77,654
PEAK LOAD REDUCTION	816,624

3.1.2. Mechanical Control.

Mechanical control changes considered included replacing manual radiator valves with thermostatic valves, night setback of heating and ventilating equipment and night setback of domestic hot water equipment. Because of the relative few number of buildings which may accommodate these improvements, the total project costs were less than $200,000 in each case and therefore failed to qualify for ECIP. Funding for these projects may however, be accomplished through the Military Community Authority. Therefore, documentation for mechanical improvements may be found in Section 3.3.

3.1.3. Lighting Projects.

All major lighting revisions have already been effected. In FY 82 all street lighting was replaced by the lessor at Schinnen Mine with new fluorescent fixtures. Interior lighting has been reduced to the maximum extent permitted by the Dutch safety officer. No further electrical revisions are possible.

3.1.4. Boiler Plants.

Schinnen Mine is served by a central hot water heating plant. The plant has two natural gas-fired boilers and is operated by the lessor. In FY 81, through persuasion of the DEH staff, the Lessor upgraded the boiler control and rearranged the piping and pumping system so that hot water temperatures are reset as a function of outdoor temperature. The reset schedule is further depressed for nighttime and weekend setback savings. The lessor provides a full time operator on the day shift only. The operator is quite experienced and, since boilers are automatic, has plenty of time for routine maintenance. The plant is in good condition and warrants no further investment.

3.1.5. Heat Distribution System.

The low temperature (180° F.) hot water distribution system runs above ground from the central plant to the various buildings. There are now 4 zones, each equipped with a 3-way valve located in the boiler plant to control supply water temperature as a function of outdoor temperature. The insulation on the piping was only in fair condition so a project was developed to replace the existing cork insulation with new fiberglass insulation. Three different insulation thicknesses were evaluated but the most favorable resulted in a savings to investment ratio of less than 0.5. Instead of complete replacement, repair of defective sections is recommended. This is included in Section 3.3.

3.1.6. Energy Monitoring and Control System.

3.1.6.1. General.

The feasibility of installing on Energy Monitoring and Control System (EMCS) for the Schinnen Mine complex was investigated as part of this study. The Master Control Room (MCR) is proposed to be located in Building T-22, the Facilities Engineering Office. The system would have field interface devices (FIDs) located in Building T-6, T-10, T-16, T-25, and T-28. The buildings without FIDs would contain multiplexers (MUXs). The entire system would be connected together with coaxial cable. All buildings would be monitored for temperature, equipment operation, and lighting control. The system has been estimated to contain 257 points and thus has been classified as a small system.

3.1.6.2. Software Functions.

The following software functions have been selected for the EMCS on the basis that local controls as described have first and EMCS has second priority. This means that the savings gains by EMCS are based on the annual heating consumption after the deduction of those savings gained by local controls.

3.1.6.3. Scheduled Start/Stop.

Function will not result in any further energy savings, other than those already gained by local controls.

3.1.6.4. Summer/Winter Operation.

This function will shut down the heating systems during periods when the outdoor temperature is above 59° F. (15° C.). Based on a computer simulation, a savings of 3.5 percent of annual heating energy could be realized.

3.1.6.5. Optimum Start/Stop.

Experience has shown that this function will result in additional annual shut-off periods of approximately 0.5 hours/day over the year, which results in 183 hours/year, with an annual heating savings constant of:

3.5%/2,394 hours x 183 hours = 0.27 percent

The electrical energy savings constant for shut-off of each hot water circulating pump will be:

183 hours x 1.5 kW = 275 kWh/YR

For each heating and ventilating unit fan, the electrical savings constant for shut-off will be:

183 hours x 0.75 kW = 137 kWh/YR

3.1.6.6. Duty Cycle.

No savings can be gained for the type of buildings in this facility.

3.1.6.7. Day/Night Setback.

This function will not result in any further energy savings, other than those already gained by local controls.

3.1.6.8. Lighting Controls.

The total annual lighting consumption of the buildings at Schinnen Mine is 486,940 kWh/YR. Experience has shown that local time clock controls will be by-passed by overriding controls in many cases and that only a centralized EMCS control function will drastically reduce lighting consumption. It will be assumed that the electrical energy savings gained by this function will be 8 percent.

3.1.6.9. Maintenance Function.

The EMCS will provide continuous information over the status of the entire systems connected to it. It will instantaneously annunciate if local control functions are in override (hand) position, if pumps or control valves are in functional operation and will save energy and maintenance effort for this reason. Experience shows that the percentage of control panels being in override (hand) position is much higher, especially after drastic energy conservation measures such as temperature reduction to 65^{o} F. (18^{o} C.) has been implemented.
For this reason this study uses a savings constant of 5 percent for overall savings due to monitoring capability.

3.1.6.10. Summary of Savings Constants.

FUNCTION	HEATING ENERGY	ELEC. ENERGY
Summer/Winter Operation	(Heat) 3.5%	
Optimum Start/Stop	(Heat) 0,27%	275 kWh/year/pump
		137 kWh/year/fan
Lighting Control		8 percent
Maintenance	5.0 percent	

Total Annual Savings.

Heating Energy: 8.77% of consumption

Lighting Energy: 8.0% of annual lighting

Pump Electrical Energy: 275 kWh/year/pump

Fan Electrical Energy: 137 kWh/year/pump

3.1.6.11. Economic Analysis.

From Table 3-5, the annual heat loss is 13,053 million BTUs. The heating savings would therefore be:

.0877 x 13,053 = 1635 million BTU

From Table 3-6, the annual lighting consumption is 486,940 KWHRS.

The annual savings would be: 0.08 x 486,940 = 38,955 KWHRS.

The pumping savings would be: 12 x 275 = 3,300 KWHRS.

The fan energy savings would be: 11 x 137 = 1,507 KWHRS.

Total Electrical Savings = 43,762 KWHRS/YR.

From the cost estimate in Appendix, the construction cost of the EMCS system is $559,065.

The SIR for is 0.24 and thus does not qualify for ECIP.

Table 3-5. Building Heat Loss

BLDG	HLWALL	HLROOF	HLGLAS	HLDOOR	TOTHLOS	ANUALHT	HTPSFYR
T02	41,190	67,378	40,733	2,260	151,562	352	170,219
T04	18,083	81,247	35,571	2,260	137,163	318	134,077
T06	18,083	81,247	35,571	946	135,849	315	122,003
T08	234,600	134,858	102,611		472,069	1,096	70,964
T09	28,014	31,027	27,186	2,849	89,077	206	58,274
T10	462,106	480,585	21,758	1,139	965,589	2,490	89,404
T11	113,417	32,775	9,765	2,849	158,808	363	191,347
T12	522,016	311,880	19,349	18,083	871,329	2,625	116,183
T15	343,507	262,200	118,080	24,068	747,855	2,253	245,416
T17	3,882	3,930	34,017	473	42,303	90	53,175
T18	44,997	82,054	166,980	17,276	311,308	723	121,598

Table 3-5. Building Heat Loss (continued)

BLDG	HLWALL	HLROOF	HLGLAS	HLDOOR	TOTHLOS	ANUALHT	HTPSFYR
T22	100,195	82,054	66,387	15,015	263,653	612	102,985
T25	220,101	131,221	9,411	18,298	379,033	977	47,980
T26	23,598	10,524	5,363	946	40,433	86	83,519
T28	87,360	36,349	31,169	22,259	177,139	540	82,240

TOTAL KASERNE ANUALHT IN MILLION BTUS	13,053
TOTAL KASERNE SQUARE FEET	129,157
AVERAGE ANNUAL BTU/SF	112,626
PEAK HEAT LOSS IN BTU	4,943,177

Table 3-6. Electric Cons by Lighting, NE 035

BLDG	USE	SQFT	WPSF	KWDEM	OCCUP	LKWH	BTUSFYR	LTGSYS
T02	M.P. ADMIN.	2,068	.98	2	2,190	4,467	7,371	FLUO
T04	GEN. WAREHOUSE	2,376	1.26	3	2,340	7,020	10,080	FLUO
T06	DENTAL CLINIC	2,586	1.70	4	2,340	10,296	13,584	FLUO
T08	POST HDQTRS.	15,450	1.94	30	2,340	70,200	15,503	FLUO
T09	HDQTRS. LINK	3,550	1.97	7	2,340	16,380	15,743	FLUO
T10	EXCH. WAREHSE.	27,857	1.97	55	2,340	128,700	15,763	FLUO
T11	EXCH. CAFE.	1,900	1.70	3	2,340	7,558	13,572	FLUO
T12	GEN. STOREHSE.	22,600	2.69	61	2,340	142,740	21,549	FLUO
T15	GEN. STOREHSE.	9,183	.40	3	2,340	8,681	3,225	FLUO
T17	E.P.& S.	1,709	2.28	3	2,340	9,126	18,219	FLUO
T18	HSNG OFF&WRHSE	5,946	.84	5	2,340	11,700	6,713	FLUO
T22	FACIL. ENG.	5,946	1.09	6	2,340	15,210	8,727	FLUO
T25	COMMISSARY	20,376	.91	18	2,080	38,646	6,471	FLUO
T26	DISPATCH OFF.	1,040	1.05	1	2,190	2,409	7,903	FLUO
T28	MOTOR REP SHOP	6,570	.89	5	2,340	13,806	7,169	FLUO

TOTAL KASERNE LIGHTING CONS IN KWHRS	486,940
TOTAL KASERNE SQUARE FEET	129,157
TOTAL LIGHTING DEMAND IN KW	210

3.1.7. Maintenance and Repair Projects.

Maintenance and repair projects that provide energy savings all fall below the minimum ECIP funding requirements. Modifications that would produce savings are listed in Section 3.3.

3.2. ECIP Projects Developed.

One Life Cycle Cost Analysis Summary yielded on ECIP project with an SIR greater than one (1) is: Weatherization - SIR = 1.54

The Life Cycle Cost Analysis Summary and Form 1391 are included in this Section.

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

LOCATION: AFCENT, Support ACT REGION NO. ______ PROJECT NUMBER ______

PROJECT TITLE Weatherization FISCAL YEAR 1987

DISCRETE PORTION NAME Wall and Roof Insulation

ANALYSIS DATE 1983 ECONOMIC LIFE 15 YEARS PREPARED BY LAD

1. INVESTMENT

A.	CONSTRUCTION COST	$ 465,913	
B.	SIOH (at 5.5%)	$ 25,625	
C.	DESIGN COST	$ ---	
D.	ENERGY CREDIT CALC (1A+1B+1C)X.9	$ 442,385	
E.	SALVAGE VALUE	$	
F.	TOTAL INVESTMENT (1D-1E)		$ 442,385

2. ENERGY SAVINGS (+)/COST (-)
ANALYSIS DATA ANNUAL SAVINGS, UNIT COST AND DISCOUNTED SAVINGS

FUEL	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$		$		$
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$ 4.90	10,909	$ 53,456	12.80	$ 684,236
E. COAL	$		$		$
F. TOTAL		10,909	$ 53,456		$ 684,236

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

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

B. NON RECURRING SAVINGS (+)/COST (-)

ITEM	SAVINGS (+) COST (-)(1)	YEAR OF OCCURRENCE(2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS (+) COST (-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+)/COST (-) (3A2+3Bd4) $ 0

4. FIRST YEAR DOLLAR SAVINGS 2F2+3A+(3B1d/YEARS ECONOMIC LIFE) $ 53,456

5. TOTAL NET DISCOUNTED SAVINGS (2F3+3C) $ 684,236

6. DISCOUNTED SAVINGS RATIO (IF LESS THAN 1 PROJECT DOES NOT QUALITY)
(SIR)=(5/1F) = 1.54

7. ECIP QUALIFICATIONS TEST

A. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F3 X .33) $ 0

(2) NON ENERGY DISCOUNTED SAVINGS (3C) $ 0

(3) ENTER SMALLER OF 7.A.1 OR 7.A.2 $ ______

ESIR = (2F3 + 7A3)/1F = 1.54

IF LESS THAN 1 PROJECT DOES NOT QUALIFY FOR ECIP

IF GREATER THAN 1 THEN PROJECT QUALIFIES FOR ECIP

AND THE "SIR" GENERATED IN 6. IS REPORTED AS THE PROJECT "SIR".

1. COMPONENT	FY 19 87 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		1 MAY 1984

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
U.S.M.C.A. AFCENT Support Activity (US),NE	ECIP - Weatherization

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
MCA, ECIP	80000		$590.0

9. COST ESTIMATES

ITEM 1.00 $ = 2.6 DG	U/M	QUANTITY	UNIT COST	COST ($000)
1 x 2 Furring Strips	SF	39,375	0.52	20.4
1 inch Rigid Insulation	SF	39,375	1.52	59.9
Vapor Barrier	SF	39,375	0.16	6.3
1/2 inch Gypsum Wallboard	SF	39,375	1.28	39.4
1/2 inch Insulating Sheathing	SF	5,441	1.04	5.7
5/8 inch Gypsum Wallboard	SF	5,441	1.28	7.0
Paint	SF	44,816	0.90	40.3
6 inch Blanket Insulation	SF	88,184	1.02	89.9
4-1/2 inch Spray-On Cementitious Insulation	SF	42,343	4.14	175.3
SUBTOTAL				444.2
Contingency (5.0 percent)				22.2
SUBTOTAL				466.4
Cost Growth (19.9 percent)				92.8
Total Contract Cost				559.2
Supervision Insp. + Ohead (5.5 percent)				30.8
TOTAL REQUEST				590.0
Installed Equip - Other Approp.				(0)

10. DESCRIPTION OF PROPOSED CONSTRUCTION

This project is to insulate 44,816 sq. ft. of uninsulated walls and 130,529 sq. ft. of poorly insulated roofs in 17 permanent buildings. Design is special to accommodate the differing existing wall conditions. Project will reduce load on the existing heating system. There is no air conditioning involved. All required utilities presently exist. The buildings are not located in a flood plain and no demolition is required. The handicapped will not be provided for since this project does not lend itself to design for the handicapped.

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11. Requirement. Wall Insul. 44,816 SF: Adequate: 0 SF: Substandard 44,816 SF
Roof Insul. 130,527 SF: Adequate: 0 SF: Substandard 130,527
ECIP Project, EEAP Package 14 SIR = 1.54

Project.
Provision of wall and roof insulation on uninsulated walls and roofs and on roofs with inadequate insulation.

DD FORM 1 DEC 76 1391 PREVIOUS EDITIONS MAY BE USED INTERNALLY UNTIL EXHAUSTED. PAGE NO. 1

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(WHEN DATA IS ENTERED)

3.3. Other Energy Conservation Projects Developed.

3.3.1. Maintenance and Repair Projects.

Maintenance and repair projects that would provide energy savings and fall below the minimum ECIP funding requirements are included in this Section. These projects are listed from highest to lowest SIR.

PROJECT	SEE PARA	$COST	ANNUAL SAVINGS MBTU	ANNUAL SAVINGS US$	SIR
Automatic Damper Camper Hendrik	3.3.1.1.	360	127.4	624	22.2
Backdraft Damper Brunsum	3.3.1.2.	80	22.3	110	19.2
Backdraft Damper TAPIJN	3.3.1.3.	27	7.4	36	17
Night Setback	3.3.1.4.	15,000	1,200.0	6,240	7.6
Automatic Damper AAFES Garage (L86)	3.3.1.5.	315	28.9	142	5.7
Thermostatic Valves	3.3.1.6.	17,136	1,447.0	7,288	4.8
Repair Insulation	3.3.1.7.	4,650	206.6	1,012	2.8
Setback Heaters	3.3.1.8.	1,620	14.2	252	1.7
Setback Convertor	3.3.1.9.	270	5.4	26	1.25
TOTAL		39,458	3159.2	15,730	

3.3.1.1. Automatic Damper, Camp Hendrik.

A walk-in cooler condensing unit is located at the mezzanine level adjacent to a window wall in Building T44 (14) at Camp Hendrik. One pane of glass (approximately 2 x 3 FT.) has been removed to allow ventilation air to reach the unit. This is fine for summer conditions, but in winter the opening should be closed to prevent building heat loss and also allow the building to reclaim the condensing unit rejected heat. An automatic damper connected to a thermostat would do this.

Energy Savings Central Plant HW System:

Infiltration = 6 FT^2 x 100 FPM = 600 CFM

600 x 1.08 x (60-22) = 24,624

(24,624 BTUH)(5,734 DD)(24 Hours)/(60-22)(0.7) = 127.4 MBTU/YR

127.4 MBTU/YR x $4.90 MBTU = $624/YR

Savings to Investment Ratio Calculation.

Construction Cost	$ 400
Energy Credit	- 40
Total Investment	$ 360
15 Year Discount Factor =	12.8
Discounted Savings = $624/YR x 12.8 =	$7,990
SIR $8,775/$360 =	22.2

3.3.1.2. Backdraft Dampers, Brunsum Building L90.

The kitchen is not now in use and so the exhaust fans never run, which allows infiltration all winter long. Add a backdraft damper.

Natural Gas Energy Savings:

Infiltration = 3 x 0.35 FT^2 x 100 FPM = 105 CFM

105 CFM x 1.08 x (70-22) = 5,443 BTUH

(5,443 BTUH)(5,734 DD)(24 Hours)/(70-22)(0.7) = 22.3 MBTU/YR

22.3 MBTU/YR x $4.90 MBTU = $110/YR

Savings to Investment ratio Calculation.

Construction Cost	$90
Energy Credit	-10
Total Investment	$80
15 Year Discount Factor =	12.8
Discounted Savings = $110/YR x 12.8 =	$1,398
SIR = $1,536/$80 =	19.2

3.3.1.3. Backdraft Damper, TAPIJN.

The window mounted exhaust fan in Building X, which probably never runs in winter, has no backdraft damper which allows infiltration. Add a backdraft damper.

Energy Savings.

Central plant HW system infiltration - 0.35 Ft^2 x 100 FPM = 35 CFM

35 CFM x 1.08 x (70-24) = 1,739 BTUH

(1,739 BTUH) (5,734 DD) (24 Hours)/(70-22)(0.7) = 7.4 MBTU/YR

Savings = 7.4 MBTU/YR x 4.90/MBTU = $36/YR

Savings to Investment Ratio Calculation.

Construction Cost	$ 30
Energy Credit	- 3
Total Investment	$ 27
15 Year Discount Factor =	12.8
Discounted Savings = 36/YR x 12.8 =	$460
SIR = $460/$27 =	17

3.3.1.4. Night Setback.

Hot water reset controllers save energy by supplying to the space only the heat required as dictated by the outside air temperature. In the case of hot water radiation systems, as the outside air temperature varies, the supply water temperature will also vary in inverse proportion to supply only sufficient heat energy to offset the building heat losses at that outside air temperature. Setback controllers will reduce energy consumption by reducing space temperature at night as well as during unoccupied periods. In the ECO, the calculations are based on reset and setback controllers being fitted on hot water boilers that currently have no energy conservation features. The savings for buildings heated with forced air equipment are calculated on the basis of replacing existing thermostats with setback thermostats.

Night and weekend setback is being considered for Buildings L80, L90, T44, T52, and Building T25 at Schinnen Mine. Other buildings located at Schinnen Mine already have night and weekend setback on the central plant boilers.

Buildings which may be set back by installation of boiler reset controls would have estimated costs of $1000 per boiler. For building with forced air systems with a local controlling thermostat, estimated costs would be $300 per thermostat for installation of setback controls. For Building T52, which is connected to a central plant, estimated costs would be $3000 for installation of mixing valves and reset controls on the building hot water header.

Buildings with manual valves which are expected to be replaced with thermostatic valves include L80 (15 percent of building heat through thermostatically controlled forced air units and the balance through manual valves), L90 (100 percent manual valves), T44 (25 percent manual valves and the balance through thermostatic forced air), T52 (100 percent manual valves), and T25 (25 percent manual valves, balance forced air with thermostats). Building L86 is entirely thermostatically controlled. Baseline consumption shall be defined as the projected consumption of the building after replacement of all manual valves with thermostatic valves.

Setback Costs:

L80 - 1 boiler, 1 thermostat =	$ 1,300
L86 - 3 thermostats =	$ 900
L90 - 1 boiler =	$ 1,000
T44 - 1 mixing valve, 6 thermostats =	$ 4,800
T52 - 1 mixing valve =	$ 3,000
T25 - 1 boiler, 10 thermostats =	$ 4,000

Individual buildings, costs, savings and SIRs.

BLDG	FUNCTION	BASELINE CONSUMPTION MBTU/YEAR	NIGHT SETBACK CONSUMPTION MBTU/YEAR	SAVINGS MBTU/ YEAR	COST	SIR
L80	EDUC. CTR.	1784	1409	375	1300	28.3
L86	GARAGE	754	596	158	900	17.2
L90	HOUSING	2119	1886	233	1000	22.9
T44	MULTI-USE	1124	1057	67	4800	1.3
T52	HOUSING	1542	1372	170	3000	5.1
T25	COMMISSARY	940	743	197	4000	4.4
	TOTAL			1200	15000	7.6

3.3.1.5. Automatic Damper, AAFES Garage (L86).

The gas-fired furnaces are presently located on the mezzanine level. There is an open 20 x 20 inch louver located in a nearby exterior wall to provide combustion air. Providing a damper that would close when the furnaces are off would prevent unnecessary outside air from entering the building.

Energy Savings. Assume the furnaces run 50 percent of the time during winter. Average inside temperature is 70° F. average wind speed is 6 knots (100 FPM), so the infiltration rate is 100 FT/MIN x 2.8 FT^2 = 280 CFM.

280 CFM x 0.5 run time = 140 CFM

140 CFM x 1.08 x (70-24) = 7,056 BTUH

(7,056 BTUH) (5,734 DD) (24 Hours)/(70-22)(0.7) = 28.9 MBTU/YR

28.9 MBTU/YR x \$4.90/MBTU = \$142/YR

Savings to Investment Ratio Calculation.

Construction Cost	\$ 350
Energy Credit	- 35
Total Investment	\$ 315
15 Year Discount Factor =	12.8
Discounted Savings = 142/YR x 12.8 =	\$1,817
SIR = \$1,817/\$315 =	5.7

3.3.1.6. Replacement of Manual Radiator Valves with Thermostatic Control Valves.

Generally, manual radiator valves are used in buildings heated with radiators. This type of heating control does not rely on a temperature measurement within the space, but instead is left to the occupants. Often, instead of closing the valve when the room starts to overheat, the occupant will open the windows. Control valves provide a much better means of regulation by automatically opening and closing as required to meet the space heating load.

Costs and savings are based upon an 8-year life because it is assumed that the valves will be defective at the end of eight (8) years.

Valve costs are estimated to be $17 each for parts and one hour labor at $25 per hour for a total installed cost of $42/valve.

Individual building costs, savings and SIRs.

BLDG	FUNCTION	PRESENT CONSUMPTION MBTU/YEAR	FRACTION OF HEAT THRU MAN VALVES	REVISED CONSUMPTION MBTU/YEAR	SAVINGS MBTU/ YEAR	COST	SIR
L90	HOUSING	2493	1.00	2119	374	2,604	8.7
L80	EDUC. CTR.	2045	0.15	1999	46	1,260	2.2
T52	HOUSING	1814	1.00	1542	272	2,520	5.6
T02	M.P. ADMIN.	352	1.00	299	53	1,428	2.0
T04	GEN. WAREHOUSE	318	1.00	270	48	504	5.2
T06	DENTAL CLINIC	315	0.90	291	24	840	1.6
T08	POST HDQTRS	1096	1.00	932	164	1,806	5.0
T09	HDQTRS LINK	206	1.00	175	31	294	5.8
T11	EXCH. CAFE.	363	1.00	309	54	378	7.9
T26	DISPATCH OFF.	86	1.00	73	13	504	1.4
D	ADMIN.	437	1.00	371	66	294	12.3
X	ADMIN.	1474	1.00	1253	221	2,898	4.2
T44	MULTI-USE	1168	0.25	1124	44	630	3.9
T25	COMMISSARY	977	0.25	940	37	420	4.9
	TOTALS				1447	17,136	4.8

3.3.1.7. Repair Damaged Insulation.

By visual inspection, approximately 10 percent of the overhead exterior pipeline insulation is damaged (wet) or missing. Of this 10 percent, it is estimated that 8 percent is damaged and 2 percent is missing. For the damaged cork insulation, it is estimated that its insulation valve has been cut in half (k = 0.05 BTU/HR·FT·F).

For bare steel pipe, the heat loss factors are as follows:

2-Inch - 1.46 BTU/LF·^{o}F·HR

3-Inch - 2.06 BTU/LF·^{o}F·HR

4-Inch - 2.58 BTU/LF·^{o}F·HR

For damaged 1-inch cork insulation with k=0.05, the "R" factors are as follows:

PIPE SIZE	"R" FACTOR
2 - Inch	1.94
3 - Inch	1.44
4 - Inch	1.17

Present Energy Losses (MBTU):

2-Inch: Bare:	(534,504) (1.46) (33) =	25.8
Damaged:	(534,504) (130)/1.94 =	35.8
3-Inch: Bare:	(534,504) (2.06) (40) =	44.0
Damaged:	(534,504) (160)/1.44 =	59.4
4-Inch: Bare:	(534,504) (2.58) (12) =	16.5
Damaged:	(534,504) (47)/1.17 =	21.5
TOTAL		203.0

Energy Losses with New 1-Inch Fiberglass Insulation:

2-Inch: (534,504) (163) divided by 4.86 =	17.9
3-Inch: (534,504) (200) divided by 3.60 =	29.7
4-Inch: (534,504) (59) divided by 2.93 =	10.8
TOTAL	58.4

Costs.

Construction Costs 1-Inch Insulation:

2-Inch Pipe: 163 LF x $8.75/LF =	$1,426
3-Inch Pipe: 200 LF x $10.66/LF =	2,132
4-Inch Pipe: 59 LF x $12.80/LF =	755
Dem + removal: 337 LF x 1.00/LF =	337
TOTAL	$4,650

Savings.

Present Losses =	203.0 MBTU/YR
After Repair Losses =	58.4 MBTU/YR
Energy Savings =	144.6 MBTU/YR
Fuel Savings = 144.6/.7 (Eff) =	206.6 MBTU/YR
Annual Cost Savings = 206.6 $4.9 =	$ 1,012
Discounted Savings = 1012 x 12.8 =	$12,956
SIR =	2.79

3.3.1.8. Electric Water Heaters.

Those buildings utilizing electricity for domestic hot water at Schinnen Mine include T2, T6, T8, and T25; at TAPIJN Kaserne, Buildings D and X have electric hot water heaters and should be set back.

Energy Savings (Unoccupied Hours):

Existing Tank Losses = 25 x 0.37 x (120-70) x 6396 = 2.96 MBTU/YR

Setback Tank Losses = 25 x 0.37 x (80-70) x 6396 = 0.59 MBTU/YR

Savings = 2.37 MBTU/YR

Individual Savings to Investment Ratio Calculation.

Construction Cost	$300
Energy Credit	- 30
Total Investment	$270
Annual savings = 2.37 MBTU/YR x 293 KWHR/MBTU	
x $.06/KWHR =	$ 42/Year
15 Year Discount Factor =	11.01
Discounted Savings = 42 x 11.01 =	$462
SIR = $462/$270 =	1.71

3.3.1.9. Domestic Hot Water Converters.

At Brunsum, Building L90 has a domestic hot water converter which uses gas-fired hot water as the heat source. These should have automatic setback.

Energy Savings (Unoccupied Hours).

Existing Tank Losses = 70 x 0.21 x (120-70) x 6396 = 4.7 MBTU/YR

Setback Tank Losses = 70 x 0.21 x (80-70) x 6396 = 0.94 MBTU/YR

Accounting for 70 percent gas efficiency.

Savings = (4.7 - 0.94)/0.7 = 5.37 MBTU/YR per water heater

Savings to Investment Ratio Calculation

Construction Cost	$300
Energy Credit	- 30
Total Investment	$270
Annual Savings = 5.37 MBTU/YR x $4.90/MBTU =	$ 26/Year
15 Year Discount Factor =	12.8
Discounted Savings = 26 x 12.8 =	$337
SIR = $337/$270 =	1.25

3.3.2. Previous Energy Studies.

No previous energy studies have been performed on this facility.

3.3.3. Operational Improvements.

Operation improvement recommended was the nightime covering of commissary cold storage cases with insulating blankets.

3.3.4. Previously Implemented Energy Projects.

The following projects have already been implemented:

FY 82: Replacement of street lights.

FY 82: Boiler plant modifications.

FY 79: Delamping.

FY 81: Insulation of unused windows.

FY 83: Reduction in security lighting education center

FY 82: Heating system modification in PX

FY 81: Installation of water saving shower heads in billets.

FY 82: Insulation of roof in motor repair shop.

3.3.5. Future Development Plans.

AFCENT S.A. (US) does not have an approved "Future Development Plan". Studies and proposals are still in progress.

3.3.6. Increment 'G'.

No Increment 'G' projects were identified at this community.

3.3.7. Other Energy Conservation Opportunities Examined.

3.3.7.1. Circulation Fan, AAFES Garage.

The building is high bay and therefore the air is very stratified inside, with the upper part being about 10° F. warmer than the lower part. Adding a circulation fan and some ductwork would bring the warm upper air down to the lower occupied level and reduce and load on the gas-fired furnaces. However an analysis of this opportunity produced an SIR of only 0.5 so it cannot be recommended.

3.3.7.2. Reinsulate Hot Water Distribution, Schinnen.

Replace existing 1 inch cork insulation on hot water lines with various thicknesses of fiberglass insulation at Schinnen Mine.

The existing insulation on the exterior hot water distribution system is 1-inch cork. An analysis was made to determine the feasibility of replacing the cork with more efficient fiberglass insulation of 3 different thicknesses: 1-inch, 1-1/2-inch, and 2-inch. However, analysis of this opportunity produced an SIR of only 0.55 and cannot be recommended.

3.3.7.3. Air Conditioning, Commissary.

Add air conditioning to the existing rooftop heating and ventilation unit in Building T25, Commissary, Schinnen Mine. The existing 1,700 CFM all outside air H & V unit introduces humidity into the building which must be taken out by the display coolers. It could be more economical if dehumidification were accomplished by an air conditioning system. Size required = 5 tons. However, an analysis of this opportunity produced an SIR of only 0.15 and cannot be recommended.

3.3.7.4. Gas-Fired Water Heaters.

Gas-fired water heaters were analyzed in the same manner as electric water heaters (3.3.1.8.) and were found to produce an annual savings of only $17 per year. This yields an SIR of only 0.8 and therefore cannot be recommended.

3.3.7.5. Unit Heater Thermostats.

In all areas surveyed that were heated with unit heaters, the heaters were manually switched on and off. Heat was turned on only if someone was cold. The temperature of all of these spaces was 60° F. (16° C.) or lower, so the installation of space thermostats would not yield any economic benefits.

3.3.7.6. Metering.

No buildings were identified where the addition of metering might be expected to reduce energy consumption.

3.3.7.7. Solar Energy.

This region of Europe is normally overcast during much of the year. Investigation of the use of solar energy is not warranted.

3.3.7.8. Inoperative Controls.

No inoperative controls were found.

3.3.7.9. District Heat.

There is no District Heating System available to the facility.

3.3.7.10. Insulating Glass.

Replacement of single pane with double pane glass had an SIR less than one (1). Evaluation of each single pane window is shown in Table 7-3.

3.3.7.11. Insulation of Walls.

Insulation of uninsulated walls and roofs is included in Weatherization Projects (3.1.1.). Walls and roofs that did not meet SIR criteria are shown in Tables 3-8 thru 3-11.

Table 3-7. Savings Weatherization Glass

BLDG	KASERNE	FUNCTION	GLASS TYPE	GLASS SQFT	SAVINGS MBTU/YEAR	SAVINGS $/YEAR	COST $	SIR	FUEL
T02	NE 035	M.P. ADMIN.	SP	2068	38	3,422	10,802	.31	NAT GAS
T04	NE 035	GEN. WAREHSE	SP	2376	33	3,000	9,433	.31	NAT GAS
T06	NE 035	DENTAL CLINIC	SP	2586	33	3,000	9,433	.31	NAT GAS
T10	NE 035	EXCH. WAREHSE.	SP	27857	21	1,896	5,770	.32	NAT GAS
T11	NE 035	EXCH. CAFE.	SP	1900	9	872	2,589	.33	NAT GAS
T12	NE 035	GEN. STOREHSE.	SP	22600	36	3,267	6,414	.50	NAT GAS
T15	NE 035	GEN. STOREHSE.	SP	9183	222	19,926	39,143	.50	NAT GAS
T18	NE 035	HSNG OFF&WRHSE	SP	5946	157	14,077	44,282	.31	NAT GAS
T22	NE 035	FACIL. ENG.	SP	5946	62	5,597	17,605	.31	NAT GAS
T25	NE 035	COMMISSARY	SP	20376	9	817	2,495	.32	NAT GAS
T26	NE 035	DISPATCH OFF.	SP	1040	4	405	1,422	.28	NAT GAS
T28	NE 035	MOTOR REP SHOP	SP	6570	59	5,329	10,332	.51	NAT GAS
L80	NE 035	EDUC. CTR.	SP	21500	381	37,481	116,289	.32	NAT GAS
L90	NE 035	HOUSING	SP	32280	174	17,171	38,150	.45	NAT GAS
L86	NE 035	GARAGE	SP	8800	75	7,398	13,231	.55	NAT GAS
D	NE 035	ADMINISTRATION	SP	11070	73	6,591	20,718	.31	NAT GAS
X	NE 035	ADMIN.	SP	14405	185	16,639	52,334	.31	NAT GAS
T44	NE 035	MULTI USE	SP	8877	109	9,778	30,783	.31	NAT GAS
T52	NE 035	HOUSING	SP	18809	304	29,924	66,464	.45	NAT GAS

TOTAL ANNUAL HEAT SAVINGS	1,992
TOTAL DOLLAR SAVINGS	186,600
TOTAL COST	497,697
TOTAL SQFT	224,189
TOTAL SQFT GLASS	37,089

Table 3-8. Savings Weatherization Walls, Schinnen

BLDG	KASERNE	FUNCTION	WALL TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT WALL
T02	NE 035	M.P. ADMIN.	CONC3	2,068	58	5,209	7,229	.72	NAT GA	1,722
T04	NE 035	GEN. WAREHO	CONC3	2,376	25	2,275	3,173	.71	NAT GA	756
T06	NE 035	DENTAL CLIN	CONC3	2,586	25	2,292	3,173	.72	NAT GA	756
T08	NE 035	POST HDQTRS	CONC4	15,450	328	29,469	41,982	.70	NAT GA	10,000
T09	NE 035	HDQTRS. LIN	CONC2	3,550	41	3,692	4,261	.86	NAT GA	1,015
T10	NE 035	EXCH. WAREH	CONC2	27,857	702	62,974	70,290	.89	NAT GA	16,743
T11	NE 035	EXCH. CAFE.	CONC1	1,900	166	14,923	15,449	.96	NAT GA	3,680
T17	NE 035	E. P. & S.	WD1	1,709			3,256		NAT GA	1,055
T18	NE 035	HSNG OFF&WR	CONC1	5,946	66	6,001	6,129	.97	NAT GA	1,460
T22	NE 035	FACIL. ENG.	CONC1	5,946	149	13,369	13,648	.97	NAT GA	3,251
T25	NE 035	COMMISSARY	CMU1	20,376	318	28,537	39,387	.72	NAT GA	9,382
T26	NE 035	DISPATCH OF	MAS2	1,040	30	2,697	4,785	.56	NAT GA	1,140
T28	NE 035	MOTOR REP S	MAS1	6,570	165	14,832	17,183	.86	NAT GA	4,093

TOTAL ANNUAL HEAT SAVINGS MBTU	2,078
TOTAL DOLLAR SAVINGS	186,277
TOTAL COST	229,952
TOTAL SQFT	97,374
TOTAL SQFT WALLS	55,053
PEAK LOAD REDUCTION	1,087,346

Table 3-9. Savings Weatherization Roofs, Schinnen

BLDG	KASERNE	FUNCTION	ROOF TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT ROOF
T17	NE 035	E. P. & S.	WD2	1,709				0.00	NAT GA	1,709
T18	NE 035	HSNG OFF&WR	CON4	5,946	108	9,694	12,652	.76	NAT GA	5,946
T22	NE 035	FACIL. ENG.	CON4	5,946	108	9,677	12,652	.76	NAT GA	5,946
T25	NE 035	COMMISSARY	MET1	20,376	163	14,686	53,903	.27	NAT GA	20,376
T28	NE 035	MOTOR REP S	MET2	6,570	35	4,974	7,195	.69	NAT GA	6,585

TOTAL ANNUAL HEAT SAVINGS MBTU	415
TOTAL DOLLAR SAVINGS	39,031
TOTAL COST	86,403
TOTAL SQFT	40,547
TOTAL SQFT ROOFS	40,562
PEAK LOAD REDUCTION	217,407

Table 3-10. Savings Weatherization Walls, (Off-Site)

BLDG	KASERNE	FUNCTION	WALL TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT WALL
D	NE 035	ADMIN.	MAS2	11,070	80	7,232	8,933	.80	NAT GA	2,128
L80	NE 035	EDUC. CTR.	WD2	21,500	47	4,700	15,478	.30	NAT GA	9,968
L86	NE 035	GARAGE	MAS2	8,800	140	13,839	16,373	.84	NAT GA	3,900
L90	NE 035	HOUSING	MAS2	32,280	464	45,591	52,792	.86	NAT GA	12,575
X	NE 035	ADMIN.	MAS2	14,405	294	26,376	32,578	.80	NAT GA	7,760

TOTAL ANNUAL HEAT SAVINGS MBTU	1,028
TOTAL DOLLAR SAVINGS	97,740
TOTAL COST	126,155
TOTAL SQFT	88,055
TOTAL SQFT WALLS	36,331
PEAK LOAD REDUCTION	427,702

Table 3-11. Savings Weatherization Roofs, (Off-Site)

BLDG	KASERNE	FUNCTION	ROOF TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT ROOF
T44	NE 035	MULTI USE	WD6	8,877	329	22,254	45,999	.48	NAT GA	13,041

TOTAL ANNUAL HEAT SAVINGS MBTU	329
TOTAL DOLLAR SAVINGS	22,254
TOTAL COST	45,999
TOTAL SQFT	8,877
TOTAL SQFT ROOFS	13,041
PEAK LOAD REDUCTION	131,974

3.3.7.12. Zone existing multiple use facilities to reduce energy consumption in minimal use areas.

This has been accomplished.

3.3.7.13. Reschedule utilization of existing facilities.

This is not feasible.

3.3.7.14. Consolidate services into permanent buildings through alteration or new construction.

New barracks have been proposed.

3.3.7.15. Connect to district heating in order to purchase or sell energy.

District heat is not available.

3.3.7.16. Interconnect existing power plants.

Not applicable.

3.3.7.17. Consolidate existing power plants where forecastable non-recurring maintenance costs can be demonstrated.

Not applicable.

3.3.7.18. Convert to more energy efficient fuels.

Most economic fuel is used.

3.3.7.19. Insulate existing supply and return piping.

Existing piping is insulated.

3.3.7.20. Return condensate.

There is no condensate.

3.3.7.21. Convert existing energy distribution systems to utilize more efficient medium.

Energy distribution is by hot water, see 3.1.4.

3.3.7.22. Recover heat from processes such as boiler blowdown, refrigerant gas, exhaust air from laundries and messhalls, destratification of air.

See 3.3.4 and 3.3.7.1.

3.3.7.23. <u>Supplement the generation of domestic hot water through installation of a heat pump</u>.

No air conditioning is installed.

3.3.7.24. <u>Decentralize domestic hot water heaters</u>.

They are decentralized.

3.3.7.25. <u>Curtail availability of energy to domestic hot water heaters</u>.

See 3.3.1.8. and 3.3.1.9.

3.3.7.26. <u>Install shower flow restrictors</u>.

Has been done.

3.3.7.27. <u>Improve street lighting efficiency by delamping (reduction of lighting level) or replacement with low or high pressure sodium</u>.

Street lighting has been replaced.

3.3.7.28. <u>Relamp with fluorescent, H.P. sodium or other more energy efficient lighting</u>.

Exterior lighting is fluorescent.

3.3.7.29. <u>Control light levels automatically</u>.

Variation in external luminance is insufficient to warrant automatic adjustment.

3.3.7.30. <u>Utilize photocell switches</u>.

These exist on outside lighting.

3.3.7.31. <u>Replace incandescent lamps with fluorescent or H.P. sodium</u>.

Has been done.

3.3.7.32. <u>Utilize high efficiency ballasts</u>.

Recommended for ballast replacement.

3.3.7.33. <u>Employ spot heating in lieu of existing unit heaters</u>.

Spot heating is not applicable to function.

3.3.7.34. Individual versus stairwell or area metering of military family housing.

There is no family housing.

3.3.7.35. Recommended preventive maintenance program procedures for high efficiency motor replacement.

There are no low efficiency motors.

3.3.7.36. Provide or improve existing controls such as thermostatic radiator valves, outside air reset, night setback, duty cycling and economizer cycles.

Thermostatic radiator valves and night setback are in 3.3.1.

3.3.7.37. Insulate basement ceilings, walls, attic floors and roofs.

See weatherization projects 3.1.1. and 3.3.7.11.

3.3.7.38. Install caulking and weather stripping.

Has been done.

3.3.7.39. Install storm or energy efficient windows, double glaze existing windows, reduce window area, install translucent panels, upgrade by replacement, install thermal barriers, modify skylights.

See 3.3.7.10.

3.3.7.40. Replace existing doors, install vestibules, air curtains and load dock seals.

Not applicable.

3.3.7.41. Study the feasibility of peak demand shedding.

There are no shedable loads.

3.4. Recommendation, Policy changes and Actions.

3.4.1. Recommendations and Policy Changes.

Future consumption of energy will change due to increased use of existing facilities and new facilities planned in the Future Development Plan. Consumption will decrease due to implementation of projects included in this report.

AFCENT S.A. (US) does not have an approved development plan since its future mission is uncertain. AFCENT S.A. has submitted MCA projects to replace the Off Site Bachelor Enlisted Mens quarters. It is recommended that the open refrigeration cases in the commissary be covered with insulating blankets when the commissary is not open.

3.4.2. Actions

3.4.2.1. The ECIP and maintenance and repair projects should be implemented.

3.4.2.2. The open refrigeration cases should be covered with insulating blankets when not in use.

3.4.2.3. If the MCA project to replace the Off-Site BEQ is approved, it should be designed as an energy efficient building.

4. ENERGY AND COST SAVINGS

This section addresses the buildings of Schinnen Mine only. Since being separated from NSSG (US) and becoming a separate community, the mission and boundaries of responsibility have continually changed. A Phase I Master Plan was in process of preparation during FY 83 but, development of the Phase II Master Plan and Future Development Plan have been delayed due to mission uncertanties. For these reasons, it would be meaningless to include the minor savings identified in Section 3.3.1. as future cost and energy savings or to include these Off-Site facilities in the energy savings forecast.

4.1. Energy Consumption Forecast.

Assuming that energy conservation projects are implemented by Spring 1988, the first fiscal year to show the results of the projects would be FY 89 when heating fuel consumption would be reduced from the present level of 21,566 MBTU/YR to 13,245. This would be a reduction of 38.6 percent. Electricity consumption would be reduced by only 2.8 MWHR per year from 1,652 to 1,649.2, a decrease of only 0.2 percent. Total energy consumption would be 32,375 MBTU.

Consumption per square foot would be 250,683 BTU/SF.

If the MCA projects are approved and proceed on the same schedule, FY 1989 consumption would be:

Natural Gas: 13,245 + 4353) = 17,598 MBTU/YR

Electricity: 1,649 + 194 = 1,843 MWHRS

Total Energy = 1843 * 11.6 + 17,598 = 38,976 MBTU

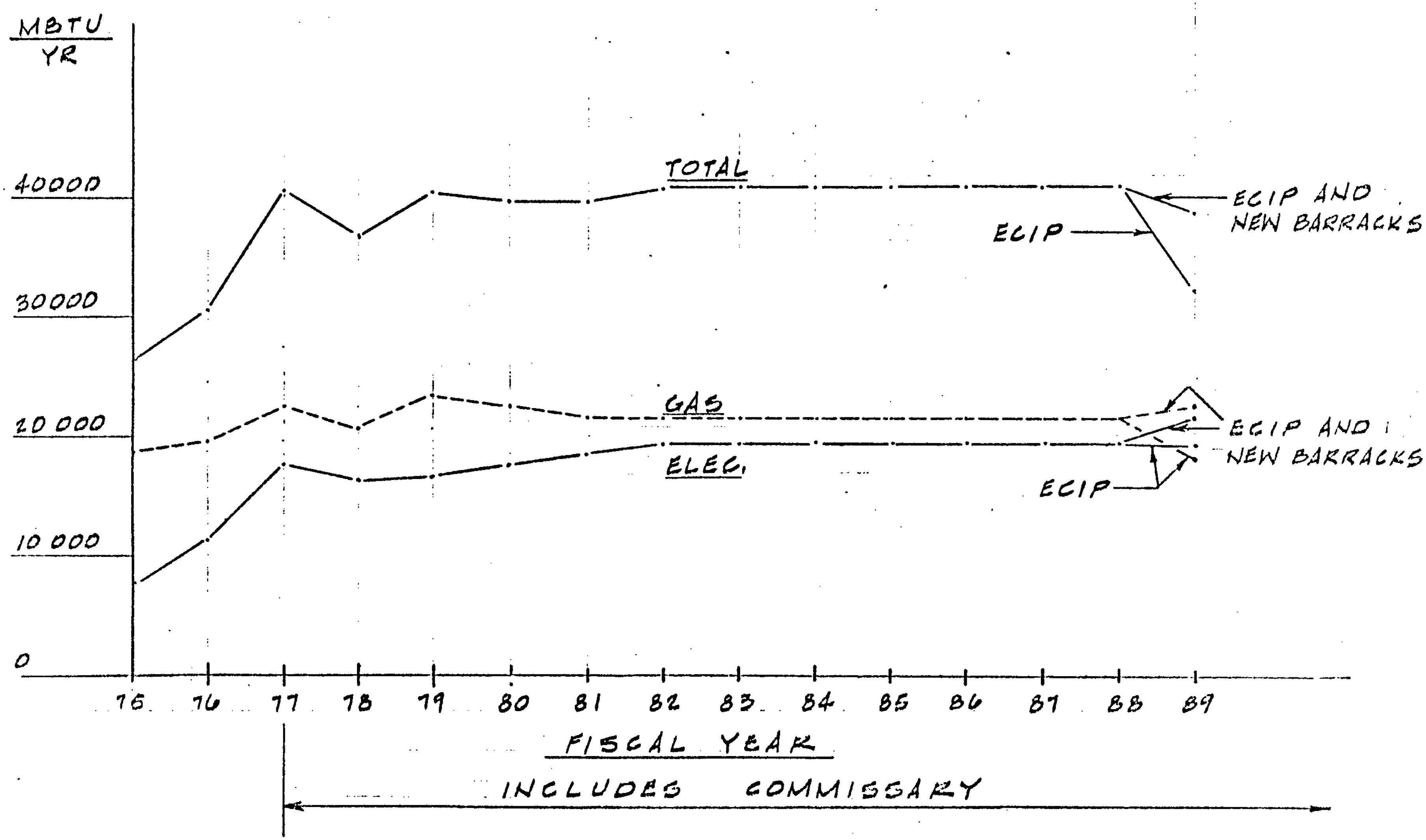
Total Consumption/SQFT = 38,976/180,246 = 216,242 BTU/SF

Previous years consumption along with the two possibilities are shown in the following table:

Total Energy Consumption Schinnen Mine

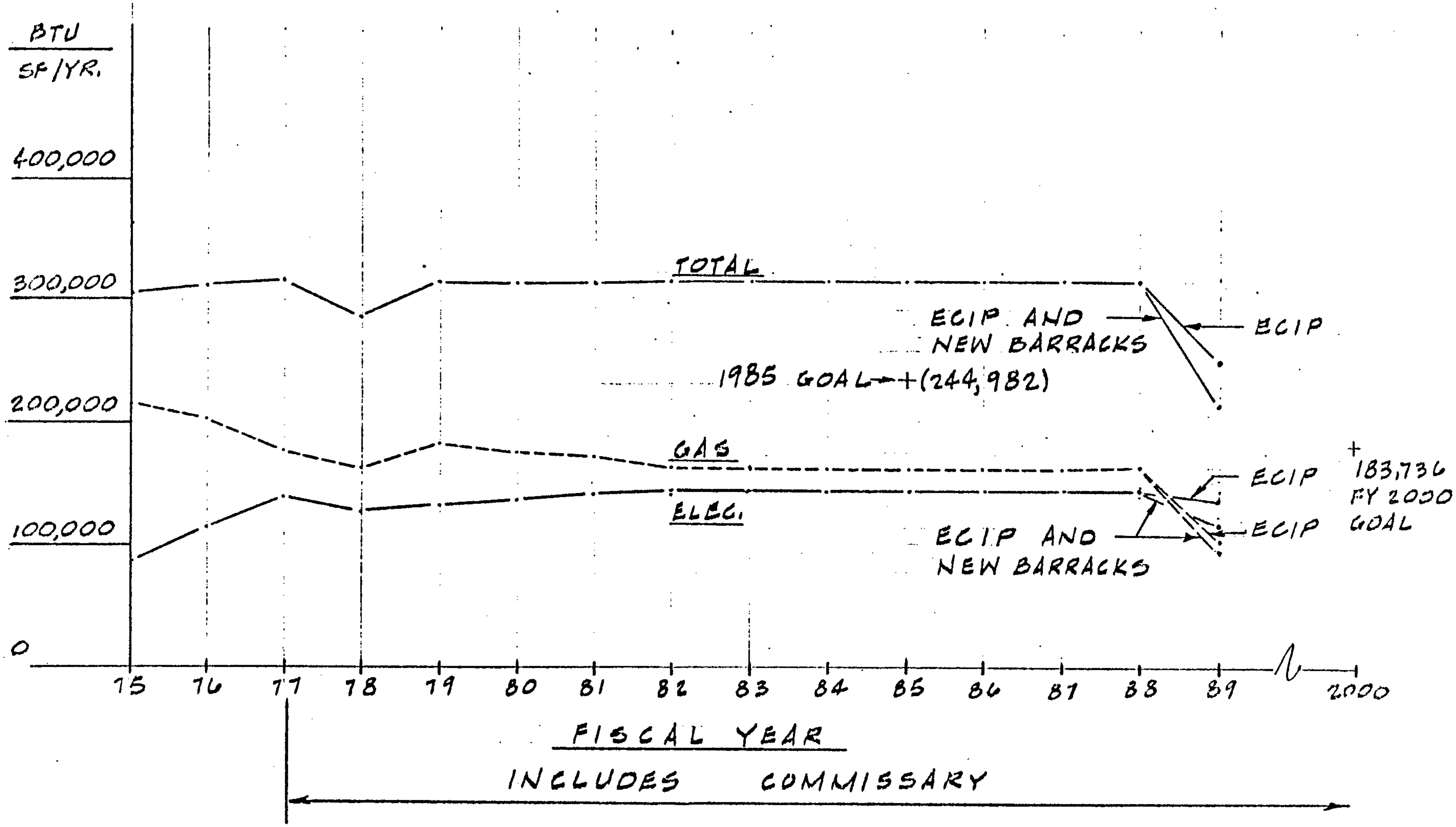
FISCAL YEAR	ELECTRICITY MBTU	NATURAL GAS MBTU	TOTAL MBTU	AREA SF	CONSUMPTION/ AREA BTU/SF
75	7,586	18,930	26,516	86,589	306,228
76	11,020	19,760	30,780	97,889	314,437
77	17,806	22,546	40,352	127,448	316,615
78	16,240	20,645	36,885	127,448	289,412
79	16,785	23,438	40,223	127,448	315,603
80	17,492	22,470	39,962	127,448	313,555
81	18,224	21,693	39,917	127,448	313,202
82	19,163	21,566	40,729	129,157	315,344
--- ASSUME CONSTANT THRU 1988 ---					
89	19,130	13,245	32,375	129,157	250,663
OR IF MCA PROJECTS ARE APPROVED					
89	21,378	17,598	38,976	180,246	216,242

These data are plotted in Figures 4-1 and 4-2.



ENERGY CONSUMPTION SCHINNEN MINE

Figure 4-1



ENERGY/SQUARE FOOT CONSUMPTION SCHINNEN MINE

Figure 4-2

4.2. Forecast Energy Savings

Assuming that energy conservation projects are implemented, the FY 89 heating fuel consumption would be reduced from the present level of 21,566 MBTU/YR to 13,245, or a savings of 8,321 MBTU/YR. This would be a savings of 38.6 percent. Electricity consumption savings would be only 2.8 MWHR per year from 1,652 to 1,649.2, a savings of only 0.2 percent. Total energy savings would be 8,354 MBTU.

4.3. ECIP Projects.

PROJECT DESCRIPTION	COST	ANNUAL SAVINGS (MBTU)	ANNUAL SAVINGS US$	SIR
Weatherization Walls and Roofs	$442,385	10,909	53,456	1.5

4.4. Projected Utility Costs.

Cost Data	FY 75	FY 77	FY 80	FY 81	FY 82
Electricity $/KWHR	N/A	.037	.048	.058	.06
Natural Gas $/MBTU	N/A	2.23	3.18	4.05	5.19

Early in FY 83, the cost of natural gas dropped to $4.61/MBTU. Since this may be only a temporary decrease, FY 83 costs are projected to be an average of FY 82 and the first 3 months of FY 83 or $4.90/MBTU.

No increase has yet occurred in the piece of electricity. FY 83 costs are projected to be $.06/KWHR or $5.17/MBTU.

Future costs are accounted for in economic analyses by using "Modified" uniform present worth discount factors included in ECIP guidance dated 18 February 1983.

4.5. Schedule of Energy Conservation Projects.

4.5.1. ECIP Projects.

PROJECT DESCRIPTION	COST	ANNUAL SAVINGS (MBTU)	ANNUAL SAVINGS US$	SIR
Weatherization Walls and Roofs	$442,385	10,909	53,456	1.5

4.5.2. Maintenance and Repair Projects.

PROJECT DESCRIPTION	COST	ANNUAL SAVINGS (MBTU)	ANNUAL SAVINGS US$	SIR
Thermostatic Valves	$17,136	1,447	7,288	4.8
Repair Insulation	4,650	206	1,012	2.8
Setback Heaters	1,620	14	252	1.7
TOTAL	$23,406	1,667	8,552	

5. SUMMARY

5.1. Summary.

The purpose of this study is to identify and financially evaluate all possible means to reduce energy consumption in compliance with the objectives set forth in the Army Facilities Energy Plan. During the first phase of the study, the AFCENT Support Activities Facilities were physically surveyed. AFCENT Support Activity's principal facilities are located at Schinnen, NL. The "Schinnen Mine" buildings were formerly occupied by a coal mining company and Schinnen was an operational mine. All facilities are leased. Most of the buildings are exposed concrete with flat roofs and substantial amounts of glazing. The principal activities/uses are administration, commissary, PX, warehousing, vehicle maintenance, facility engineering and maintenance. The support activity also occupies facilities at the following locations:

* Tapijn Kaserne at Maastricht - 2 small office buildings, D and X. The buildings are owned by the Government of the Netherlands.
* Education Center at Heerlen (L80).
* AAFES Garage in Brunsum (L86).
* BEQ in Brunsum (L90).
* Laundry/warehouse T-44 (14) and BEQ T-52 (19) at Camp Hendrick at Brunsum.

MCA projects have been submitted to replace the BEQS in Brunsum with new facilities at Schinnen Mine.

Assuming that energy conservation projects are implemented by Spring 1988, the first fiscal year to show the results of the projects would be FY 89 when heating fuel consumption would be reduced from the present level of 21,566 MBTU/YR to 13,245. This would be a reduction of 38.6 percent. Electricity consumption would be reduced by only 2.8 MWHR per year from 1,652 to 1,649.2, a decrease of only 0.2 percent. Total energy consumption would be 32,375 MBTU.

Consumption per square foot would be 250,633 BTU/SF.

If the MCA projects are approved and proceed on the same schedule, FY 1989 consumption would be:

Natural Gas: 17,598 MBTU/YR

Electricity: 1,843 MWHRS

Total Energy: 38,976 MBTU

Total Consumption/SQFT = 38,976/180,246 = 216,242 BTU/SF

5.2. Conclusions.

The Army Energy Plan's goal for 1985 is a reduction in total energy consumption of 20 percent of FY 75 consumption and a further reduction of 20 percent by FY 2000.

Schinnen Mine FY 75 consumption was 306,228 BTU/SF/YR

The goals would then be:

FY 1985 - 244,982

FY 2000 - 183,736

Schinnen Mine will not meet the Fy 85 goal.

- If ECOs are implemented and 250,663 BTU/SF/YR is achieved by 1989, this would be a reduction of 18.2 percent.
- If new energy efficient barracks are constructed in addition to implementation ECOs, and 216,242 BTU/SF/YR is achieved by 1989, this would be a reduction of 29.4 percent.